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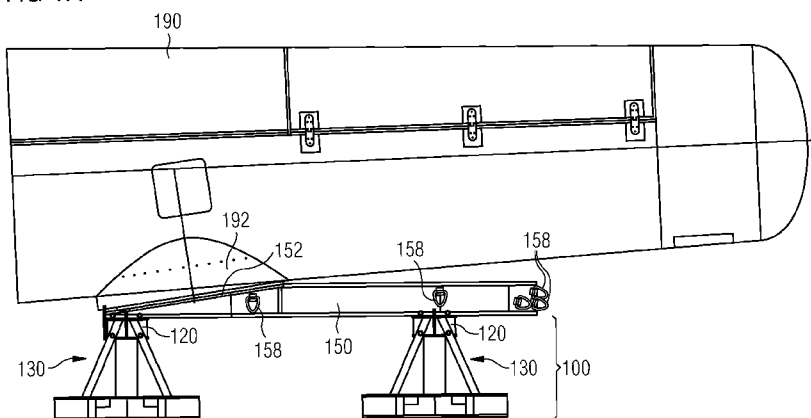
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(54) Title: SYSTEM AND METHOD FOR HANDLING A NACELLE OF A WIND TURBINE

FIG 1A



(57) Abstract: System (100) for handling a nacelle (190) of a wind turbine. The system (100) comprises a first supporting device (110) and a second supporting device (110). Each supporting device comprises (a) a crossbeam (120) extending between a left end section of the crossbeam (120) and a right end section of the crossbeam (120), the crossbeam (120) being adapted for supporting the nacelle (190) in between the left end section and the right end section, (b) a left pedestal (130) being attached to the left end section in a detachable manner, and (c) a right pedestal (130) being attached to the right end section in a detachable manner. It is further described a method for handling a nacelle (190) of a wind turbine by using the above described nacelle handling system (100).

DESCRIPTION

System and method for handling a nacelle of a wind turbine

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Field of invention

The present invention relates to the technical field of wind turbines and in particular to the field of transporting components of a wind turbine. Specifically, the present invention relates to a system and to a method for handling a nacelle of a wind turbine for instance for the purpose of transporting the nacelle to or from a site of installation of the wind turbine.

15

Art Background

When large nacelles of wind turbines are to be shipped a large crane is needed to move and lift each nacelle to a vehicle to further transport each nacelle to the site for erection of the wind turbines or to transport each nacelle to a ship or a train for further transportation or just to store the nacelle before a further transportation is possible.

However, a large crane used both for loading or unloading a nacelle to or from a vehicle for transportation is typically very expensive and slow when many nacelles are to be shipped. Further, when the crane is only a fixed portal crane there may be not enough space available below the crane for all the nacelles to be stored and to be shipped.

US 3289868 A discloses to load or unload a container to or from a truck by a system comprising hydraulic displaceable legs, which are attached to the container in a demountable manner.

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WO 2008/000268 A1 discloses a handling system for a nacelle of a wind turbine in connection with self-loading or self-

unloading of the nacelle to or from a vehicle. The handling system comprises two or more lifting means for displacing the nacelle substantially in a vertical direction during self-loading or self-unloading of a nacelle. The lifting means
5 comprises displacing means with displaceable legs.

There may be a need for improving the handling of a nacelle in particular for transportation purposes.

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Summary of the Invention

This need may be met by the subject matter according to the independent claims. Advantageous embodiments of the present
15 invention are described by the dependent claims.

According to a first aspect of the invention there is provided a system for handling a nacelle of a wind turbine, in particular for handling a nacelle of a wind turbine for the
20 purpose of transporting the nacelle. The described handling system comprises a first supporting device and a second supporting device, wherein each supporting device comprises (a) a crossbeam extending between a left end section of the crossbeam and a right end section of the crossbeam, the
25 crossbeam being adapted for supporting the nacelle in between the left end section and the right end section, (b) a left pedestal being attached to the left end section in a detachable manner, and (c) a right pedestal being attached to the right end section in a detachable manner.

30

The described nacelle handling system is based on the idea that the pedestals can be demounted from the respective crossbeam if they are not needed for keeping the respective crossbeam in an elevation above ground, which elevation depends on the vertical extension of the pedestals when being
35 vertically oriented. A demounting of the pedestal may be done for instance after the two crossbeams together with the supported nacelle are situated on a loading platform of a trans-

portation device such as for instance a truck or a coach or locomotive cart.

Each supporting device may be for instance a supporting trestle. Thereby, the supporting trestle may comprise a mechanical stability, which allows for carrying, together with at least one further supporting trestle, the nacelle.

Each crossbeam may be any mechanically stable element, which, when the nacelle is supported, extends at least from the left side to the right side of the nacelle.

Each pedestal may be any construction, which allows for keeping the crossbeam at a certain elevation above ground. In particular, the pedestal may be a leg or a bearing block.

Generally speaking, the nacelle can be placed on two or more supporting devices for instance by using a crane. The respective two pedestals of each supporting device, which are attached to the crossbeam in a demountable manner, can be removed or demounted from the crossbeam if they are not needed in particular when they are bulky and/or make the whole arrangement comprising (a) the nacelle, (b) the at least two crossbeams and (c) the pedestals attached to the respective crossbeam unwieldy.

When the nacelle is to be moved or transported the loading platform in particular of a truck or trailer is positioned beneath the two crossbeams of the supporting devices. Then, the loading platform of the truck or trailer may be raised at least a little such that both the nacelle and the supporting devices are lifted. The raising of the loading platform of the truck or trailer may be done by hydraulics, by pneumatics, mechanically, electrically and/or by any kind of actuator installed on the truck or trailer. The pedestals of each supporting device may be finally demounted before the nacelle is driven away by the truck or trailer.

When the nacelle is to be unloaded from the truck or trailer the pedestals may be mounted again just before unloading the nacelle from the truck or trailer. The unloading is then done by lowering the loading platform of the truck or trailer at least a little and then driving away the truck or trailer empty i.e. without having the nacelle loaded any more.

It is mentioned that if the nacelle is only to be moved locally e.g. within a working and/or a storing area it may not be necessary to demount the pedestals of the supporting devices before moving the nacelle.

In other words, the nacelle may be placed on the supporting devices each being equipped with demountable pedestals or legs for moving, transportation or storing of the nacelle. This may make the moving, the transportation and/or the storing of the nacelle of a wind turbine very flexible and cheap. The supporting devices can be used in connection with many kinds of different types of nacelles without an adaption, as the nacelle is just resting on top of the crossbeams of the supporting devices.

According to an embodiment of the invention the crossbeam is adapted to indirectly support the nacelle. This may provide the advantage that the nacelle does not come into direct mechanical contact with the crossbeam. An unwanted damage of the nacelle housing such as for instance a scratching of the outer surface of the nacelle housing may be avoided.

According to a further embodiment of the invention the crossbeam is adapted to support an attachment arrangement, which is constructed in such a manner that for transporting and/or storing the nacelle the nacelle can be attached to the attachment arrangement in a detachable manner.

The attachment arrangement may have the general shape of a plate, a frame or a bed. The attachment arrangement may be mounted to the bottom of the nacelle. When supporting the na-

celle with the at least two supporting devices the attachment arrangement may rest on top of the crossbeams of the respective supporting devices. Thereby, the attachment arrangement may ensure that the nacelle is safely placed on the cross-
5 beams and that the surface of the nacelle does not get any scratches as the nacelle is normally painted.

It is mentioned that the nacelle may be mounted to the attachment arrangement in a slightly angular manner. This may
10 provide the advantage that, if the nacelle has substantially an outer shape being at least approximately similar to a truncated cone (i.e. the diameter of the nacelle at a rear end is smaller than the diameter of the nacelle at a front end), the overall height of an assembly comprising the sup-
15 porting devices, the attachment arrangement and the nacelle may be reduced. As a consequence, when transporting the nacelle there can be used also tunnels, underbridges and/or underground crossings, which have a limited height.

20 According to a further embodiment of the invention the left pedestal and/or the right pedestal is capable of being adapted with respect to the vertical extension of the respective pedestal. This may provide the advantage that the height for supporting the nacelle can be adjusted in an appropriate
25 way in order to ensure a convenient further nacelle handling. Furthermore, if the left pedestal and the right pedestal have a different length with respect to each other, the nacelle can be securely supported even on an uneven and/or on a bumpy ground.

30 The described capability for adapting the length or the height of the pedestals may be realized in different ways. For instance a pedestal may be adjusted by inserting an extension piece into or by removing an extension piece from the
35 pedestal. Further, the pedestal may be equipped with vertical or at least partially vertical legs, which are automatically displaceable for instance by using hydraulics. In such a case the elevation of the supported nacelle can be varied even if

actually the nacelle is situated on the two crossbeams. In this way it is also possible to lower the nacelle down to the ground on a working place and/or a storing place.

5 In this respect it is mentioned that the supporting devices can be provided with a set of different pedestals, wherein at least some of the pedestals have a different length. Specifically, in one embodiment the detachable respectively demount-
10 able pedestals are produced in sets of different lengths to ensure that the length of the pedestals fit to the height of the loading platform of the specific transportation device that is used.

According to a further embodiment of the invention each sup-
15 porting device comprises (a) at least one left engagement opening being formed on a left side of the supporting device and (b) at least one right engagement opening being formed on a right side of the supporting device. This may provide the advantage that a handling of the supporting devices in par-
20 ticular for placing the supporting device to a correct position in order to be ready for supporting the nacelle can be facilitated. Thereby, the left and/or the right engagement openings may be formed within the crossbeam and/or within the respective pedestal.

25 Preferably, on each side of the supporting device there are provided at least two engagement openings, which are appropriately spaced apart from each other. Then, for instance a conventional forklift can be used for correctly placing the
30 supporting device.

In other words, the two or more supporting devices may be placed directly on a transportation device by employing one or more forklift trucks before the nacelle is placed on the
35 supporting devices. When the forklift trucks are used to lift the supporting devices each fork may be driven through a separate rectangular hole in a bottom beam of each pedestal of each supporting device.

According to a further embodiment of the invention the system further comprises a distance element, which extends between the first supporting device and the second supporting device and which is attached to the two supporting devices in a de-mountable manner. This may provide the advantage that the two or more supporting devices are placed in a specific distance between each other. Thereby, it may be ensured that the nacelle is placed in a safe way on top of the at least two crossbeams.

Preferably the described handling system comprises at least two distance elements, wherein one distance element is provided at a left side of the handling system and the other distance element is provided at the right side of the handling system. This means that, if a nacelle is supported respectively carried by the described handling system, there is one distance element provided at the left side of nacelle and the other distance element provided at the right side of the nacelle. Thereby, the terms left side and right side of the nacelle may refer to a longitudinal axis of the nacelle.

The distance elements may be attached to the pedestals of the two supporting devices. Preferably, the distance elements are attached to a bottom portion such as a bottom beam of the respective pedestal. This may provide the advantage that the leverage will be optimized such that the mechanical stability can be optimized.

It is mentioned that if the described handling system comprises more than two supporting devices, there may be provided an appropriate number of distance elements, which mechanically connect also the further supporting device(s) with at least one of the first and the second supporting device.

It is further mentioned that the length of the distance element(s) may be adjustable. Thereby, the longitudinal dimension of the whole handling system may be adjusted properly to

the dimension of the nacelle which is supposed to be supported.

According to a further embodiment of the invention the length of the crossbeam is adjustable. This may provide the advantage that the supporting devices can be optimally fit (a) to the width of the loading platform of the specific transportation device which is used (for instance a truck or a trailer) and/or (b) to the width of a specific nacelle type.

The length adjustability of the crossbeam may be realized for instance by inserting one or more appropriate extension piece(s) into or by removing one or more extension piece(s) from the crossbeam. Further, the lengths of the crossbeam may be provided with an appropriate automatic extension mechanism such as for instance a telescopic mechanism.

According to a further embodiment of the invention the system further comprises at least one guide element, which is provided at the crossbeam and which is adapted for ensuring that when placing the nacelle onto the crossbeam the nacelle is placed in a proper horizontal position.

In other words, the at least one guide element may be used for guiding the placement of the nacelle in the forward and/or the sideways direction in relation to the respective supporting device.

It is mentioned that if the above mentioned attachment arrangement is used for indirectly supporting the nacelle the guide element may mechanically interact with the attachment arrangement. Thereby, an unwanted scratching of the surface of the nacelle can be effectively avoided.

According to a further embodiment of the invention the guide element is formed in such a manner that a correct placement of the nacelle with respect to a longitudinal extension of the crossbeam is ensured.

In this context the guide element may be called a side guide element, because with respect to a longitudinal extension of the nacelle a lateral or a sidewise correct placement of the nacelle may be ensured.

If there are provided at least two guide elements at the same crossbeam, the lateral position of the nacelle on the crossbeam may be fixed both with respect to the left side and with respect to the right side of the crossbeam respectively of the nacelle.

According to a further embodiment of the invention the guide element is formed in such a manner that a correct placement of the nacelle with respect to a direction being perpendicular to a longitudinal extension of the crossbeam is ensured.

In this context the guide element may be called a front guide element or a back guide element, because with respect to a longitudinal extension of the nacelle a correct placement of the nacelle is ensured in a forward and/or in a backward direction.

If there are provided at least two guide elements at different crossbeams, the longitudinal position of the nacelle on the described handling system may be fixed both with respect to the front and with respect to the back direction of the nacelle.

According to a further embodiment of the invention the guide element comprises a slanted surface. This may provide the advantage that when lowering the nacelle onto the crossbeams the nacelle or, if applicable, the attachment arrangement may slide downward along the slanted surface into the correct lateral and/or longitudinal position.

Preferably, two slanted guide elements are employed which cooperate with each other in such a manner that when lowering

the nacelle the nacelle or, if applicable, the attachment arrangement is spatially constricted in between the two side elements. This may hold both for the above mentioned side guide elements and for the above mentioned front/back guide elements.

In other words, the guide elements may be made with an angle so that the distance between two cooperating guide elements is increasingly larger in the upwards direction. This means that when lowering the nacelle the nacelle or, if applicable, the attachment arrangement is incrementally constrained in between the two cooperating guide elements towards the final position on the handling system.

According to a further aspect of the invention there is described a method for handling a nacelle of a wind turbine. The described handling method comprises (a) bringing the nacelle to a position with respect to a handling system as described above, wherein the two crossbeams of the system are located below the nacelle, and (b) lifting the system and/or lowering the nacelle such that the nacelle is directly or indirectly supported by the two crossbeams.

The provided handling method is based on the idea, that the above described handling system can be used in an effective manner in order to support the nacelle for transportation and/or for storage purposes.

The nacelle may be brought to the appropriate vertical position with respect to the crossbeams of the handling system for instance by using a crane. Thereby, the nacelle may be lowered by the crane until it is hanging just above the crossbeams of the at least two supporting devices.

When lifting the system, wherein the crossbeams are approached from below to the nacelle or, if applicable, to the attachment arrangement, the nacelle may be moved or pushed forward so that the nacelle or, if applicable the attachment

arrangement, comes into contact with at least one of the guide elements described above. Thereby, a proper positioning of the nacelle with respect to the handling system may be ensured when further lowering the nacelle and/or when further
5 lifting the handling system. The proper positioning may be ensured with respect to a longitudinal and/or with respect to a transversal direction of the nacelle. Thereby, the direction of the nacelle may be defined by its longitudinal extension.

10 It has to be noted that embodiments of the invention have been described with reference to different subject matters. In particular, some embodiments have been described with reference to apparatus type claims whereas other embodiments
15 have been described with reference to method type claims. However, a person skilled in the art will gather from the above and the following description that, unless other notified, in addition to any combination of features belonging to one type of subject matter also any combination between fea-
20 tures relating to different subject matters, in particular between features of the apparatus type claims and features of the method type claims is considered as to be disclosed with this application.

25 The aspects defined above and further aspects of the present invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to the examples of embodiment. The invention will be described in more detail hereinafter with reference to examples of embodi-
30 ment but to which the invention is not limited.

Brief Description of the Drawings

35 Figure 1a shows a side view of a nacelle handling system together with a nacelle, which is supported indirectly by means of a nacelle supporting bed.

Figure 1b shows two pedestals of the handling system depicted in Figure 1a, wherein the pedestals are mechanically connected with a distance element in order to stabilize the whole nacelle handling system.

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Figure 1c shows a cross sectional view of a crossbeam of the handling system depicted in Figure 1a.

Figure 1d shows a front view of the handling system depicted in Figure 1a together with a supported nacelle supporting bed

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Figure 2 shows a photographic picture of a nacelle being supported by a nacelle handling system in accordance with an embodiment of the invention.

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Figure 3 shows a photographic picture of a supporting device being loaded on a loading platform of a truck.

Figure 4 shows a photographic picture of a supporting device, which is placed on a loading platform of a truck by means of two forklifts.

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Figure 5 shows a photographic picture of a nacelle handling system, which is placed on the ground.

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Figure 6 shows a cross sectional side view of a nacelle supporting bed being supported by two crossbeams.

Figures 7a, 7b, 7c and 7d show in respectively two different cross sectional views the procedure for placing a nacelle supporting bed onto two crossbeams of a nacelle handling system.

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35 Detailed Description

The illustration in the drawing may be schematically. It is noted that in different figures, similar or identical ele-

ments are provided with the same reference signs or with reference signs, which are different from the corresponding reference signs only within the first digit.

5

Figure 1a shows a side view of a nacelle handling system 100 together with a supported nacelle 190. The handling system 100 comprises two supporting devices, each having a crossbeam 120 and two pedestals 130. In Figure 1a, because of the perspective, only one pedestal 130 of each supporting device can be seen.

As can be seen from Figure 1a, the nacelle 190 is not supported directly by the two crossbeams 120. The two crossbeams 120 are at first supporting an attachment arrangement 150. In the following the attachment arrangement is also called a nacelle supporting bed.

According to the embodiment described here the nacelle supporting bed 150 comprises a slanted surface 152. The slanted surface is formed in such a manner, that a connection element 192 of the nacelle can be temporarily but securely attached to the nacelle supporting bed 150. The connection element 192 may be for instance a flange, which is permanently fixed to the housing of the nacelle 190 e.g. by means of welding. When the nacelle is in operation the flange 192 may be connected to the tower of the respective wind turbine.

The nacelle supporting bed 150 comprises a plurality of eyes 158, which allow for instance a row or a hook to be engaged. Therefore, the eyes 158 may be used for facilitating the handling of the nacelle supporting bed 150 during a reloading procedure, during which the nacelle 190 together with the nacelle supporting bed 150 may be held for instance by a crane.

35

Figure 1b shows two pedestals 130 of the handling system 100. According to the embodiment described here each pedestal 130 comprises a bottom beam 132, a vertical bar 134 and two

slanted bars 136. In the bottom beam 132 there are formed two engagement openings 133. The engagement openings 133 may be used for handling the respective pedestal 130. According to the embodiment described here the engagement openings 133 may be used by a forklift truck, which can insert the front ends of its two fork pieces into the openings 133.

The two pedestals 130 shown in Figure 1b are assigned to different supporting devices respectively to different crossbeams of the nacelle handling system 100. In order to increase the mechanical stability of the handling system 100 the two pedestals 130 are connected with a distance element 140. According to the embodiment described here the distance element is a distance bar 140, which is attached to the respective bottom beam 132 in a demountable manner. This means that the distance bar 140 can be removed from the two pedestals 130 when it is not needed. This may be the case for instance when the pedestals 130 are removed from the respective crossbeam 120 for instance when the nacelle 190 is transported on a loading platform of a truck or a trailer.

Figure 1c shows a cross sectional view of a crossbeam 120 of the handling system 100. At the crossbeam there are affixed two types of guide elements, a side guide element 121 and a front/back guide element 122. According to the embodiment described here the side guide element 121 comprises a slanted surface, which however cannot be seen in the perspective of Figure 1c. Further, the front/back guide element is a front/back stop element 122. The guide elements 121, 122 are adapted for ensuring that, when placing the nacelle supporting bed 150 onto the crossbeams 120 for instance by lowering the nacelle 190 together with the nacelle supporting bed 150, the nacelle supporting bed 150 is placed into a proper horizontal position onto the two crossbeams 120. Further details about the guide elements 121 and 122 will be given below, where a preferred procedure for placing the nacelle supporting bed 150 onto the two crossbeams 120 is described in more detail.

Figure 1d shows a front view of the handling system 100 together with the supported nacelle supporting bed 150. In this view there can be seen one complete supporting device 110
5 comprising one crossbeam 120 and two pedestals 130. Each pedestal 130 can be attached to the crossbeam 120 in a detachable manner via an attachment mechanism 125. The attachment mechanism may be realized by means of any connecting system. According to the embodiment described here the attachment
10 mechanism 125 comprises a mechanical bolt 126 in order to secure the respective pedestal 130 to the crossbeam 120.

Figure 2 shows a photographic picture of a nacelle 290 being
15 supported by a nacelle handling system in accordance with an embodiment of the invention. The nacelle 290 together with a nacelle supporting bed has been placed onto crossbeams 220 of the handling system. The loading of the nacelle 290 and its supporting bed has been carried out with a crane having a
20 rope 298. Due to the perspective of Figure 2 only one crossbeam 220 of the two crossbeams of the handling system can be seen. However, in addition to the pedestals 230 of the front (depicted) crossbeam 220 also at least a portion of the pedestals being assigned to the rear crossbeam (not depicted)
25 can be seen in Figure 2.

Figure 3 shows a photographic picture of a supporting device being loaded on a loading platform 396 of a truck. The supporting device comprises a crossbeam 320 and two pedestals,
30 wherein only one pedestal 330 can be seen. Further, in Figure 3 next to the two workers a pedestal 330 of the other supporting device is also depicted.

35 As can be further seen from Figure 3 the pedestal 330 comprises a bottom beam 332, a vertical bar 334 and two slanted bars 336. The pedestal 330 is attached to the crossbeam 320

in a detachable manner by means of an attachment mechanism 325.

5 Figure 4 shows a photographic picture of a supporting device, which is placed on a loading platform 496 of a truck by means of two forklifts. Due to the perspective only one of the forklifts can be seen in this Figure. Again the detachable attachment of a pedestal 430 to a crossbeam 420 by means of
10 an attachment mechanism 425 can be seen.

The fork 494 of the forklift engages into two engagement openings 433, which are formed within the bottom beam 432 of the pedestal 430. On the crossbeam 420 a side guide element
15 421 with a slanted surface is provided. Further details about the function of the side guide element 421 will be given below with reference to Figure 7.

20 Figure 5 shows a photographic picture of a nacelle handling system 500, which is now placed on the ground. A front crossbeam of the handling system 500 is denominated with reference numeral 520. A side guide element 521, which is provided at the crossbeam 520, is used for placing a nacelle supporting
25 bed 550 in an appropriate horizontal position. According to the embodiment described here this is achieved by lowering the nacelle supporting bed 550, which supports a nacelle 590, onto the crossbeams 520. Thereby, a lower side edge of the nacelle supporting bed 550 slides along a slanted surface of
30 the side guide element 521.

A connection element, which mechanically connects the nacelle 590 to the nacelle supporting bed 550, is denominated with reference numeral 592. According to the embodiment described
35 here the connection element is a flange 592.

An attachment mechanism 525 can also be seen in Figure 5. The attachment mechanism 525 connects in a detachable manner a pedestal 530 to the crossbeam 520.

5

Figure 6 shows a cross sectional side view of a nacelle supporting bed 650 being supported by two crossbeams 620. At the front crossbeam there are provided both side guide elements 621 having a non depicted slanted surface and front guide elements 622. According to the embodiment described here the front guide elements are front stop elements. All the guide elements are used for ensuring and facilitating a proper placement of the nacelle supporting bed 650 onto the crossbeams 620.

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The nacelle supporting bed 650 comprises a slanted surface 652, at which a flange of a nacelle can be attached. Eyes 658 can be used for handling the nacelle supporting bed 650 conveniently.

20

Figures 7a, 7b, 7c and 7d illustrate a procedure for placing a nacelle supporting bed 750 respectively a non depicted nacelle into a proper horizontal position onto two crossbeams 720, which represent respectively a part of a nacelle handling system in accordance with an embodiment of the invention. Figure 7a corresponds to a first relative position between the nacelle supporting bed 750 and the crossbeams 720. In the Figure 6 this first position is indicated with a circle 1. Figure 7b corresponds to a second relative position, which is indicated with a circle 2 in Figure 6. Figure 7c corresponds to a third relative position, which is indicated with a circle 3. Figure 7d corresponds to a forth relative position, which is indicated with a circle 4 in Figure 6.

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According to the embodiment described here the nacelle supporting bed 750 comprises a slanted surface 752 and eyes 758.

The function of the slanted surface 752 and the function of the eyes 758 have already been described above.

5 The Figures 7a, 7b, 7c and 7d respectively show two different cross sectional views. The respective left figure framing shows a front end of the nacelle supporting bed 750 including the slanted surface 752 and an eye 758. The left figure framings are oriented parallel to a xz-plane. The respective right figure framings shows a central section of the nacelle
10 supporting bed 750, which is placed or which is supposed to be placed onto the rear crossbeam 720. The right figure framings are oriented parallel to a yz-plane. Thereby, x, y, and z define a right angled cartesian coordinate system.

15 At the front cross beam 720, which can be seen respectively at the left figure framings, there are provided both side guide elements 721 and front guide elements 722. According to the embodiment described here the front guide elements are front stop elements. At the rear crossbeam 720 there are pro-
20 vided only side guide elements 721. Each side guide element 721 comprises a slanted surface.

As will be seen from the following description of a placement procedure of the nacelle supporting bed 750, all guide ele-
25 ments 721 and 722 are used for ensuring a proper placement of the nacelle supporting bed 750 onto the crossbeams 720.

In between the operational states shown in Figures 7a and 7b, the nacelle supporting bed 750 is lowered by e.g. a crane so
30 that it is hanging just above the upper side of the crossbeams 720. Then, in between the operational states shown in Figures 7b and 7c the nacelle respectively the nacelle supporting bed 750 is moved or pushed forward so that the front end of the supporting bed 750 just hits the front guides 722.
35 Then, in between the operational state shown in the Figures 7c and 7d the nacelle respectively the nacelle supporting bed 750 is simultaneously lowered and adjusted sideways between

the side guides 721 while the supporting bed 750 is still hold against the front guides 722.

5 The side guides 721 are attached on top of at least one of the two crossbeams 720. One side guide 721 is attached at the left side and one side guide 721 is attached at the right side of the crossbeam 720. The two side guides 721 are spaced apart in a distance depending on the width of the nacelle supporting bed 750. The side guides are made with an angle
10 respectively with a slanted surface, so that the distance between the right side guide 721 and the left side guide 721 is increasingly larger in the upwards direction.

15 It should be noted that the term "comprising" does not exclude other elements or steps and "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be con-
20 strued as limiting the scope of the claims.

List of reference signs:

	100	handling system
	110	supporting device
5	120	crossbeam
	121	side guide element (with slanted surface)
	122	front/back guide element / front/back stop element
	125	attachment mechanism
	126	bolt
10	130	pedestal
	132	bottom beam
	133	engagement opening
	134	vertical bar
	136	slanted bar
15	140	distance element / distance bar
	150	attachment arrangement / nacelle supporting bed
	152	slanted surface
	158	eyes
	190	nacelle
20	192	connection element / flange
	220	crossbeam
	230	pedestal
	290	nacelle
25	298	rope of crane
	320	crossbeam
	325	attachment mechanism
	330	pedestal
30	332	bottom beam
	334	vertical bar
	336	slanted bar
	396	loading platform
35	420	crossbeam
	421	side guide element (with slanted surface)
	425	attachment mechanism
	430	pedestal

	432	bottom beam
	433	engagement opening
	494	fork
	496	loading platform
5		
	500	handling system
	520	crossbeam
	521	side guide element (with slanted surface)
	525	attachment mechanism
10	530	pedestal
	550	attachment arrangement / supporting bed
	590	nacelle
	592	connection element / flange
15		
	620	crossbeam
	621	side guide element (with slanted surface)
	622	front guide element / front stop element
	650	attachment arrangement / supporting bed
	652	slanted surface
20	658	eyes
	720	crossbeam
	721	side guide element (with slanted surface)
	722	front guide element / front stop element
25	750	attachment arrangement / supporting bed
	752	slanted surface
	758	eye

CLAIMS:

1. A system for handling a nacelle (190) of a wind turbine,
in particular for handling a nacelle (190) of a wind turbine
5 for the purpose of transporting the nacelle (190), the system
(100) comprising
- a first supporting device (110) and
 - a second supporting device (110),
- wherein each supporting device comprises
- 10 - a crossbeam (120) extending between a left end section of
the crossbeam (120) and a right end section of the crossbeam
(120), the crossbeam (120) being adapted for supporting the
nacelle (190) in between the left end section and the right
end section,
- 15 - a left pedestal (130) being attached to the left end sec-
tion
in a detachable manner, and
- a right pedestal (130) being attached to the right end sec-
tion
- 20 in a detachable manner.
2. The system as set forth in claim 1, wherein
the crossbeam (120) is adapted to indirectly support the na-
celle (190).
- 25
3. The system as set forth in claim 2, wherein
the crossbeam (120) is adapted to support an attachment ar-
rangement (150), which is constructed in such a manner that
for transporting and/or storing the nacelle (190) the nacelle
30 (190) can be attached to the attachment arrangement (150) in
a detachable manner.
4. The system as set forth in any one of the preceding
claims, wherein
- 35 the left pedestal (130) and/or the right pedestal (130) is
capable of being adapted with respect to the vertical exten-
sion of the respective pedestal (130).

5. The system as set forth in any one of the preceding claims, wherein

each supporting device comprises

- at least one left engagement opening (133) being formed on
5 a left side of the supporting device (110) and
- at least one right engagement opening (133) being formed on
a right side of the supporting device (110).

6. The system as set forth in any one of the preceding
10 claims, further comprising
a distance element (140), which extends between the first
supporting device (110) and the second supporting device
(110) and which is attached to the two supporting devices
(110) in a demountable manner.

15

7. The system as set forth in any one of the preceding
claims, wherein
the length of the crossbeam (120) is adjustable.

20 8. The system as set forth in any one of the preceding
claims, further comprising
at least one guide element (121, 122), which is provided at
the crossbeam (120) and which is adapted for ensuring that
when placing the nacelle (190) onto the crossbeam (120) the
25 nacelle (190) is placed in a proper horizontal position.

9. The system as set forth in claim 8, wherein
the guide element (121) is formed in such a manner that
a correct placement of the nacelle (190) with respect to a
30 longitudinal extension of the crossbeam (120) is ensured.

10. The system as set forth in any one of the claims 8 to 9,
wherein
the guide element (122) is formed in such a manner that
35 a correct placement of the nacelle (190) with respect to a
direction being perpendicular to a longitudinal extension of
the crossbeam (120) is ensured.

11. The system as set forth in any one of the claims 8 to 10, wherein the guide element (121) comprises a slanted surface.

- 5 12. A method for handling a nacelle (190) of a wind turbine, the method comprising
- bringing the nacelle (190) to a position with respect to a system (100) as set forth in any one of the preceding claims, wherein the two crossbeams (120) of the system
 - 10 (100) are located below the nacelle (190), and
 - lifting the system (100) and/or lowering the nacelle (190) such that the nacelle (190) is directly or indirectly supported by the two crossbeams (120).

FIG 1A

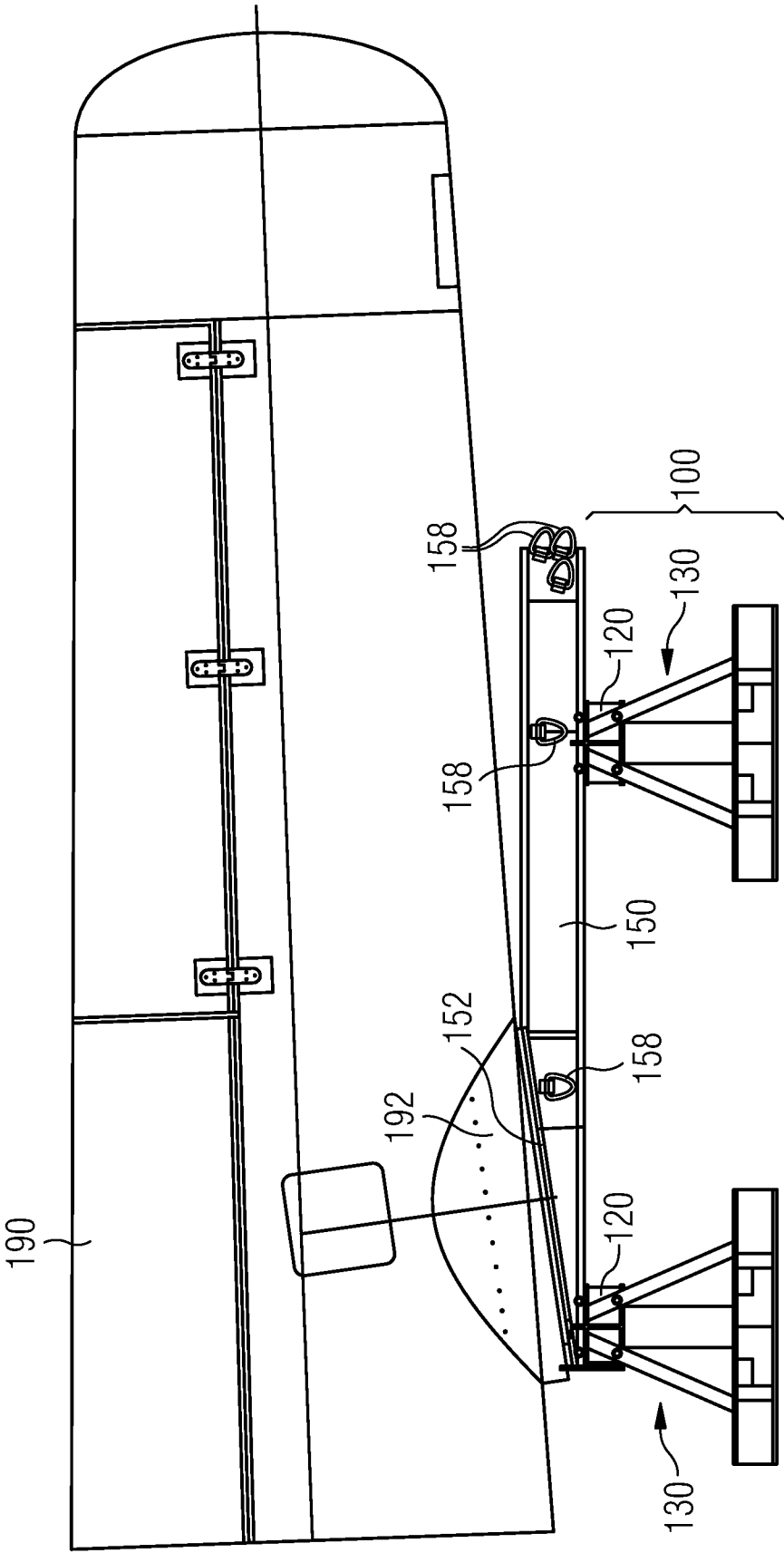


FIG 1B

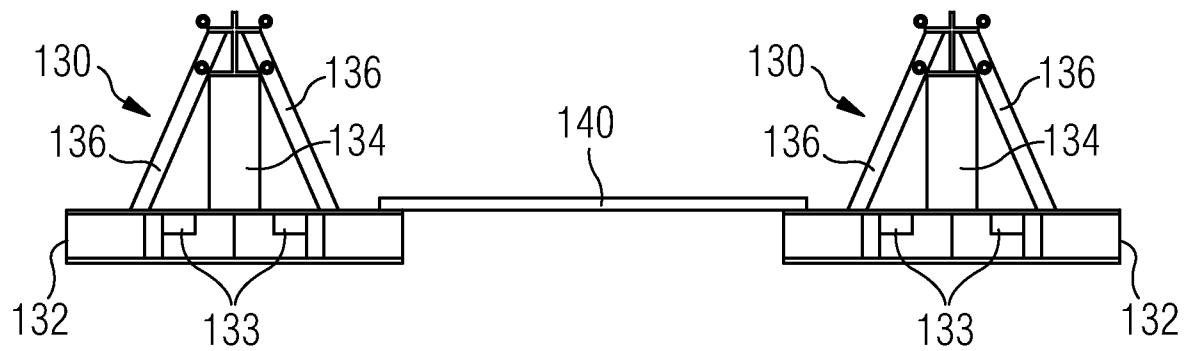


FIG 1C

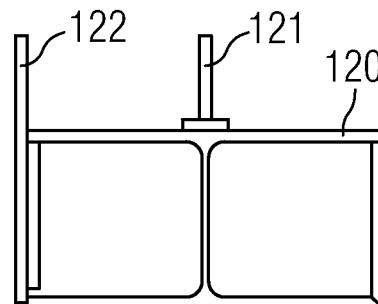


FIG 1D

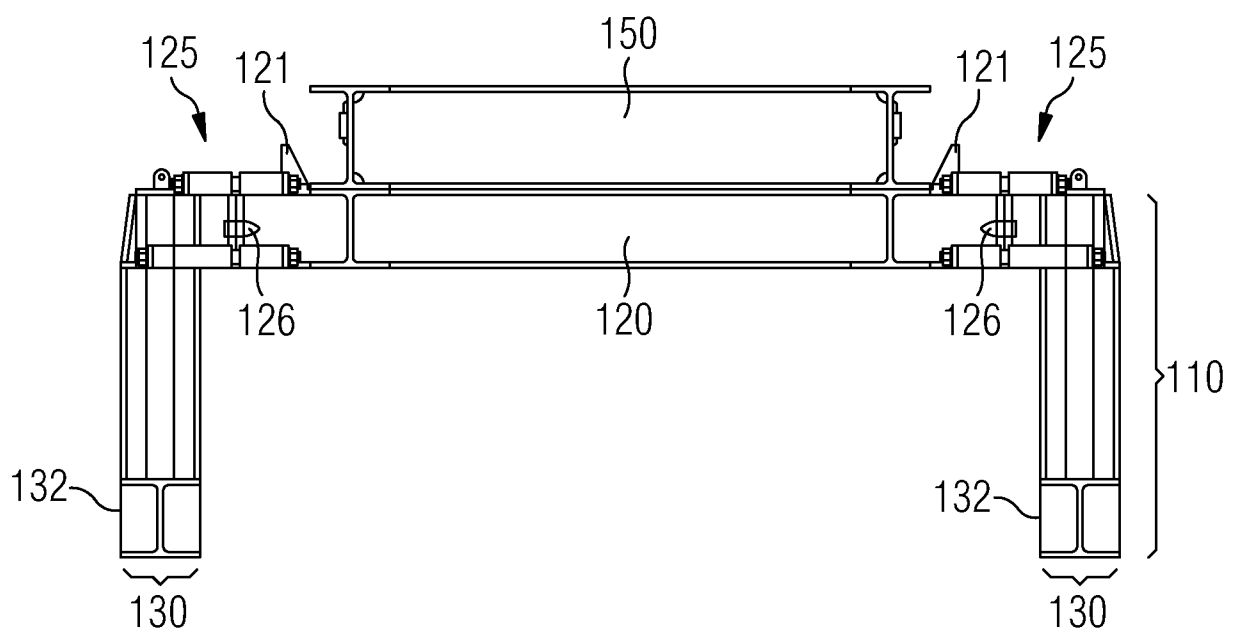


FIG 2

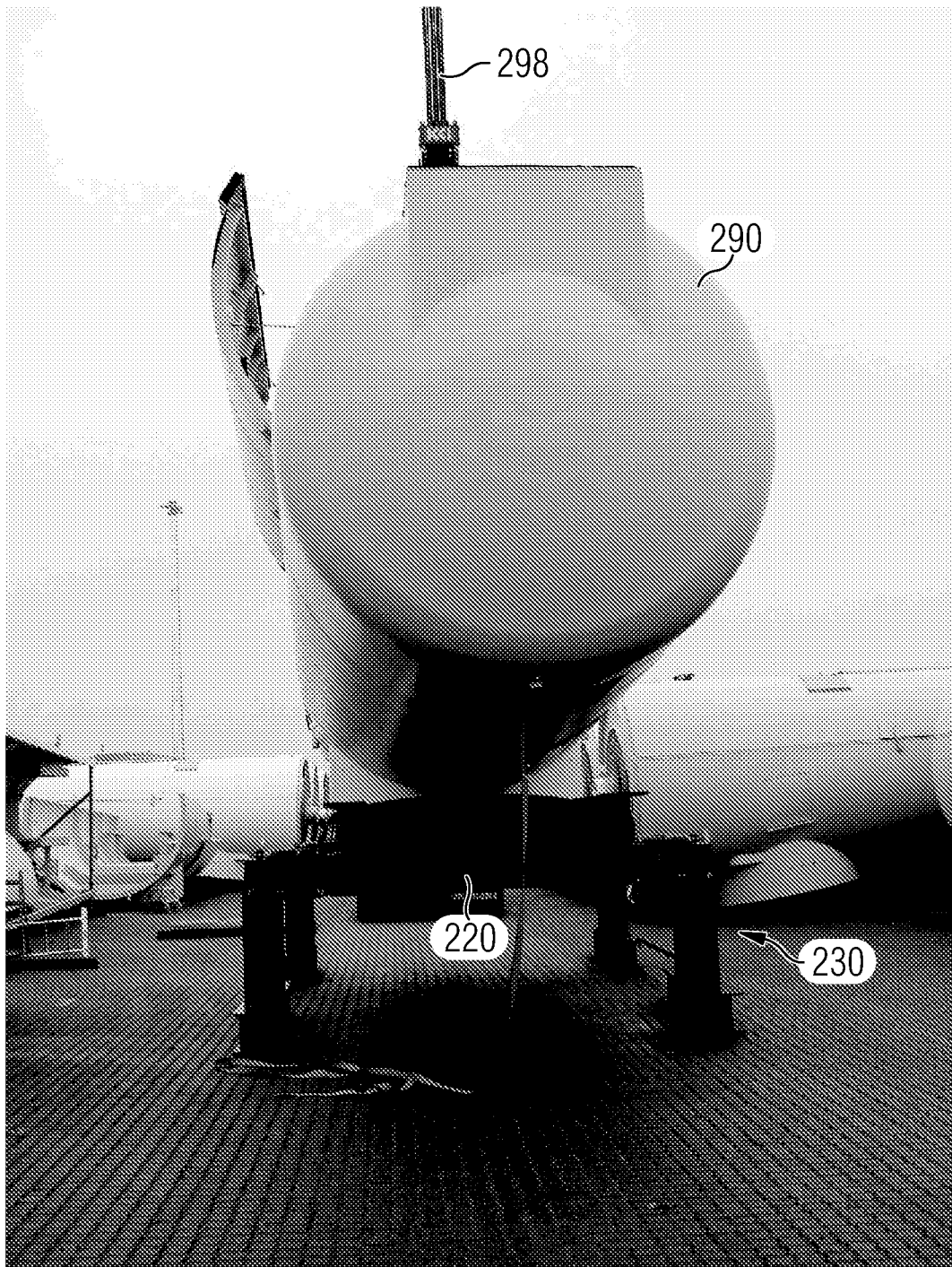


FIG 3

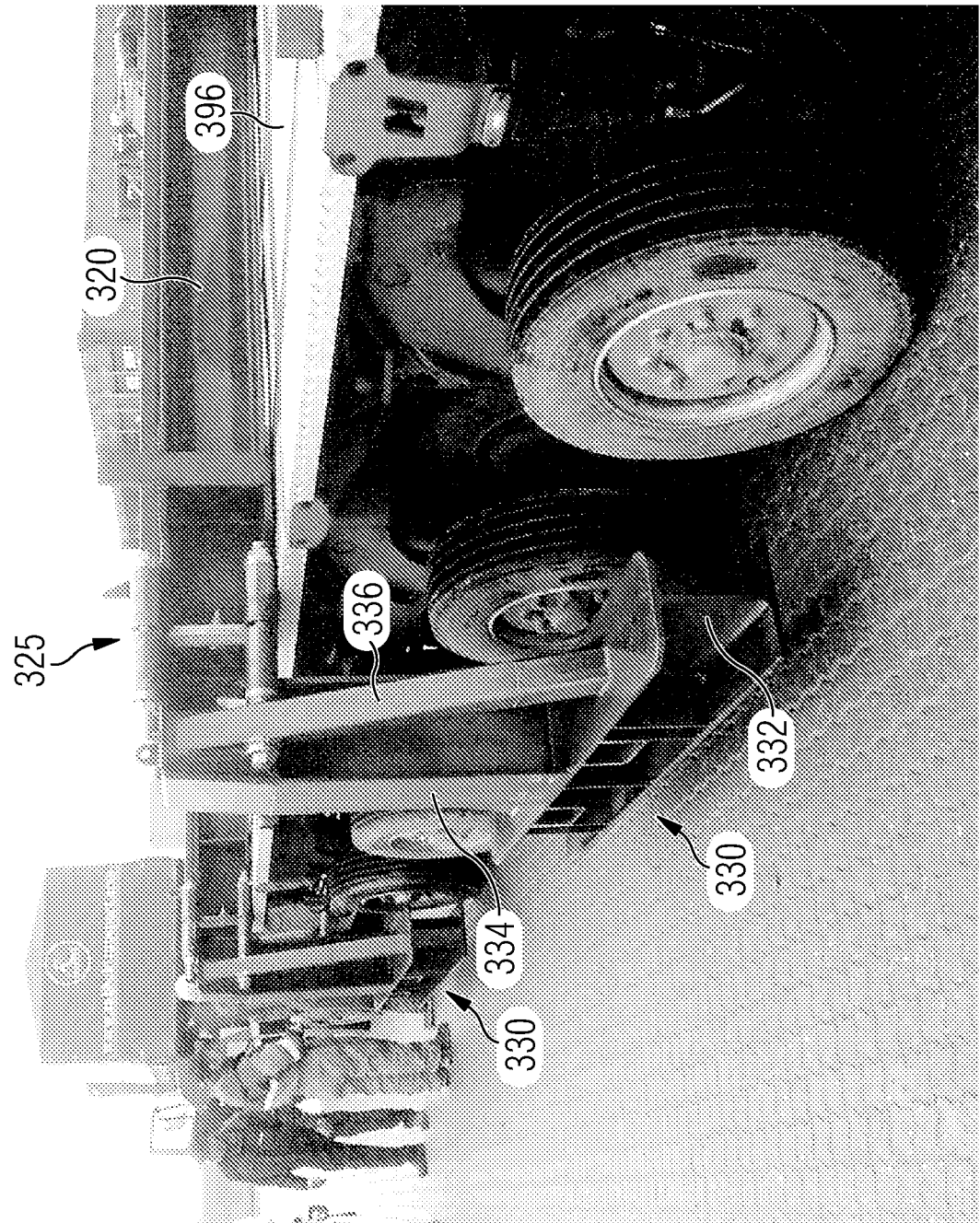


FIG 4

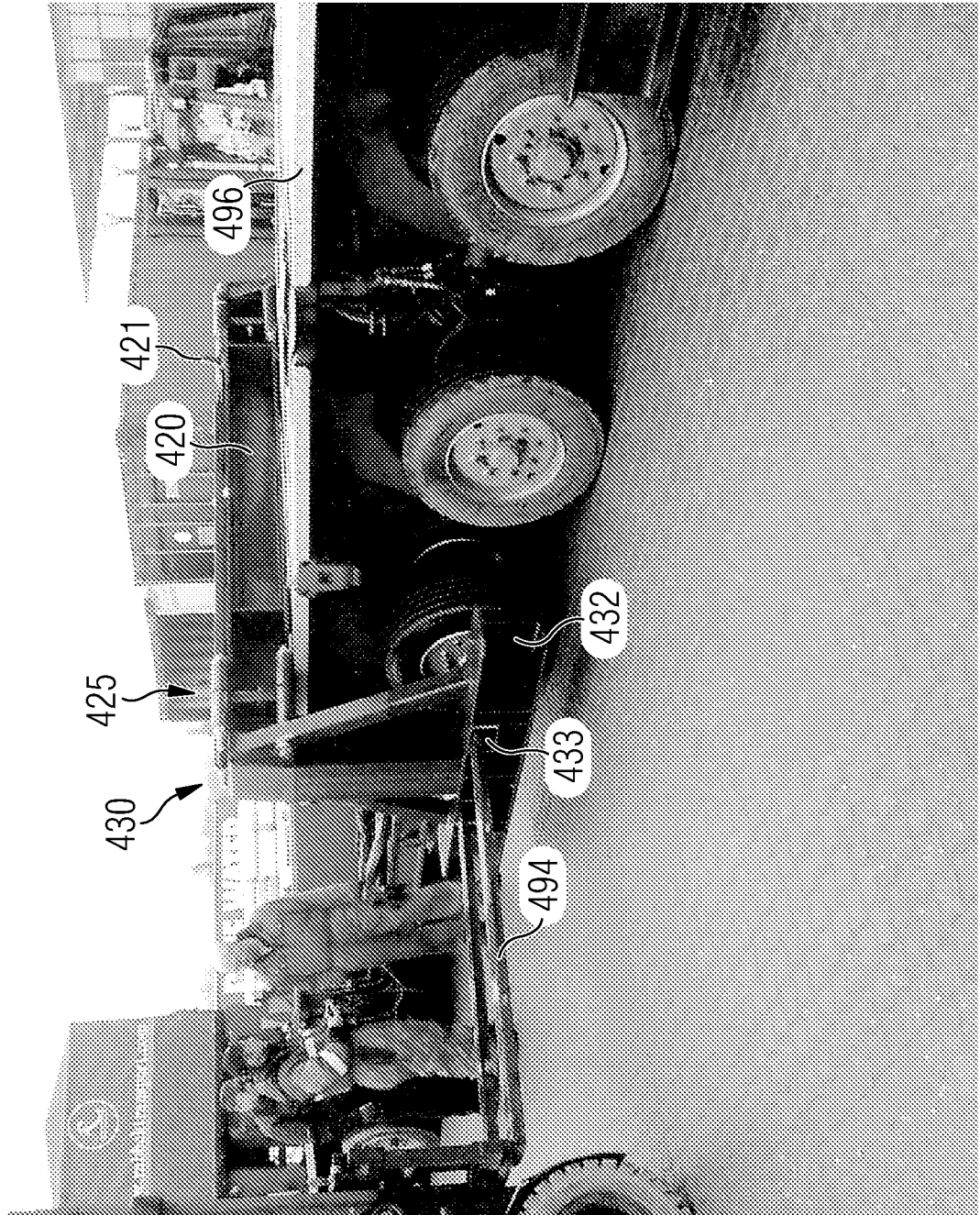


FIG 5

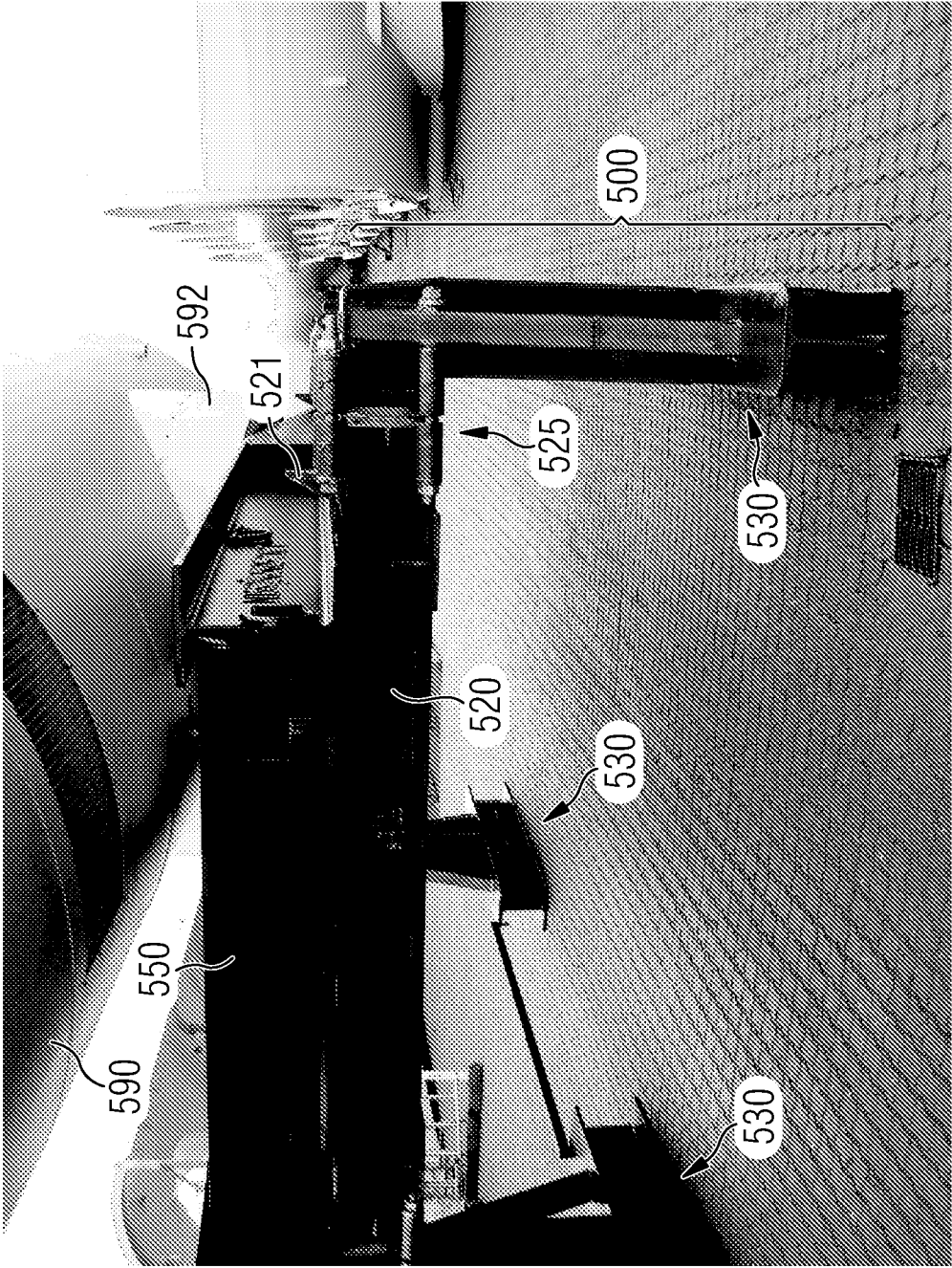


FIG 6

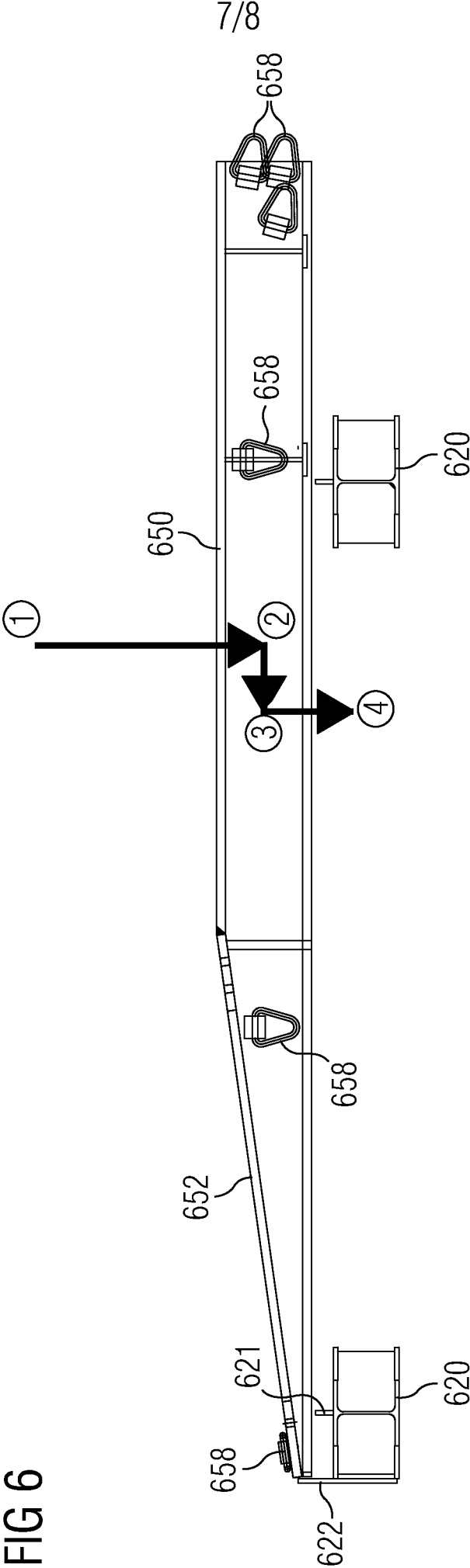


FIG 7A

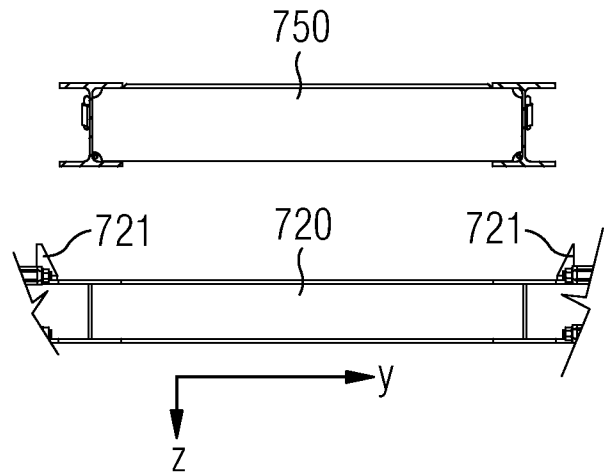
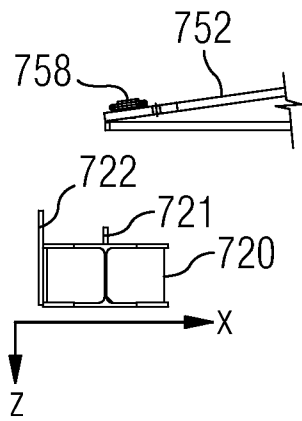


FIG 7B

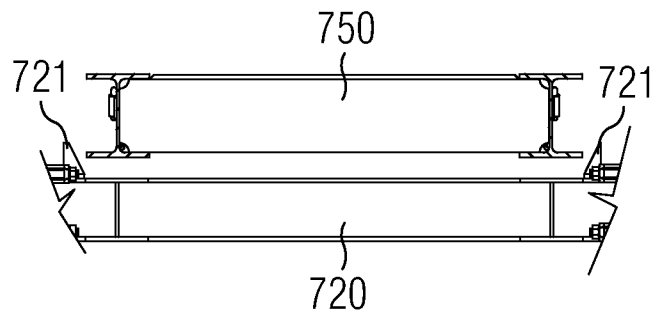
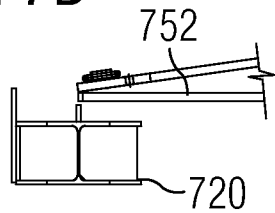


FIG 7C

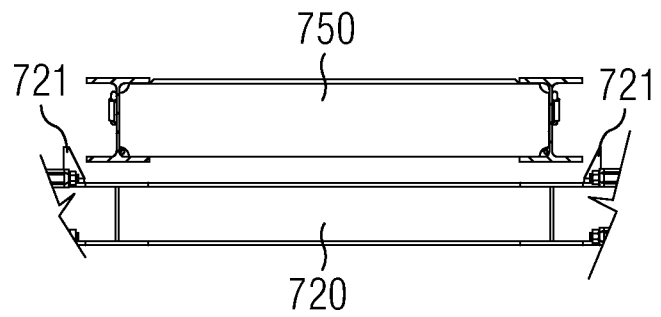
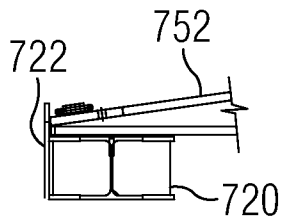
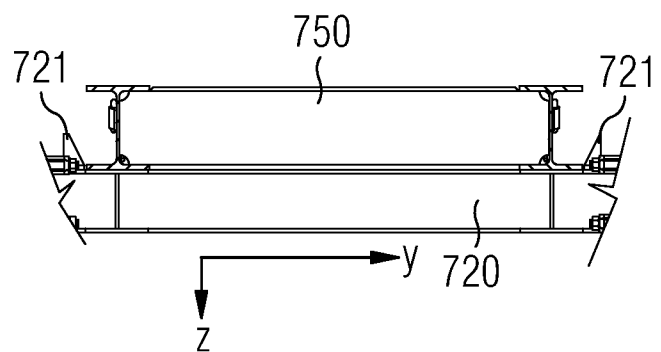
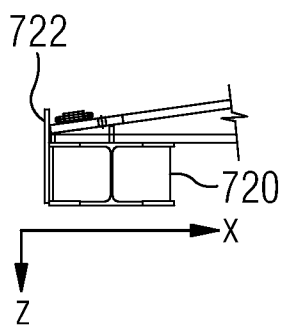


FIG 7D



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/054419

A. CLASSIFICATION OF SUBJECT MATTER

INV. B66F3/46 B66F9/12 B66F9/18 F03D1/00 F03D11/04

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)

F03D B66F B66C

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.
X	US 2 820 644 A (SMITH MORTIMER P) 21 January 1958 (1958-01-21) the whole document	1-4,12
X	US 4 400 133 A (BOOKER ARTHUR J [US]) 23 August 1983 (1983-08-23) abstract; figures	1-3,12
A	WO 2004/101313 A (VESTAS WIND SYS AS [DK]; PEDERSEN GUNNAR STORGAARD [DK]) 25 November 2004 (2004-11-25) abstract; figures 4-6	1,6,7
A	US 4 206 906 A (EUBANK MARCUS P [US]) 10 June 1980 (1980-06-10) abstract; figures	1,2,4,12
	----- -/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

21 August 2009

Date of mailing of the international search report

31/08/2009

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Verheul, Omiros

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/054419

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 2005/100786 A (DONOVAL JAN HM [SK]) 27 October 2005 (2005-10-27) abstract; figures -----	1,2,4,12
A	WO 2006/076920 A (A2SEA AS [DK]; THOMSEN KURT ELITH [DK]) 27 July 2006 (2006-07-27) abstract; figure 2 -----	1,2,12

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Information on patent family members

International application No

PCT/EP2009/054419

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