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(54) Title: A SYSTEM AND METHOD FOR TWISTING CABLES

(57) Abstract: A System and Method for Twisting Cables According to an embodiment of the invention, a system 102 for twisting a plurality of cables 104 in a wind turbine 100 is disclosed. The plurality of cables 104 may extend from a nacelle 106 to a bottom of a tower 108 of the wind turbine 100. The system 102 may include a circular plate 110. The circular plate 110 may have a plurality of holes 112 such that each hole 112 may hold one or a group of the cables 104 extending from the nacelle 106 to the tower 108. The system 102 for twisting the plurality of cables 104 may further include a means for rotating the circular plate 110. The means for rotating the circular plate 110 may rotate the circular plate 110 in a predefined direction. The predefined direction of the circular plate 110 may be opposite to the direction of rotation of the nacelle 106.

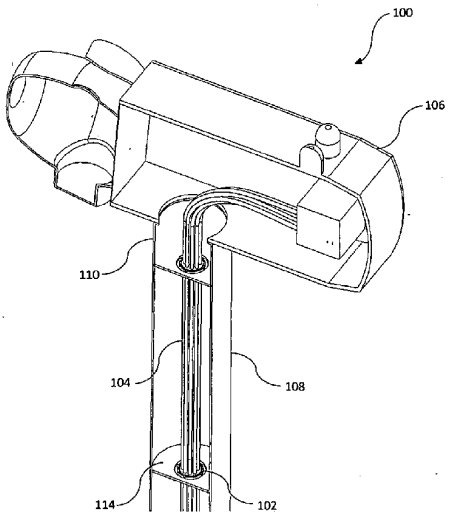

Figure 1

ABSTRACT

A System and Method for Twisting Cables

According to an embodiment of the invention, a system 102 for twisting a plurality of cables 104 in a wind turbine 100 is disclosed. The plurality of cables 104 may extend from a nacelle 106 to a bottom of a tower 108 of the wind turbine 100. The system 102 may include a circular plate 110. The circular plate 110 may have a plurality of holes 112 such that each hole 112 may hold one or a group of the cables 104 extending from the nacelle 106 to the tower 108. The system 102 for twisting the plurality of cables 104 may further include a means for rotating the circular plate 110. The means for rotating the circular plate 110 may rotate the circular plate 110 in a predefined direction. The predefined direction of the circular plate 110 may be opposite to the direction of rotation of the nacelle 106.

FIELD OF INVENTION

The invention generally relates to wind turbines, and more particularly to a system and method for twisting cables in wind turbines.

BACKGROUND

A typical wind turbine includes a nacelle mounted on top of a wind turbine tower via a yaw bearing. The yaw bearing enables the nacelle to rotate with respect to the tower. The nacelle is mainly rotated to direct the wind turbine blades, mounted on a wind turbine hub, against the direction of wind. A properly positioned nacelle may maximize the use of wind energy thereby making the system more efficient. However, during such rotations of the nacelle, the cables, especially power cables, extending from the nacelle to the bottom of the tower undergoes heavy twisting. This twisting of the cables causes damage to the cables and often leads to breakage or wear and tear of the cables.

Furthermore, the rotation of the nacelle in such wind turbines is quite limited and the nacelle is needed to be rotated back to the initial position to prevent breakage of cables. The act of bringing the nacelle back to the initial position wastes the opportunity to effectively utilize the wind energy. To overcome such issues, the conventional wind turbines usually uses flexible cables or cable twisting arrangements that are too complex to be integrated in the wind turbine systems.

Hence there is a need for an improved system and method for protecting cables in wind turbines.

SUMMARY OF THE INVENTION

According to an exemplary embodiment of the invention, a system for twisting a plurality of cables in a wind turbine is disclosed. The plurality of cables may extend from a nacelle of the wind turbine to the bottom of a tower of the wind turbine. The system for twisting the plurality of cables may include a circular plate. The circular plate may have a plurality of holes such that each hole may hold one or a group of the cables extending from the nacelle to the tower. The system for twisting the plurality of cables may further include a means for rotating the circular plate. The means for rotating the circular plate may rotate the circular plate in a predefined direction. The predefined direction of the circular plate may be opposite to the direction of rotation of the nacelle.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings wherein, like reference numerals denote corresponding parts throughout the several views.

Figure 1 illustrates a cross-sectional isometric view of a wind turbine having a system for twisting cables in the wind turbine according to an embodiment of the invention;

Figure 2 illustrates an isometric view of a circular plate according to an embodiment of the invention; and

Figure 3 illustrates an isometric view of the circular plate with magnetic bearing according to an embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skilled in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

Figure 1 illustrates an isometric cross-sectional view of a wind turbine 100 having a system 102 for twisting a plurality of cables 104 in the wind turbine 100 according to an embodiment of the invention. The system 102 may be employed in the wind turbine 100 for increasing the rotational capacity of a nacelle 106. The system 102 may further protect the cables 104 from breakage due to excessive twisting when the nacelle 102 rotates. The nacelle 102 may be mounted on top of a tower 108 via a yaw bearing (not shown in Figure). The yaw bearing may enable the nacelle 106 to rotate in either a clockwise direction or an anticlockwise direction depending on the direction of flow of wind. The plurality of cables 104 may extend from the nacelle 106 to the bottom of the tower 108. It will be apparent to a person skilled in the art that the cables 104 may include power cables, communication cables, signal cables and any other suitable cables known in the art. It should be noted that the terms 'cables' and 'wires' may be used interchangeably without restricting the invention in any way. The cables 104 may be made

of materials that may include, but are not limited to copper, aluminium etc. and may be covered by a housing. The cables 104 may be used to transfer electricity generated by wind turbine blades (not shown if Figure) to a power collection system (not shown in Figure) located at the base of the tower 108. At one end, the cables 104 may be connected to an equipment within the nacelle 106 and at other end, the cables 104 may be connected to the power collection system. The nacelle 106 may be rotated to direct the wind turbine blades against the wind flow direction for producing maximum electricity. The nacelle 106 may be further rotated to prevent the wind turbine blades from getting damaged due to excessive wind force. The rotation of the nacelle 106 with respect to the tower 108 may be achieved by the yaw bearing arranged between the nacelle 106 and the tower 108.

The system 102 for twisting the plurality of cables 104 in the wind turbine 100 may include a circular plate 110. Referring now to figure 2, an isometric view of a circular plate 110 according to an embodiment of the invention is illustrated. The circular plate 110 may be arranged within the tower 108 of the wind turbine 100. The circular plate 108 may be arranged in a horizontal position such that it may be substantially parallel to the yaw bearing of the wind turbine 100. It will be apparent to a person skilled in the art that the size of the circular plate 110 may vary depending on the size of the wind turbine 100. The circular plate 110 may have a plurality of holes 112. Each hole 112 may hold one or a group of cables 104 that are extending from the nacelle 106 to the bottom of the tower 108. It will be apparent to a person skilled in the art that the position and count of the holes 112 on the circular plate 110 may vary depending on the design of the wind turbine 100 and the number of cables 104 in the wind turbine 100. It should be noted that the system 102 may include one or more circular plates 110 arranged throughout the height of the wind turbine tower 108. These circular plates 110 may be arranged at different heights of the tower 108 and may hold the cables 104 from the top to the bottom of the tower

108. By way of an example, for a wind turbine having three circular plates, first circular plate may be in proximity to the top part of the tower, the second circular plate may be in proximity to the middle part of the tower and the third circular plate may be in proximity to the bottom part of the tower.

The system 102 may further include a means for holding the circular plate 110 in the horizontal position within the tower 108. The means for holding the circular plate 110 may hold the circular plate 110 substantially at the centre of the tower 108 below the yaw bearing. According to an embodiment, the means for holding the circular plate 110 may be a platform 114 having a hollow circular space wherein the circular plate 110 is arranged. The wind turbine platform 114 may be fixedly attached to the interior surface of the tower 108. It will be apparent to a person skilled in the art that the wind turbine platform 114 may be attached to the interior of the tower 108 by a bolt arrangement or any other arrangement know in the art. It should be noted that the platform 114 may be further used by workers to stand or rest during performing inspection and maintenance in the wind turbine 100.

According to another embodiment, the holding means may be at least one or more mechanical arms (not shown in Figure), either protruding from the internal surface of the tower 108 or fixedly attached to the internal surface of the tower 108. The mechanical arms may converge at the centre of the tower and are connected to a circular ring. The circular ring may hold the circular plate 110 in the horizontal position. The means for holding the circular plate 110 may hold the circular plate 110 in such a way that the circular plate 110 may be rotatable along a vertical axis relative to the holding means. It should be noted that for wind turbines having multiple circular plates 110 throughout the height of the tower 108, each circular plate 110 may be held by a separate circular plate holding means.

The system 102 for twisting the plurality of cables 104 in the wind turbine 100 may further include a means for rotating the circular plate 110 in a predefined direction. The predefined direction of rotation of the circular plate 110 may be either a clockwise direction or an anticlockwise direction. The predefined direction of the circular plate 110 may be opposite to the direction of rotation of the nacelle 106. By way of an example, when the nacelle 106 rotates in a clockwise direction, the cables 104 also rotates in clockwise direction forming a twist, and so the circular plate 110 may be rotated in an anti-clockwise direction to untwist the cables 104.

According to an embodiment, the means for rotating the circular plate 110 may be a bearing (not shown in Figure). The bearing may be arranged between the means for holding the circular plate 110, and the circular plate 110. In other words, the means for holding the circular plate 110 may be connected to the circular plate 110 via the bearing. The bearing may have an exterior ring and an interior ring. The bearing may be arranged in the system 102 in such a way that the exterior ring may be attached to the holding means and the interior ring may be attached to the circular plate 110. It will be apparent to a person skilled in the art that as the exterior ring is attached to the fixed holding means, the interior ring may be free to rotate thereby enabling the circular plate 110 to rotate.

According to an embodiment, the bearing for rotating the circular plate 110 may be a magnetic bearing 116. Referring now to figure 3, an isometric view of the circular plate with the magnetic bearing 116 is illustrated according to an embodiment of the invention. In case of a magnetic bearing 116, both the holding means and the circular plate 110 may be coupled to a separate magnetic element 118. The magnetic element 118 may be a permanent magnet or an

electromagnet. The magnetic bearing 116 may be arranged in such a way that at least one magnetic element 118 coupled to the holding means may be selectively excited to provide a magnetic flux having a polarity opposite to the polarity of the magnetic element 118 on the circular plate 110. The controlled excitation of the at least one magnetic element 118 may enable rotation of the circular plate 110 as required.

According to another embodiment, the means for rotating the circular plate 110 in a predefined direction may be a motor (not shown in Figure). The motor may be connected to the inner ring for rotating the circular plate 110. The motor may be connected to electric supply for rotating the circular plate 110 in the predefined direction. The circular plate 110 may be rotated in the predefined direction as required.

According to an embodiment, the system 102 for twisting the plurality of cables 104 may be a manual system. According to another embodiment, the system 102 for twisting the plurality of cables 104 may be an automatic system. The automatic system may include a locking arrangement for locking and unlocking the movement of the circular plate 110. The locking arrangement may lock the circular plate 110 when the nacelle 106 is at an initial position. The automatic system may further include a sensor. The sensor may monitor the degree of twist in the cables 104 extending from the nacelle 106 to the bottom of the tower 108. The automatic system may further include a control system. On sensing the degree of twist in the cables 104, the control system may unlock the circular plate 110 and cause the rotation of the movement of the circular plate 110. The rotation of the circular plate 110 may be in the predefined direction. The predefined direction of rotation of the circular plate 110 may be either clockwise direction or an anticlockwise direction. The direction of rotation of the circular plate 110 may

be opposite to the direction of rotation of the nacelle 106 for untwisting the cables. The control system may further control each of the circular plate 110 independently.

It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein," respectively.

We claim:

1. A system 102 for twisting a plurality of cables 104 in a wind turbine 100, the plurality of cables 104 extending from a nacelle 106 to a bottom of a tower 108, the system 102 comprising:

   a circular plate 110 having a plurality of holes 112 for holding the plurality of cables 104; and

   a means for rotating the circular plate 110 in a predefined direction, wherein the predefined direction is opposite to the direction of rotation of the nacelle 106.

2. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the circular plate 110 is arranged in a horizontal position by a circular plate holding means.

3. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the means for holding the circular plate 110 in the horizontal position is a wind turbine platform 114 arranged within the tower 108.

4. The system 102 for twisting the plurality of cables as claimed in claim 1, wherein the means for rotating the circular plate 110 is a bearing arranged between the holding means and the circular plate 110.

5. The system 102 for twisting the plurality of cables 104 as claimed in claim 4, wherein the bearing arranged between the holding means and the circular plate 110 is a magnetic bearing 116.

6. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the means for rotating the circular plate 110 is a motor.

7. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the predefined direction of rotation of the circular plate 110 is a clockwise direction or an anticlockwise direction.

8. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the system 102 is an automatic system, the automatic system comprising:

a locking arrangement to hold the circular plate 110 in a fixed position;

a sensor to monitor the degree of twist in the plurality of cables 104;

a control system to control the locking arrangement and the rotation of the circular plate 110 in the predefined direction.

9. The system 102 for twisting the plurality of cables 104 as claimed in claim 1, wherein the system 102 is a manual system.

Dated this 28th day of March 2019

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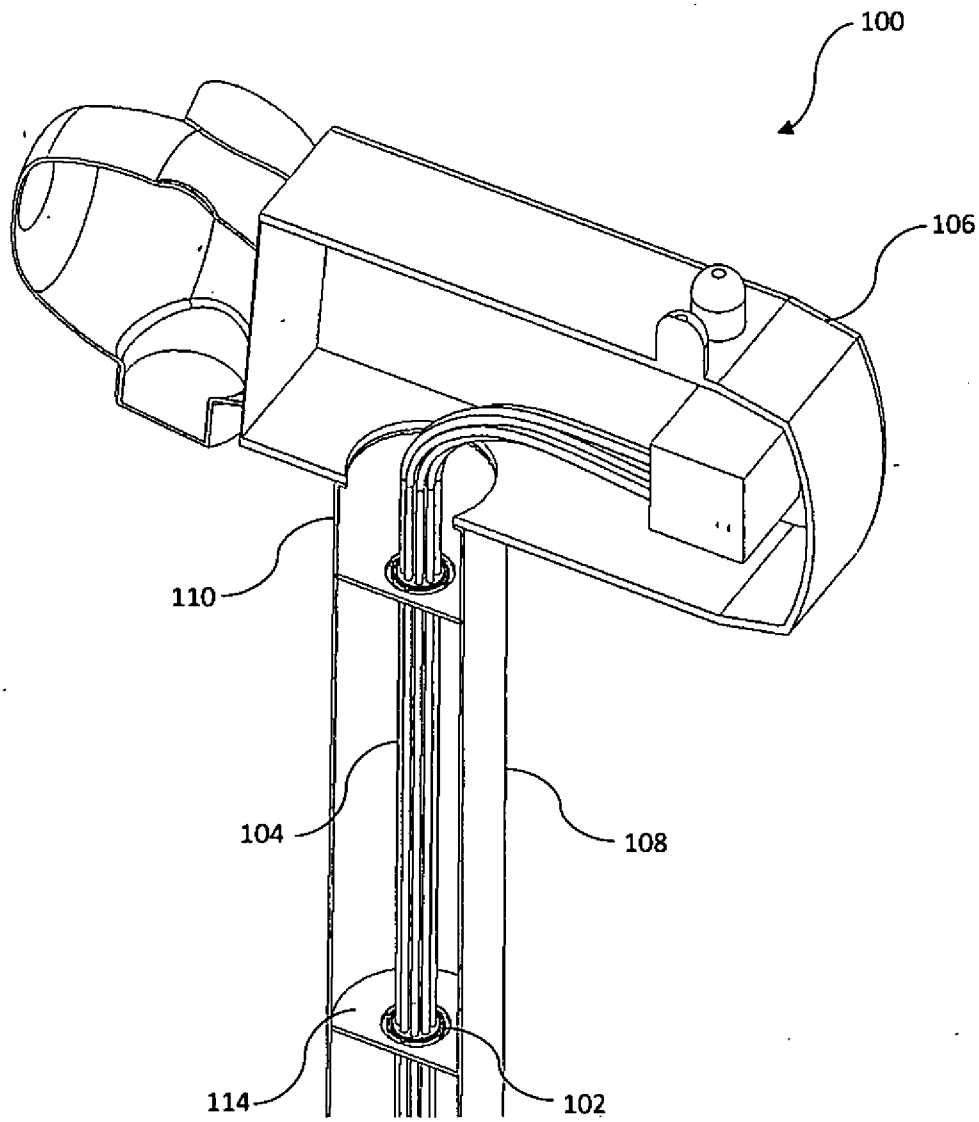

Figure 1

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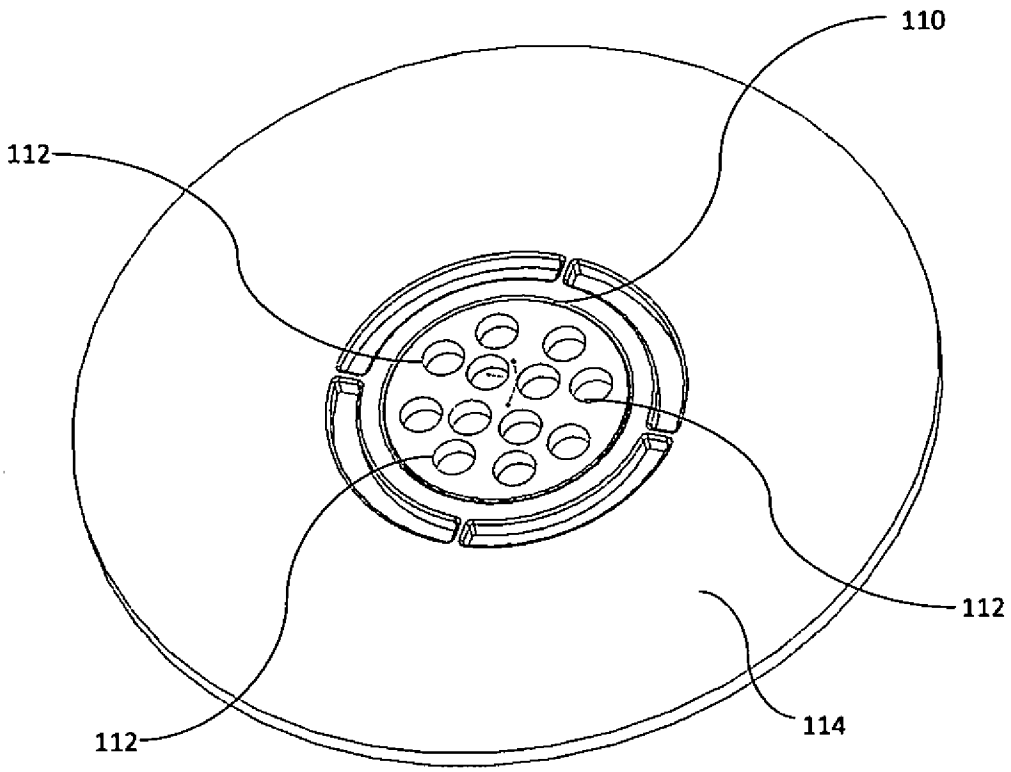

Figure 2

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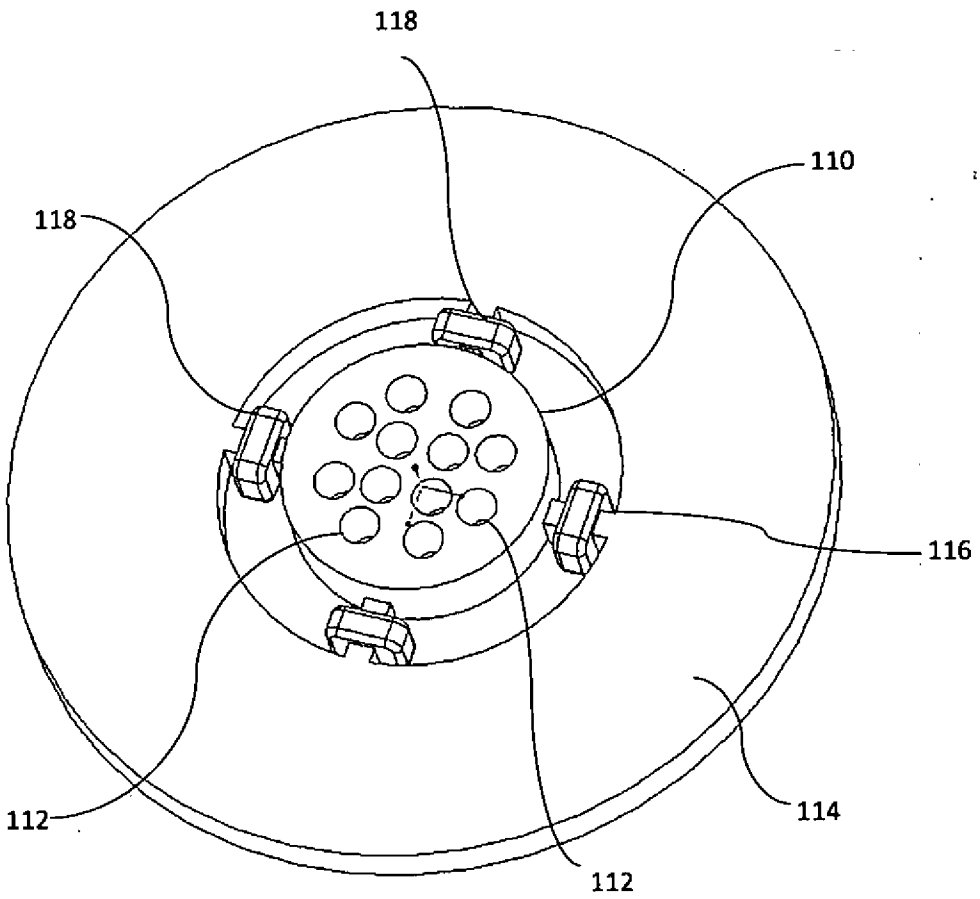

Figure 3

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