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Crane for installing a Wind Turbine.

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Hoisting system for the installation of a wind turbine comprising a column and a boom wherein said column comprises measures to achieve a load bearing connection to the tower of the wind turbine and wherein said column comprises measures to move the hoisting system up and down along the tower. Such a system can install successive tower sections while moving upwardly along the installed tower sections. After the tower is completed it can install the nacelle, generator, hub and the rotor blades. According to a further aspect the column comprises a rail which guides the hoisting system in essentially vertical direction along guiding points which are fixed to the tower and wherein said rail has a length of maximally 60m and in particular at least 23m and more in particular at least 34m. The long rail allows the hoisting of heavy parts such as the lower tower sections or the nacelle without applying high sideward forces to the tower since $\text{force} = \text{bending moment} / \text{arm}$. This hoisting system is efficient since it allows simple and fast movement of the system up and down along the guiding points on the tower. The aim is further reached by a wind turbine comprising a tower, a nacelle, a generator, a hub and at least a blade wherein the tower comprises guiding point for the fixation and guiding of the hoisting system according to the invention.

Crane for Installing a Wind Turbine

Relation

- 5 The present invention relates to a hoisting system for the commissioning of a wind turbine and to a wind turbine which comprises measures to facilitate the use of said hoisting system and to the combination of said wind turbine and said hoisting system.

Introduction/problem

- 10 The costs of labor and maintenance increase only gradually with increasing turbine size, and therefore to minimize costs, wind turbines are getting bigger and bigger. With increasing size and height the installation costs of the turbines are not rising gradually but at least linearly with turbine size. The largest industrial cranes available are required to install the largest land based wind turbines. Those heavy modular crane units are
15 expensive, often require strengthening of the roads and special transportation permits. In addition to these disadvantages said cranes need a lot of space which is not always available and when such a crane is needed for the next turbine in a wind farm it may occur that the crane cannot move thereto for example because the terrain is complex or the roads are too small. Then the crane has to be decommissioned, transported in parts
20 and commissioned again which is an inefficient time consuming operation. This explains the initiatives to find a way around: to install a wind turbine more efficiently and in particular without the need of a large general purpose crane.

Prior Art

- 25 One initiative is that described in WO2014/082176A1 (Pellerin 2012) wherein a rails is attached to the tower and a lifting platform can move up and down over said rails. This system has the drawbacks that the rails is required over the full length of the tower, which adds weight and that the rails increases the tower stiffness in one direction so that the tower eigen frequencies in that direction become higher than those in the
30 perpendicular direction which reduces the design freedom for modern variable rotor speed wind turbines where resonance between the tower eigen frequencies should be avoided in the full range of rotor frequencies and blade passage frequencies. Another drawback of the lifting platform is that it is attached to the rails over a vertical distance of about the length of 1 tower section or less. This relatively short distance leads to large
35 forces on the wind turbine tower when heavy parts like the nacelle are lifted. And since the lifting platform moves over the entire rails length, the rails needs to be strong and

heavy over the entire length and becomes expensive and economically inefficient. All said disadvantages of a lifting platform also turn up for the embodiments presented in US4311434 (Abe 1982), US6357549B1 (Brennan 2000), US6614125B2 and US6522025B2 (Willis 2002).

5 An alternative and also not efficient solution is presented in US8069634B2 (Livingston 2007). Herein a first crane which can be a large industrial crane or a crane of the ginpole type which is moveably attached to a partially constructed structural tower of a wind turbine is applied to hoist and install a structural tower in several parts and, once the tower is completed, to lift a second lifting system which is installed on top of the tower and serves to hoist the nacelle and the rotor. Next to the con of requiring two lifting systems the application is time consuming: the first crane should hoist the second lifting system to the top and this second should be installed and made operational. Then the first crane should be positioned away to avoid interfering with the second lifting system. After that the nacelle and rotor can be hoisted and when this is finished all steps need to be repeated in reversed order. A third con is that the ginpole as is shown in figures 29-37 of Livingston 2007 is not resistant to sideward wind loading: the tall crane has one or two slender beamlike joints to the tower which cannot take the sideward wind load so that the entire crane could spin around the vertical axis. A fourth con considers the embodiment of the ginpole moving system shown in figures 57 and 58 of Livingston 2007: The system employs one or more standoff brackets for fixation of a jump rack slidably to the wind turbine tower. The ginpole is also connected slidably to the jump rack. Moving the ginpole is a stepwise procedure wherein each step consists of installing successive standoff brackets to wind turbine tower, shifting the jump rack so that it overlaps with the successive standoff brackets and subsequently sliding the ginpole over the jump rack. This cumbersome procedure, which looks essentially equivalent to the invention presented in Gebrauchsmuster G9414643.8 (Kröger 1994) is time consuming and not cost-effective. It should be noted that the erection of a wind turbine requires a period of calm weather and in particular low wind speeds. If the hoisting takes much time the probability of completing the job in the low wind period is reduced which further decreases efficiency. US2015/0048043A1 (Laurens 2011) presents another comparable lifting system wherein after completion of the tower, a crane is installed on the tower top to hoist the nacelle and rotor. This system has the additional disadvantages that it feeds forces all the way down to the tower bottom and it cannot lift tower sections, so that a large conventional crane is still required.

35 An alternative method to install a wind turbine is by designing the nacelle of the wind turbine in such a way that it comprises a hole which encloses a non tapered tower.

Embodiments used for this approach are described e.g. in US756216 (Crunican 1902), DE2823525B1 (Sprang 1978), DE2735298A1 (Rogge 1979) and in US6408575B1 (Yoshida 2000). Although the Growian, a turbine of 100m height was made using this method, it turned out to be not efficient for large wind turbines: the large turbines require tapered towers to deal efficiently with the high bending moments. Therefore non-tapered towers have phased out for wind turbines with an axis height of above about 80 meters.

State of the art wind turbine towers are of the tapered structural type or of the tapered tubular type and sometimes the lower side of the tower is structural and the upper side tubular. The structural tower has the benefit that it can be transported in parts and assembled at the site, this advantage is however valid as well for the tubular towers of which the vertical sections can be assembled from easily transportable segments or shells. The tubular tower has the additional advantages that its appearance has better public acceptance and that it protects the equipment inside the turbines such as the inverter, transformer, controller etc. against the outdoor climate. Therefore solving the problem of the inefficiency of the installation of wind turbines is more relevant for tubular towers than for structural towers. This is another argument against the lifting system presented by Livingston 2007 which is suitable for structural towers only. It should be noted that we define tubular towers as towers of which horizontal cross sections are closed curves, which can be circular, polygonal, or of any other closed shape.

In DE19741988A1 (Peiter 1999) and DE19647515A1 (Gerd-Albrecht 1996) alternative lifting systems are presented wherein the lifting systems can climb cylindrical tubular towers by fixing itself by a system that surrounds the tower. Those systems easily damage the tower since large holding forces are needed to obtain sufficient friction on the tower wall to avoid the systems from gliding downward. Furthermore the systems are most suitable for non-tapered towers which have phased out. Finally the systems are not designed for carrying heavy parts of large modern wind turbines since the vertical length whereover the bending moments are fed into the tower is less than the length of one tower section or less than 2 tower top diameters which leads to unacceptable high forces on the tower wall.

Since the wind speed increases with height, and the average hub height of wind turbines increases with the successive wind turbine generations, the hoisting is getting increasingly hindered by high wind speeds. In particular this is relevant to the hoisting of the entire rotor i.e. the hub and the blades in a single hoist: the large aerodynamically shaped blades are sensitive to gusts. The lifting devices described in the above prior art are designed for single hoist lifting of the rotor and are not suitable for single blade

hoisting and in particular not for the case that a single blade is hoisted in an about horizontal position.

All the above mentioned patent texts should be considered as integrated in this document with the exception that in the case of inconsistencies, the contents of this
5 documents supersedes above the referenced texts.

Aim / Invention

The aim of the invention is to overcome the above mentioned disadvantages of existing solutions. This aim is reached by a hoisting system for the installation of a wind
10 turbine comprising a column, a boom and a winch wherein said column comprises measures to achieve a load bearing connection to the tower of the wind turbine and wherein said column comprises measures to move the hoisting system up and down along the tower. Such a system can install successive tower sections while moving upwardly along the installed tower sections. After the tower is completed it can install the
15 nacelle, generator, hub and the rotor blades. According to a further aspect the column comprises a rail which guides the hoisting system in essentially vertical direction along guiding points which are fixed to the tower. A beneficial maximum length of said rail is 60m, while the minimum length is 10m and in particular 20m and more in particular 34m. The long rail allows the hoisting of heavy parts such as the lower tower sections or the
20 nacelle without applying high sideward forces to the tower since force = bending moment / arm. This hoisting system is efficient since it allows simple and fast movement of the system up and down along the guiding points on the tower. A further embodiment of the hoisting system is that wherein it comprises a rail of which a section can be put in a first position wherein the rail section can be placed over a guiding point on the wind
25 turbine tower and in a second position wherein it encloses the guiding point in such a way that the rail can only move up and down along the tower. In a further embodiment the column of the hoisting system comprises measures to move the hoisting up and down along the tower. Such measures can comprise a hydraulic cylinder or an electromechanical linear actuator which is fixed at one end to the column and at the
30 other end to a guiding point or alternatively it can comprise a chain which moving around over driven cogwheels which are fixed to the column. By fixing the chain to a guiding point it can move the hoisting system up and down. Another option to move the hoisting system is to fix a cable at one side to a guiding point and at another side to a winch which is mounted to the column. A further embodiment of the hoisting system comprises
35 a coupling which can fix the hoisting system rigidly to a guiding point in such a manner that it can transfer vertical forces of the hoisting system to the guiding point in particular

at least 30% of those vertical forces and more in particular at least 90% of those vertical forces. The height position of a coupling in the column is within the lower 65% of the length of the rail and in particular between 35% and 65% of the rail length. A beneficial embodiment of the hoisting system comprises a boom which reaches at least 15m from the rail and in particular at least 25m from the rail. According to one embodiment of the hoisting system the maximum length of the boom is 60m. A further beneficial hoisting system is that wherein the boom is fixed to the column via a yaw bearing and in particular wherein the rotation axis of said yaw bearing is inclined to the length direction of the rail by more than 0.5 degrees and in particular by more than 1 degree and even more in particular by less than 5 degrees. In a further beneficial embodiment of the hoisting system the boom is fixed with a tilt hinge to the yaw bearing or the boom comprises a tilt hinge, wherein the tilt hinge can be adjusted over at least 20 degrees and in particular over less than 200 degrees. The tilt motion can be driven by a hydraulic or electro mechanic actuator. An alternative beneficial embodiment is one wherein the column is extended to more than 15m and in particular more than 25m above the rail and comprises a yaw bearing whereon an about horizontal boom is attached which comprises a hoisting point which can move along the boom. In a further beneficial embodiment of the hoisting system the boom comprises a winch which drives the hoisting cable and in particular the boom comprises multiple winches which each have a separate hoisting cable leading to the hoisting point so that each winch carries part of the total load. A further beneficial embodiment of the hoisting system comprises a boom which is bended or inflected to that a line piece from the center of the tilt hinge to the hoisting point reaches a distance to the boom of at least 1.5m and in particular of at least 2.5m and preferably of about 4m. while a conventional heavy crane requires several dozens of trucks e.g. 50 for transportation, The hoisting system according to the invention can be transported by less than 5, e.g. just 2 standard trucks, , which gives advantage in cost and space requirements at the site. A further advantage is that the hoisting system can be installed in several hours while the erection of a heavy crane takes several days. An even further advantage is that the hoisting system can move up and down along the wind turbine tower relatively fast compared to the lifting systems found in the prior art.

The aim of the invention is further reached by a wind turbine comprising a tower, a nacelle, a generator, a hub and at least a blade wherein the tower comprises guiding points for the fixation and guiding of a hoisting system and in particular of the hoisting system according to the invention. An embodiment of such a wind turbine comprises guiding points at a relative spacing of more than 10m and less than 30m. A further

embodiment of a wind turbine according to the invention is that wherein the tower comprises tubular overlapping sections which are bolted together on the overlap and wherein a guiding point is installed on the overlap so that less stiffening of the tower near the guiding points is required since the double layered overlapping parts have more stiffness by themselves. An even further embodiment of the wind turbine according to the invention comprises a guiding point which comprises a stiffening structure which is fixed to the tower and which extends from the center of the guiding point by at least 50cm and in particular by at least 100cm. Such a stiffening structure can be installed at the outer side or at the inner side or at both sides of the tower. In particular for the first or second tower section of a segmented tower the stiffening structure may comprise a structural beam from the guiding point to the tower foundation or a structural beam in about horizontal direction to the tower wall at a position which is more than 10degrees and in particular more than 30degrees away from the guiding point when rotating around the tower axis along the tower wall. A further embodiment of a wind turbine according to the invention comprises N guiding points which are numbered 1 to N in upward direction wherein for guiding point M for $M = 1$ to $N-2$, the line between the centers of guiding points M and M+1 reaches a distance to the center of a successive guiding point of maximally 5cm, in particular of maximally 10cm and more in particular of maximally 20cm. A further embodiment of a wind turbine according to the invention comprises a tower with a load carrying wall and in particular one wherein the wall is load carrying over a tower length of at least 50% and more in particular over at least 80%. One beneficial embodiment of a wind turbine according to the invention comprises a non-structural tower with a load carrying wall over its full length. A further embodiment of a wind turbine according to the invention comprises a tower of which a horizontal cross section of the outer side is shaped circular or polygonal. A further embodiment of a wind turbine according to the invention comprises a tubular tower which comprises a vertical section of which said sections are made of bended or folded steel plates which extend over the vertical length of said section. A further embodiment of a wind turbine according to the invention comprises a tower which comprises multiple vertical sections of a length between 10m and 22m and particularly between 10m and 16m. A further embodiment of a wind turbine according to the invention comprises a tower which is tapered over at least 50% of the tower length and in particular over at least 80% of the tower length. A further embodiment of a wind turbine according to the invention comprises a tower of which the guiding points including the stiffening thereof cover together less than 10% and in particular less than 20% of the tower length in any side view of the tower. A further embodiment of a wind turbine according to the invention of which the tower

center is installed at a horizontal distance to the center of a dike of less than 100m, in particular less than 50m and more in particular less than 20m. A further embodiment of a wind turbine according to the invention which is installed using a hoisting system according to the invention. A further embodiment of a wind turbine according to the invention comprises an offshore turbine and in particular an offshore turbine of which the part which passes the sea level comprises a guiding point and more in particular wherein the transition piece comprises a guiding point for a hoisting system. A further embodiment according to the invention comprises a wind turbine with a axis height of more than 80m and in particular more than 130m and more in particular of more than 180m, wherein the maximum axis height according to an embodiment is 500m. A further embodiment according to the invention comprises a wind turbine of which the ratio between the design rotor speed at 6m/s wind speed and at 12 m/s wind speed is above 1.3 and in particular above 1.5 and more in particular above 1.8 and less than 3.

The aim of the invention is further reached by the combination of a wind turbine according to the invention with a hoisting system according to the invention. A further embodiment of a combination according to the invention is one wherein the rail of the hoisting system during hoisting work is fixed permanently in a star non-slidable manner to the column of the hoisting system while said rail is star or slidably fixed to the guiding points on the tower of the wind turbine. A further embodiment of the combination according to the invention is one wherein the rail of the hoisting system is at least connected to two or three guiding point during hoisting work. A further embodiment of the combination according to the invention is one wherein the highest guiding position where the hoisting system is fixed to the tower during the hoisting of tower parts corresponds to the overlapping part of the highest two installed tower sections.

The aim of the invention is reached as well by installing a wind turbine according to a following method according to the invention which comprises the following steps: The installation of the lower 1 to 3 tower sections with a conventional method possibly by the hoisting system according to the invention. Subsequently the installation of the rail of the hoisting system to the guiding points of the one or more installed tower sections. Subsequently the hoisting of 1 to 3 higher tower sections in parts or in single hoists and the installation of said higher sections. The repetition of unlocking, moving and relocking the hoisting system in a higher position and the hoisting and installation of one or two higher tower sections until the tower is fully assembled. Subsequently the unlocking, moving and relocking the hoisting system in the highest position and the hoisting of the nacelle, generator, hub and the rotor blades in one or more combined hoists or in a single hoist. In case of single blade hoisting the hoisting system can be

used to turn the hub in a convenient position for installation a next blade by hoisting an installed blade to a lower or higher position. And finally the unlocking of the hoisting system and moving it downwardly by repetitively locking and moving the hoisting system back to the tower bottom and the removal of the hoisting system. A further method
 5 according to the invention is one wherein the horizontal distance between the hoisting point of the boom and the highest applied guiding point is less than the diameter of a hoisted tower segment.

Figures

10 The figures below show preferred embodiments of the invention.

Fig. 1: a wind turbine and a hoisting system;

Fig. 2: tower sections of a wind turbine;

Fig. 3: tower sections of a wind turbine;

Fig. 4: tower sections of a wind turbine;

15 Fig. 5: tower sections of a wind turbine;

Fig. 6: a wind turbine under construction and a hoisting system;

Figure 1 shows the combination of a wind turbine and a hoisting system 1. The wind turbine comprises tower sections 2 which overlap in areas 8 and each have a guiding
 20 point 7, a nacelle 3, a generator 4, a hub 5 and several blades 6. The hoisting system comprises a column 10, a yawing platform 11 which carries via a tilt hinge 12 the boom 14. The boom can tilt by activation of the hydraulic cylinder 13. The hoisting cable 18 is lead via pulleys 16 and 17 to the winch 15. The hoisting system is fixed to a rail 9 which is, depending on its position, slidably attached to guiding points 7, 19 and 20, so that it
 25 can move up and down along the tower. Before hoisting is started any of the locking systems 21, 22, 23, 24 locks the rail to a guiding point. **Figure 2** shows the first three tower sections 30, 31 and 32 of a wind turbine. Section 32 is elevated for illustrative reasons. Section 30 comprises the guiding points 34 and 36 with respectively stiffening structures 33 and 35. Sections 31 and 32 comprise guiding points 39 and 40 with
 30 stiffening structures 38. Guiding points 36 and 40 comprise a hole 37 which is used for locking the hoisting system to the installed tower sections. The supporting beams 44 are fixed to stiffener 35 and to fixation means 45 which are fixed to the tower foundation 46. The dashed lines 41, 42 and 43 illustrate positions of the connection between the tower sections which e.g. can be bolted together. In this example the stiffeners 33, 35 and 38
 35 are also bolted to the tower sections. According to an installation method according to the invention a general purpose crane installs the first tower section 30. Then the

hoisting system is installed to the guiding points 34 and 36 of this first tower section 30. The hoisting system uses locking system 22 to lock itself to hole 37 of guiding point 36. Then it hoists tower section 31 on top of section 30 and during this hoist the guiding point 39 is placed in the rail 9. The sections are bolted together and the hoisting system

5 hoists section 32 similarly on top of section 31 and subsequently hoists the fourth section. Then the hoisting system unlocks, moves upwardly and locks with locking system 23 to guiding point 37 of section 32 so that it can hoist section 5. This continues until the entire tower is installed. The hoisting system subsequently hoists and installs the nacelle, generator, hub and the blades, where several combined hoisting operations

10 can be beneficial e.g. the nacelle and generator or the entire rotor comprising the hub and the blades or even the combination of the nacelle, the generator and the rotor in a single hoist. **Figure 3** illustrates another embodiment of the first two tower sections 55 and 56 where section 55 has two guiding points 34 and 62. Guiding point 62 is installed on stiffener 58 which is placed via plate 59 (shown by a dashed line) to the tower wall.

15 Plate 59 has the same thickness as the wall of tower section 56, so that this section fits precisely between section 57 and stiffener 58. The dashed lines 57 and 58 illustrate the positions for a bolted connections. In practice the bolts can be placed in multiple lines per connections which is not shown for illustrative reasons. Guiding point 62 is supported by beams 60 which are fixed to supports 61 on the inner side of the tower.

20 The embodiment of figure 2 can also be combined with supporting beams on the inner side of the tower and that of figure 3 can be combined with supporting beams on the outside of the tower. In the case of the embodiment in figure 3 the locking system 22 is not required. **Figure 4** illustrates again another embodiment of the first tower sections 70, 71 and 32 of a wind turbine. In this case section 32 and the higher sections which

25 are not shown have a standard length 78 which can be transported easily e.g. a length between 10m and 16m such as e.g. 12m. The tower sections overlap over a distance 76 which is e.g. 0.5m, so that the tower height increases 11.5m per standard section. For the hoisting system it is beneficial when the guiding points always have the same vertical spacing 79, e.g. one guiding point per 11.5m. By increasing the length 75 of the

30 first tower section 70 it can comprise two guiding points at a spacing of 11.5m and still sufficient length is left for the overlap 76 with tower section 71. This enables to attach the hoisting system to section on 70 and subsequently to hoist section 71 and 32, without the need of the special structure with plates 58 and 59 in figure 3. A consequence is that section 75 requires a longer transport length. Section 71 has a

35 shorter length 77 and does not carry a guiding point. Guiding point 74 has a stiffening structure 73 on the outer side of the tower and a stiffening structure 80 on the inner side

of the tower. **Figure 5** illustrates a further embodiment of the first tower sections. In this case the first tower section 85, which also could be an integrated part of the tower foundation 46, comprises the first guiding point 90 with stiffener 91 at a distance 94 from the foundation. The second section 86 comprises a guiding point 92 with stiffener 93 and similar to figure 4 an internal stiffener 79. This embodiment has the advantage that the first, second and third sections can have equal or shorter lengths, respectively 88, 89 and 77, compared to the length 78 of the fourth section 32, which can be the maximum transport length of all sections. **Figure 6** shows the hoisting system and the first tower sections in more detail compared to figure 1. The column of the hoisting system comprises a hydraulic cylinder 95 with piston 96 and an actuator in a state 97 so that it can pass a guiding point 99 and in a state 98 wherein it connects to guiding point 99. The hoisting system can move up after the actuator is in state 98 and is locked to guiding point 99 on tower section 103 and the hydraulic cylinder 95 is actuated until the weight of the crane is carried by the hydraulic cylinder. Then the locking systems 21, 23 and 24 are unlocked, where it should be noted that although this figure illustrated 3 locking systems any number of locking systems larger than zero is possible. Then the hydraulic cylinder 95 is further activated so that piston 96 is pulled into cylinder 95 so that the hoisting system moves upwardly. The upward movement continues until any locking system reaches a guiding point whereon it can be locked and the weight of the hoisting system can be transferred from the hydraulic cylinder 95 to the locking system. The figure is just an illustrative example. It should be clear that also two cylinders are possible: each at one side of the column or even multiple cylinders e.g. cylinders which push the hoisting system upwardly instead of pulling it upwardly. The figure further illustrates another tower section 100 which still has to be hoisted. The section comprises a guiding point 102 with edge 101 which serves to capture actuator 98.

Interpretation / Generalisation:

The above description focusses at the installation of a wind turbine using the hoisting system according to the invention, but it should be understood that the same hoisting system according to the invention is favourable for maintaining and decommissioning the wind turbine according to the invention.

Although the illustrative embodiments of the present invention have been described in greater detail with reference to the accompanying drawings, it will be understood that the invention is not limited to those embodiments. Various changes or modifications or combinations of embodiments in the description and or in the figures may be effected by

one skilled in the art without departing from the scope or the spirit of the invention as defined in the claims.

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

In this description the term hoisting system always refers to an embodiment according to the invention.

CONCLUSIES

Hijssysteem

1. Hijssysteem voor het opbouwen van een windturbine omvattende een mast, een
5 giek en een lier waarbij de mast voorzieningen omvat om een dragende verbinding tot stand te brengen met een deel van de toren van de windturbine en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting langs het genoemde torendeel kan verplaatsen.
2. Hijssysteem volgens conclusie 1 waarbij de mast star verbonden is met een rail die
10 in het bijzonder een lengte heeft van minimaal 10m, meer in het bijzonder minimaal 20m en nog meer in het bijzonder minimaal 34m.
3. Hijssysteem volgens conclusie 2 waarbij de rail een sectie omvat waarbinnen de rail een eerste positie kan aannemen waarbij een geleidingspunt in de rails plaatsbaar is en een tweede positie waarbij een geleidingspunt opgesloten ligt in de rail en
15 alleen nog in de lengterichting van de rail kan verschuiven.
4. Hijssysteem volgens een der voorgaande conclusies waarbij de mast voorzieningen omvat ten behoeve van de verplaatsing van het hijssysteem in de in hoofdzaak verticale richting waarbij deze voorzieningen bijvoorbeeld een rondgaande ketting of een hydraulische cilinder omvatten.
- 20 5. Hijssysteem volgens een der voorgaande conclusies waarbij de mast een dragende koppeling omvat voor het star verbinden van het hijssysteem met een geleidingspunt van de toren en in het bijzonder dat deze koppeling zich in de onderste 65% van de railenlengte bevindt en meer in het bijzonder dat deze koppeling zich tussen 35% en 65% van de railenlengte bevindt.
- 25 6. Hijssysteem volgens een der voorgaande conclusies waarbij de koppeling tussen mast en een geleidingspunt zodanig is dat deze in hijsbedrijf tenminste 0.25 graden en in het bijzonder tenminste 0.5 graden en meer in het bijzonder tenminste 1 graad rotatievrijheid om een denkbeeldige horizontale as toelaat tussen de door de koppeling verbonden delen.
- 30 7. Hijssysteem volgens conclusie 2 waarbij de giek reikt tot een afstand tot de rail van tenminste 15m en bij voorkeur van tenminste 25m.
8. Kraan volgens conclusie 7 waarbij de giek via een kruilager verbonden is met de mast van het hijssysteem en in het bijzonder waarbij de as van het kruilager een hoek maakt met de lengterichting van de rail van tenminste 0.5 graden en in het
35 bijzonder tenminste 1 graad.

9. Hijssysteem volgens conclusie 1 waarbij de giek via een tiltscharnier verbonden is met de mast van het hijssysteem.
10. Hijssysteem volgens conclusie 9 omvattende een hydraulische cilinder voor het verdraaien van de giek tov. de mast om het tiltscharnier zodanig dat een tiltverdraaiing mogelijk is van tenminste 20 graden.
11. Hijssysteem volgens een der voorgaande conclusies waarbij de giek een kabellier omvat om de hijskabel mee te bedienen.
12. Hijssysteem volgens een der voorgaande conclusies waarbij de giek geknikt of gebogen is zodanig dat tussen de giek en het denkbeeldige lijnstuk van het hijspunt van de giek tot het centrum van het tiltscharnier een afstand ontstaat van tenminste 1.5m en in het bijzonder tenminste 2.5m en bij voorkeur ongeveer 4m.
13. Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten voor de bevestiging en geleiding van een hijssysteem.
14. Windturbine volgens conclusies 13 waarbij de toren bevestigingspunten omvat op een onderlinge verticale afstand van meer dan 10m en minder dan 30m.
15. Windturbine volgens conclusie 13 of 14 waarbij tenminste een bevestigingspunt is aangebracht op de overlap van twee opeenvolgende torensecties.
16. Windturbine volgens een der voorgaande conclusies 13 t/m 15 waarbij een bevestigingspunt versterkt is tot op een afstand van het centrum van het bevestigingspunt van 50cm en in het bijzonder van 100cm.
17. Windturbine volgens een der voorgaande conclusies 13 t/m 16 waarbij de torenbinnenzijde versterkt is ter plekke van een bevestigingspunt.
18. Windturbine volgens een der voorgaande conclusies 13 t/m 17 met N bevestigingspunten die van onder naar boven nummerbaar zijn met nummers 1 t/m N waarbij voor $M = 1$ tot $N-2$, de lijn die de centra van twee opeenvolgende bevestigingspunten M en M+1 verbindt een afstand heeft tot het centrum van een derde opeenvolgend bevestigingspunt M+2 van maximaal 5cm en in het bijzonder maximaal 10cm en meer in het bijzonder maximaal 20cm.
19. Windturbine volgens een der voorgaande conclusies 13 t/m 18 waarvan de toren voorzien is van een dragende wand over 50% van de torenlengte en in het bijzonder over 80% van de torenlengte.
20. Windturbine volgens conclusie 13 t/m 19 waarbij een buitenaanzicht van een horizontale doorsnede van de dragende wand in hoofdzaak de vorm van een cirkel of van een veelhoek heeft.

21. Windturbine volgens een der voorgaande conclusies 13 t/m 20 waarbij de toren de vorm heeft van een buis die is opgebouwd uit verticale secties waarbij een genoemde sectie opgebouwd is uit gekromde of gezette platen die zich uitstrekken over de lengte van de sectie.
- 5 22. Windturbine volgens een der voorgaande conclusies 13 t/m 21 waarbij de toren is opgebouwd uit meerdere verticale secties met een lengte tussen 10m en 16m.
23. Windturbine volgens een der voorgaande conclusies 13 t/m 22 met een toren die taps is over 50% van de torenlengte en in het bijzonder over 80% van de torenlengte.
- 10 24. Windturbine volgens een der voorgaande conclusies 13 t/m 23 waarbij de bevestigingspunten tesamen bij elk zijaanzicht van de toren minder dan 20% en in het bijzonder minder dan 10% van de torenlengte innemen.
25. Windturbine volgens een der voorgaande conclusies 13 t/m 24 waarbij de windturbine is geplaatst op een afstand tot het hart van een dijk van minder dan
15 100m, in het bijzonder minder dan 50m en meer in het bijzonder van minder dan 20m.
26. Windturbine volgens een der voorgaande conclusies 13 t/m 25 waarbij de windturbine is geplaatst met gebruik van een hijssysteem.
27. Windturbine volgens een der voorgaande conclusies 13 t/m 26 die een offshore
20 windturbine betreft.
28. Windturbine volgens conclusie 27 omvattende een structuur die het zeeniveau passeert en in het bijzonder waarbij deze structuur een transitiedeel betreft waarbij genoemde structuur voorzien is van een bevestigingspunt voor de bevestiging en geleiding van een hijssysteem.
- 25 29. Windturbine volgens een der voorgaande conclusies 13 t/m 28 met een ashoogte van meer dan 80m, in het bijzonder van meer dan 130m en meer in het bijzonder van meer dan 180m.
- 30 30. Windturbine volgens een der voorgaande conclusies 13 t/m 29 waarbij de verhouding tussen het ontwerptoerental van de rotor bij een windsnelheid van 6 m/s en bij 12 m/s minder bedraagt dan 3 en meer bedraagt dan 1.3 en in het bijzonder meer dan 1.5 en bij voorkeur meer dan 1.8.
31. Windturbine volgens een der conclusies 13 t/m 30 waarbij deze windturbine gecombineerd is met een hijssysteem volgens een der conclusies 1 t/m 12.
- 35 32. Windturbine volgens conclusie 31 waarbij de mast van het hijssysteem voorzien is van een met de mast verbonden rails en waarbij genoemde rails zowel star als

verschuifbaar te verbinden is met een geleidingspunt aan de genoemde windturbine.

33. Windturbine volgens conclusies 31 of 32 waarbij de rails van het hijssysteem tijdens
hijswerkzaamheden verbonden is met tenminste twee en bij voorkeur drie
5 geleidingspunten aan de toren van windturbine.
34. Windturbine volgens een der conclusies 31, 32 of 33 waarbij de hoogste positie
waarop het hijssysteem verbonden is tijdens hijswerkzaamheden van torendelen
voor de opbouw van de windturbine maximaal het deel is van het bovenste reeds
geplaatste torensegment dat overlapt met het torensegment daaronder.
- 10 35. Methode voor het installeren van een windturbine volgens een der conclusies 31 t/m
34 omvattende tenminste 6 van de onderstaande stappen:
 - a. Het opbouwen van tenminste een torensegment op conventionele wijze
of met het hijssysteem.
 - 15 b. Het bevestigen van het hijssysteem met zijn rails aan de
geleidingspunten welke verbonden zijn aan de een of meer geplaatste
torensegmenten.
 - c. Het hijsen in een of meer delen van een tot drie volgende
torensegmenten met het hijssysteem en het installeren van deze
segmenten.
 - 20 d. Het herhalen van het verplaatsbaar maken van het hijssysteem, het naar
boven geleiden van het hijssysteem, het vastzetten van het hijssysteem,
het hijsen van een of twee volgende torensegmenten en het installeren
van deze elementen totdat de toren volledig is opgebouwd.
 - 25 e. Het verplaatsbaar maken van het hijssysteem, het naar de hoogste
positie geleiden van het hijssysteem, het vastzetten van het hijssysteem
en het apart of in een of meer delen samengesteld hijsen en installeren
van de gondel, de generator, de naaf en de rotorbladen.
 - 30 f. Bij het afzonderlijk hijsen en installeren van de bladen: het na het
plaatsen van het eerste blad verdraaien van de stand van de naaf door
het blad met het hijssysteem omlaag of omhoog te hijsen zodanig dat de
naaf gunstig gepositioneerd is voor de installatie van het tweede blad.
Het herhalen van deze stap voor eventuele volgende bladen.
 - 35 g. Het verplaatsbaar maken van het hijssysteem en het naar beneden
verplaatsen van het hijssysteem en het demonteren van het hijssysteem
van de windturbine.

36. Methode volgens conclusie 31 waarbij bij het hijsen van een torensegment de horizontale afstand tussen het hijspunt van de giek en de bovenste bevestiging tussen kraan en toren minder bedraagt dan de diameter van het genoemde torensegment.

5

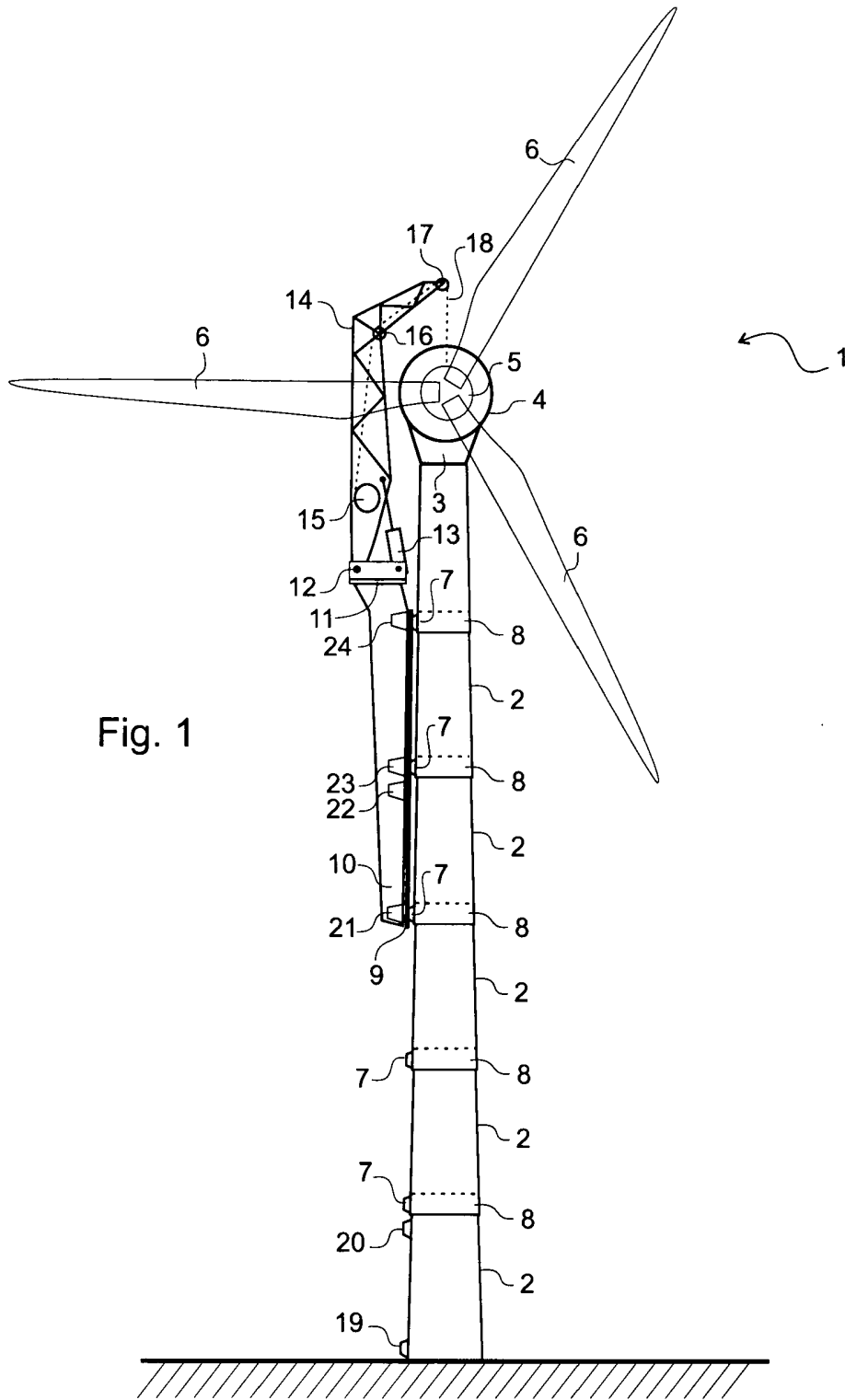


Fig. 1

Fig. 2

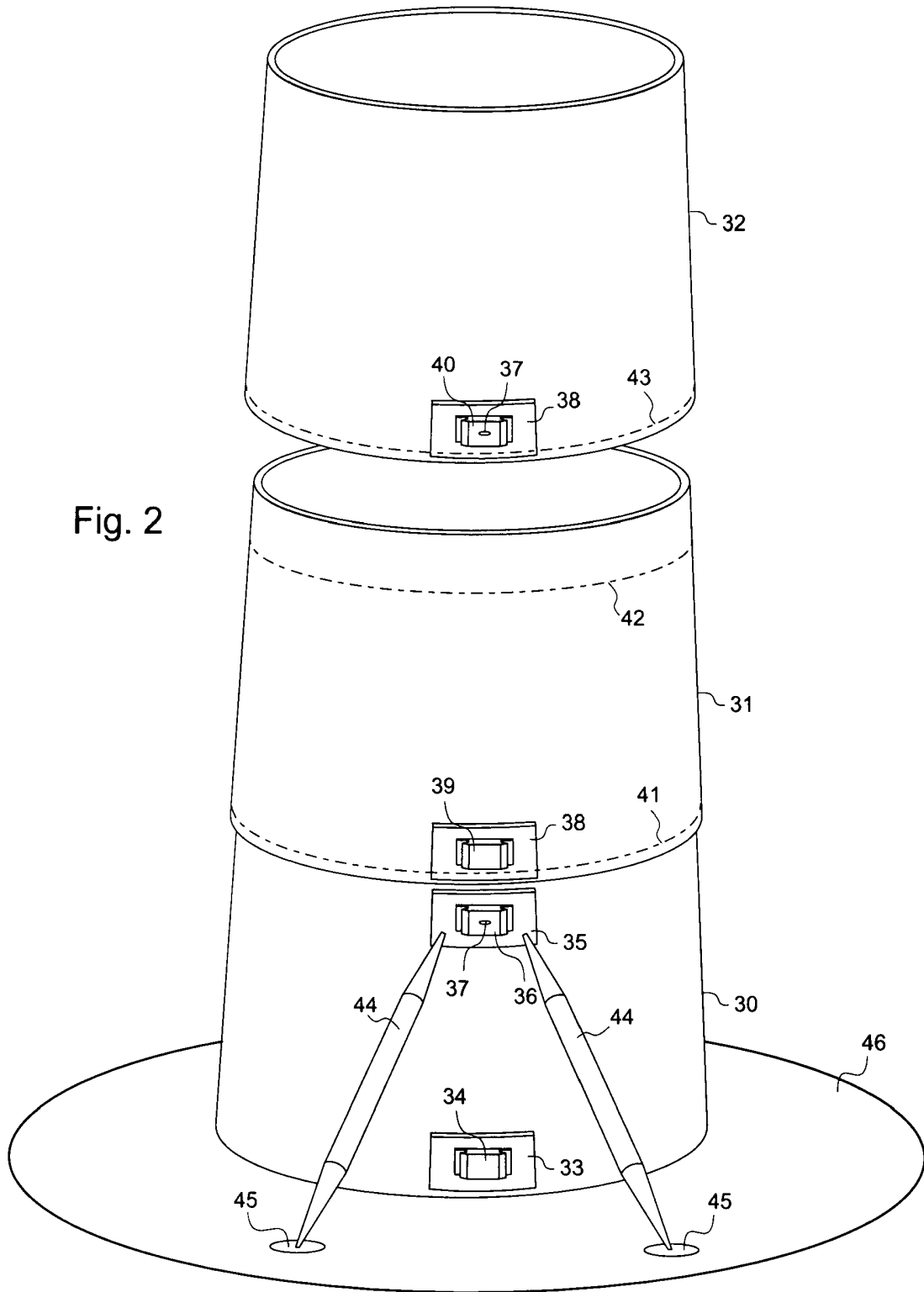


Fig. 3

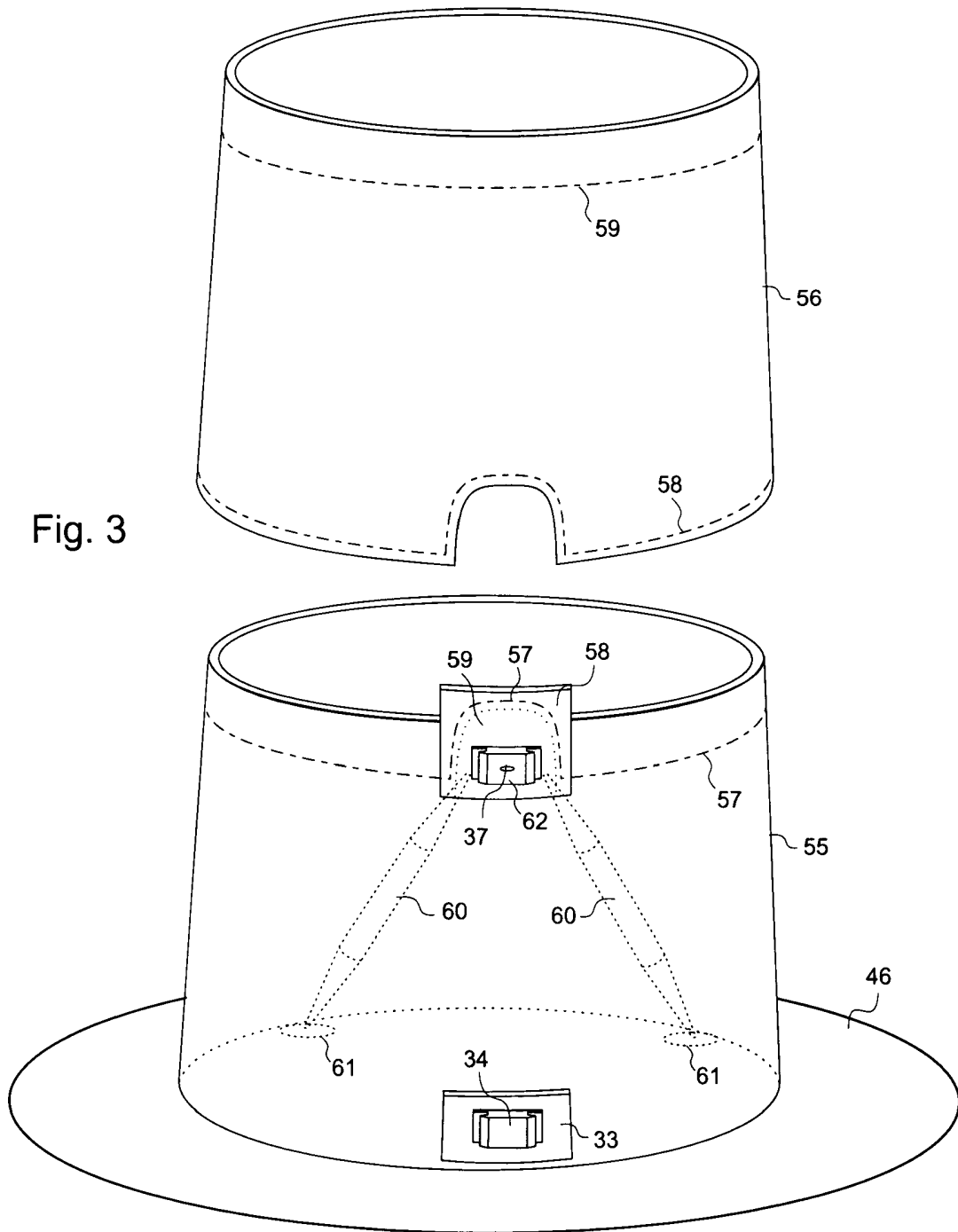


Fig. 4

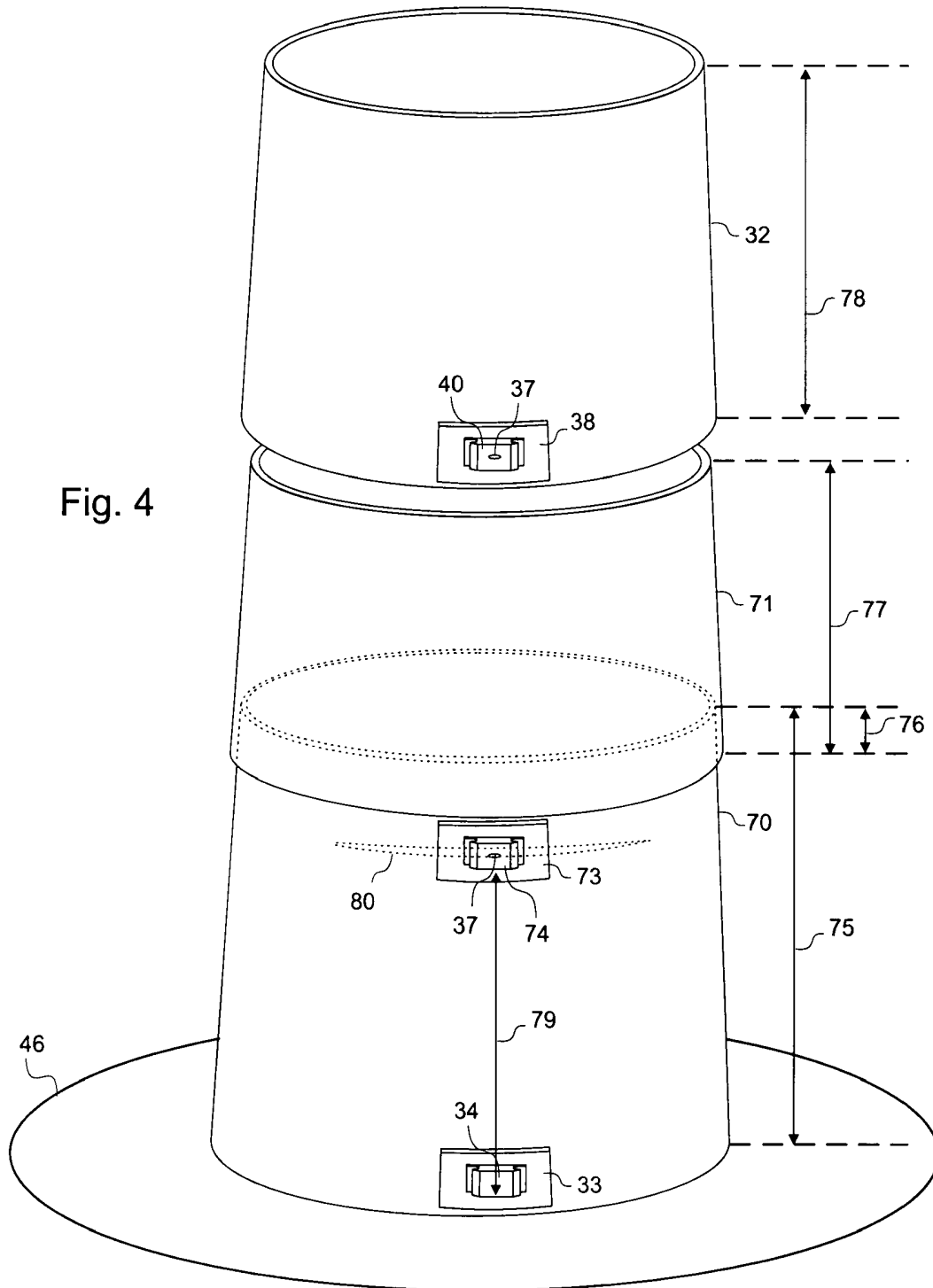


Fig. 5

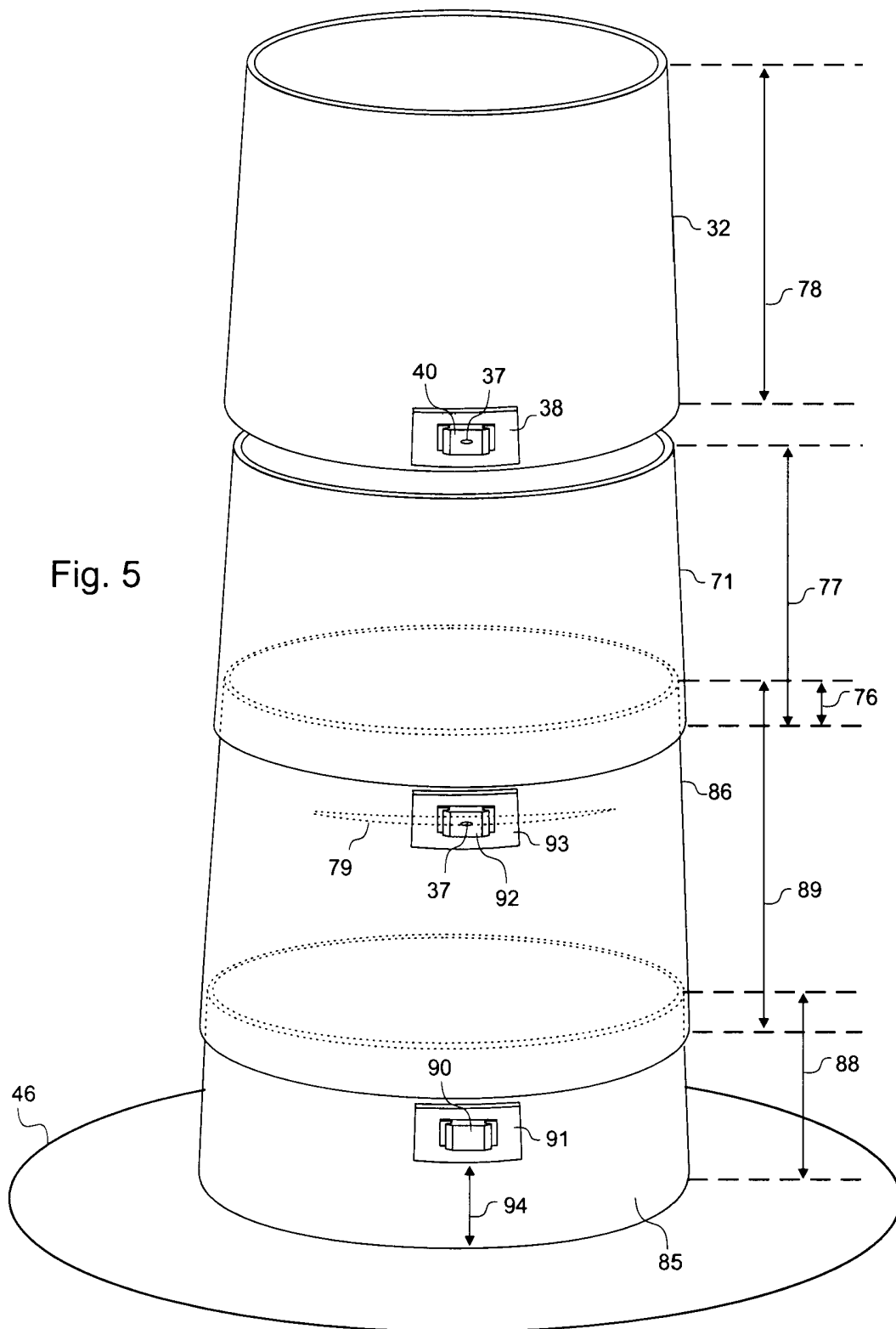
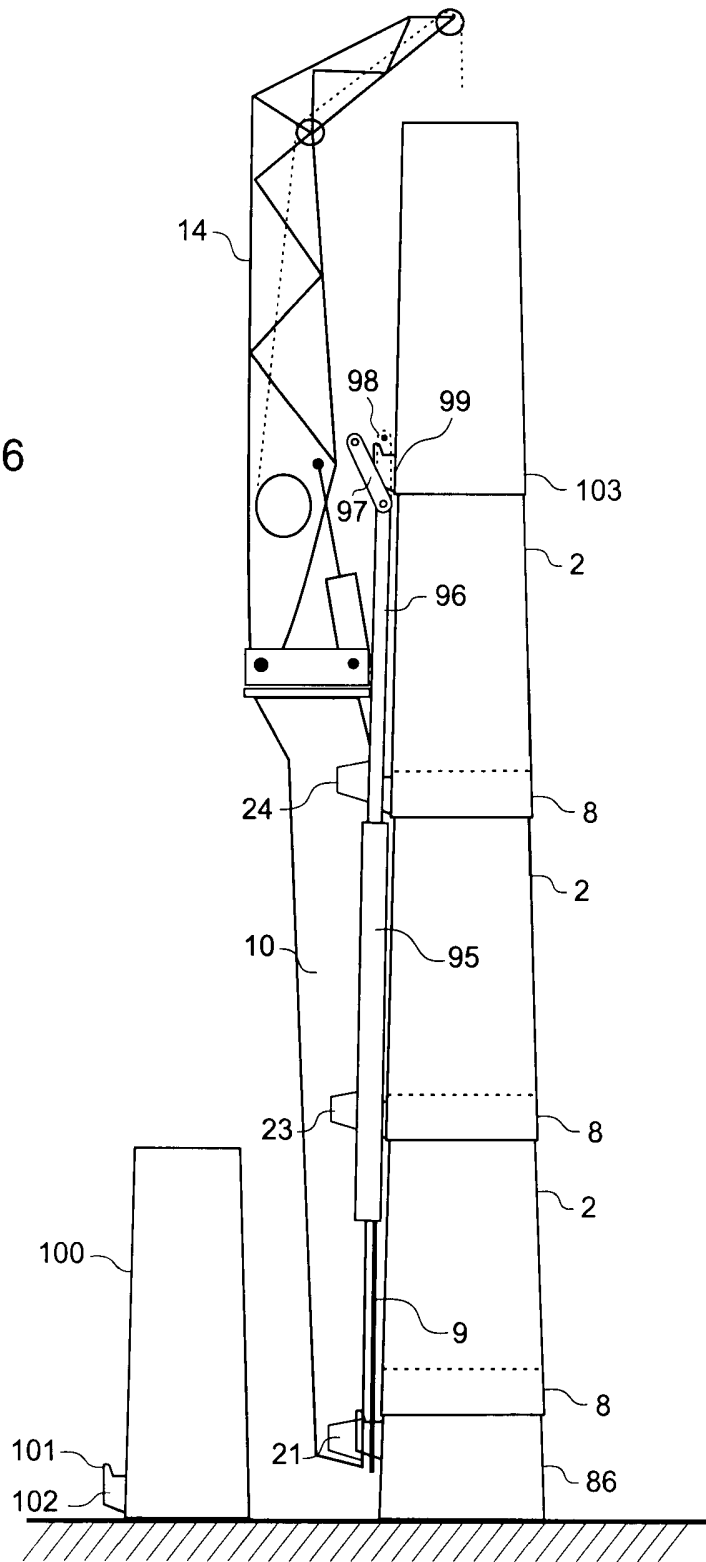


Fig. 6



UITTREKSEL

Hoisting system for the installation of a wind turbine comprising a column and a boom wherein said column comprises measures to achieve a load bearing connection to the tower of the wind turbine and wherein said column comprises measures to move the hoisting system up and down along the tower. Such a system can install successive tower sections while moving upwardly along the installed tower sections. After the tower is completed it can install the nacelle, generator, hub and the rotor blades. According to a further aspect the column comprises a rail which guides the hoisting system in essentially vertical direction along guiding points which are fixed to the tower and wherein said rail has a length of maximally 60m and in particular at least 23m and more in particular at least 34m. The long rail allows the hoisting of heavy parts such as the lower tower sections or the nacelle without applying high sideward forces to the tower since $\text{force} = \text{bending moment} / \text{arm}$. This hoisting system is efficient since it allows simple and fast movement of the system up and down along the guiding points on the tower. The aim is further reached by a wind turbine comprising a tower, a nacelle, a generator, a hub and at least a blade wherein the tower comprises a guiding point for the fixation and guiding of a hoisting system and in particular the hoisting system according to the invention.

SAMENWERKINGSVERDRAG (PCT)

RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE Lagerwey Wind / Kraan
Nederlands aanvraag nr. 1041499	Indieningsdatum 01-10-2015
	Ingeroepen voorrangsdatum
Aanvrager (Naam) Lagerwey Wind B.V.	
Datum van het verzoek voor een onderzoek van internationaal type 06-02-2016	Door de instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr. SN65646
I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven) Volgens de internationale classificatie (IPC) B66C23/20;B66C23/32;B66C23/18	
II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK Onderzochte minimumdocumentatie	
Classificatiesysteem	Classificatiesymbolen
IPC	F03D;E04H
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 1041499

A. CLASSIFICATIE VAN HET ONDERWERP
INV. B66C23/20 B66C23/32 B66C23/18
ADD.

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

B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)

B66C F03D E04H

Onderzochte andere documentatie dan de minimum 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,D	EENHEID VAN UITVINDING ONTBREEKT zie aanvullingsblad B ----- WO 2014/082176 A1 (MARMEN INC [CA]) 5 juni 2014 (2014-06-05) in de aanvraag genoemd	1,4,5, 9-12
A	* alinea [0078] - alinea [0079] * * alinea [0089] - alinea [0090] * * alinea [0080] - alinea [0087] * * figuren *	7
X	----- JP 563 189391 A (KAWASAKI HEAVY IND LTD; KAWAJU KOJI KK) 4 augustus 1988 (1988-08-04)	1
A	* figuren 1, 4 *	7
	----- -/-	



Verdere documenten worden vermeld in het vervolg van vak C.



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 octrooiaanvraag vermeld

"E" eerdere octrooi(aanvraag), 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 bezwaarlijk is voor de octrooiaanvraag, 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

"Z" lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid

2 juni 2016

Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type

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

Guthmuller, Jacques

**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 1041499

C. (Vervolg). VAN BELANG GEACHTE DOCUMENTEN

Categorie *	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
A	JP S59 158794 A (TOMOEGUMI GIKEN KK) 8 september 1984 (1984-09-08) * de figuren 1, 2 en 3 samen met de detail-figuren 4 en 6 *	2-5
A	JP S56 155193 A (ISHIKAWAJIMA HARIMA HEAVY IND; ICHIKAWA YOSHIO) 1 december 1981 (1981-12-01) * de figuren 3 tot 5 samen met de detail-figuren 10 en 11 *	2-5
A	JP S51 62222 U (-----) 17 mei 1976 (1976-05-17) * figuren *	4,5
A,D	DE 197 41 988 A1 (PEITER KARIN [DE]) 1 april 1999 (1999-04-01) in de aanvraag genoemd * figuren 2-5 *	1-12

GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvraag Nr.:

SN 65646

NL 1041499

AANVULLINGSBLAD B

De instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

1. conclusies: 1-12

Hijssysteem voor het opbouwen van een windturbine omvattende een mast, een giek en een lier waarbij de mast voorzieningen omvat om een dragende verbinding tot stand te brengen met een deel van de toren van de windturbine en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting langs het genoemde torendeel kan verplaatsen.
[As defined in independent apparatus claim 1, and further defined in its depending claims 2 to 12.]

2. conclusies: 13-36

Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten voor de bevestiging en geleiding van een hijssysteem.
[As defined in independent apparatus claim 13, and further defined in its depending claims 14 to 34.]
And, of course, combined therewith:
Methode voor het installeren van een windturbine.
[As defined in independent method claim 35, and further defined in its depending claim 36.]

Het vooronderzoek werd tot het eerste onderwerp beperkt.

The present application relates to several inventions or groups of inventions which are not so linked as to form a single general inventive concept and therefore do not comply with the requirements of unity, the different inventions being the following:

Group 1 : see claim 1.

Hijssysteem [geschikt voor het opbouwen van een windturbine] omvattende een mast, een giek en een lier waarbij de mast voorzieningen omvat [geschikt om een dragende verbinding tot stand te brengen met een deel van de toren van de windturbine (= tweede entiteit)] en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting [langs het genoemde torendeel (= tweede entiteit)] kan verplaatsen .
This, when all the features not formally/strictly belonging to the considered claim (thus, the features of the second and non-claimed entity: the wind turbine) are removed, finally boils down to:
Hijssysteem omvattende een mast, een giek en een lier waarbij de mast (verbinding-)voorzieningen omvat en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting kan verplaatsen.

Group 2 : see claim 13.

Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten [geschikt voor de bevestiging en geleiding van een hijssysteem (= eerste

GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvraag Nr.:

SN 65646

NL 1041499

AANVULLINGSBLAD B

De instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

entiteit]]).

This, when all the features not formally/strictly belonging to the considered claim (thus, the features of the first and non-claimed entity: the lifting device) are removed, finally boils down to:

Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten. This, obviously together with the corresponding method for installing a wind turbine, as defined in the independent method claim 35.

There are absolutely no technical features/elements which can be considered to be common to the Group 1 and the Group 2.

Therefore, one can argue that either no document at all or - formally perhaps more exactly - that all the documents of the entire universe of documents disclose(s) the 'empty set' of common technical features/elements.

One can also fairly and rightly conclude that there is no general common problem to be solved, as such.

{By the way, the non-existing general common problem cannot be considered as constituting a meaningful basis for a single general inventive concept between the two groups of inventions.}

The remaining features/elements of the two groups of inventions solve two different problems [or, formulated otherwise, aim at achieving two different technical goals] by means of specif technical features.

Taking all the above into consideration, the remaining specific features/elements of the two groups of inventions - for each of the above group of claims - can be defined as:

For Group 1 : apparatus claim 1 in its entirety.

For Group 2 : apparatus claim 13 in its entirety & method claim 35 in its entirety.

The technical goal/objective to be achieved by Group 1 can be defined as: Providing a type of LIFTING DEVICE having a mast, a tiltable fly-arm and a hoisting winch, which lifting device is suitable for building/assembling a wind turbine, and which lifting device must be able to move easily vertically along a vertical structure (like, for example, the tower-mast of a wind turbine).

The technical goal/objective to be achieved by Group 2 can be defined as: Providing a WIND TURBINE having a tower-mast, a gondola, a generator and so on, the tower-mast of said wind turbine being equipped with fixation points adapted for holding and guiding whatever lifting device. Providing the corresponding method of installing a/the wind turbine with the use of a lifting device.

Since the technical objectives to be achieved by the ways/means of the two groups of inventions and the features/elements which allow achieving said objectives are indeed different, there is no unity of invention. Consequently, the present application does not comply with the requirements of unity.

**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 1041499

In het rapport genoemd octrooigescrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
WO 2014082176	A1	05-06-2014	CA 2892651 A1 05-06-2014
			EP 2925942 A1 07-10-2015
			US 2015300037 A1 22-10-2015
			WO 2014082176 A1 05-06-2014
JP S63189391	A	04-08-1988	JP 2515531 B2 10-07-1996
			JP S63189391 A 04-08-1988
JP S59158794	A	08-09-1984	GEEN
JP S56155193	A	01-12-1981	GEEN
JP S5162222	U	17-05-1976	JP S5162222 U 17-05-1976
			JP S5435489 Y2 27-10-1979
DE 19741988	A1	01-04-1999	GEEN

WRITTEN OPINION

File No. SN65646	Filing date (day/month/year) 01.10.2015	Priority date (day/month/year)	Application No. NL1041499
International Patent Classification (IPC) INV. B66C23/20 B66C23/32 B66C23/18			
Applicant Lagerwey Wind 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 Guthmuller, Jacques
--	---------------------------------

WRITTEN OPINION

Application number
NL1041499

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:

WRITTEN OPINION

Application number
NL1041499

Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

☐ the entire application

☒ claims Nos. 13-36

because:

☐ the said application, or the said claims Nos. relate to the following subject matter which does not require a search (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):

☒ no search report has been established for the whole application or for said claims Nos. 13-36

☐ a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).

☐ a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.

☐ See Supplemental Box for further details.

Box No. IV Lack of unity of invention

1. The requirement of unity of invention is not complied with for the following reasons:

see separate sheet

2. This report has been established in respect of the following parts of the application:

☐ all parts.

☒ the parts relating to claims Nos. (see Search Report)

WRITTEN OPINION

Application number
NL1041499

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	2, 3, 6-8, 12
	No: Claims	1, 4, 5, 9-11
Inventive step	Yes: Claims	2, 3, 6-8
	No: Claims	1, 4, 5, 9-12
Industrial applicability	Yes: Claims	1-12
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the application

see separate sheet

Re Item IV

Lack of unity of invention

1.1 The present application relates to several inventions or groups of inventions which are not so linked as to form a single general inventive concept and therefore do not comply with the requirements of unity, the different inventions being the following:

1.2 **Group 1:** see claim 1.

Hijssysteem [geschikt voor het opbouwen van een windturbine] omvattende een mast, een giek en een lier waarbij de mast voorzieningen omvat [geschikt om een dragende verbinding tot stand te brengen met een deel van de toren van de windturbine (= tweede entiteit)] en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting [langs het genoemde torendeel (= tweede entiteit)] kan verplaatsen.

This, when all the features not formally/strictly belonging to the considered claim (thus, the features of the second and non-claimed entity: the wind turbine) are removed, finally boils down to:

Hijssysteem omvattende een mast, een giek en een lier waarbij de mast (verbinding-)voorzieningen omvat en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting kan verplaatsen.

1.3 **Group 2:** see claim 13.

Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten [geschikt voor de bevestiging en geleiding van een hijssysteem (= eerste entiteit)].

This, when all the features not formally/strictly belonging to the considered claim (thus, the features of the first and non-claimed entity: the lifting device) are removed, finally boils down to:

Windturbine omvattende een toren, een gondel, een generator, een naaf en tenminste een blad waarbij de toren voorzien is van bevestigingspunten.

This, obviously together with the corresponding method for installing a wind turbine, as defined in the independent method claim 35.

1.4 There are absolutely no technical features/elements which can be considered to be common to the Group 1 and the Group 2.

Therefore, one can argue that either no document at all or - *formally perhaps more exactly* - that all the documents of the entire universe of documents disclose(s) the 'empty set' of common technical features/elements.

One can also fairly and rightly conclude that there is no general common problem to be solved, as such.

{By the way, the non-existing general common problem cannot be considered as constituting a meaningful basis for a single general inventive concept between the two groups of inventions.}

- 1.5 The remaining features/elements of the two groups of inventions solve two different problems [or, formulated otherwise, aim at achieving two different technical goals] by means of specific technical features/elements.

Taking all the above into consideration, the remaining specific features/elements of the two groups of inventions - for each of the above group of claims - can be defined as:

For Group 1: apparatus claim 1 in its entirety.

For Group 2: apparatus claim 13 in its entirety & method claim 35 in its entirety.

- 1.6 The technical goal/objective to be achieved by Group 1 can be defined as:

Providing a type of LIFTING DEVICE having a mast, a tiltable fly-arm and a hoisting winch, which lifting device is suitable for building/assembling a wind turbine, and which lifting device must be able to move easily vertically along a vertical structure (like, for example, the tower-mast of a wind turbine).

The technical goal/objective to be achieved by Group 2 can be defined as:

Providing a WIND TURBINE having a tower-mast, a gondola, a generator and so on, the tower-mast of said wind turbine being equipped with fixation points adapted for holding and guiding whatever lifting device.

Providing the corresponding method of installing a/the wind turbine with the use of a lifting device.

- 1.7 Since the technical objectives to be achieved by the ways/means of the two groups of inventions and the features/elements which allow achieving said objectives are indeed different, there is no unity of invention.

Consequently, the present application does not comply with the requirements of unity.

Re Item V

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

- 2 Reference is made to the following documents:

D1	<u>WO 2014/082176 A1</u> (MARMEN INC [CA]); (2014-06-05); <i>in de aanvraag genoemd</i>
D2	<u>JPS63189391 A</u> (KAWASAKI HEAVY IND LTD et al.); (1988-08-04)

FIRST INVENTION GROUP (the apparatus claims 1 to 12):

- 3 The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.
- 3.1 **D1** discloses [see the relevant passages cited in the search report]:
Hijssysteem voor het opbouwen van een windturbine omvattende een mast {see **72**; see also the paragraphs [0078], [0079]}, een giek {see the boom **82** & the gantry **84**; see also the paragraphs [0089], [0090]} en een lier {see the which on figure 4} waarbij de mast voorzieningen omvat om een dragende verbinding tot stand te brengen met een deel van de toren van de windturbine {the pawls; see the figures 2-7 and the paragraphs [0083]-[0086]} en voorzieningen omvat waarmee het hijssysteem zich in hoofdzaak in verticale richting langs het genoemde torendeel kan verplaatsen {the actuator **102**; see for example the paragraphs [0080], [0082], [0084]}.
- 3.2 The document **D2** discloses [see the figures 1 and 4] also discloses a lifting system according to claim 1.
- 3.3 {The independent apparatus claim 1 is most probably formulated too broadly.}
- 4 Dependent claims 4, 5, 9 to 11 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of novelty.
- 4.1 **D1** discloses {see the paragraphs [0080]-[0087]; more specifically the actuator **102**} also discloses all the technical features of the depending claim 4.

- 4.2 D1 discloses {see the paragraphs [0080]-[0087]; more specifically the pawls} also discloses all the technical features of the depending claim 5.
- 4.3 D1 discloses {see the paragraphs [0089]-[0090]; pivotal boom **82**, pivotal gantry **84**} also discloses all the technical features of the depending claim 9.
- 4.4 D1 discloses {see the paragraphs [0089]-[0090]; hydraulic actuators **90**, **92**} also discloses all the technical features of the depending claim 10.
- 4.5 D1 discloses {the winch; see the figures 2-7} also discloses all the technical features of the depending claim 11.
- 5 Dependent claim 12 does not contain any features which, in combination with the features of claim 1 to which it refers, meet the requirements of inventive step.
In claim 12 a very slight constructional change in the lifting apparatus of claim 1 is defined which comes within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be foreseen. Consequently, the subject-matter of claim 12 also lacks an inventive step.
- 6 The combination of the features of dependent claims **2**, **3**, 6-8 is neither known from, nor rendered obvious by, the available prior art.

Re Item VII

Certain defects in the application

- 7 The relevant background art disclosed in D2 is not mentioned in the description, nor is this document identified therein.
- 8 Independent claim 1 is not in the two-part form, with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.
- 9 The features of the claims are not provided with reference signs placed in parentheses.