

Description

Title of Invention: APPARATUS AND METHOD FOR A TURRET TEST

Technical Field

- [1] The present invention relates to a turret test method and apparatus that check performance of a turret by rotating the turret.

Background Art

- [2] A marine structure such as a drillship or a floating production storage and offloading (FPSO) unit independently operates on the sea. To this end, the marine structure is equipped with various kinds of equipment. Before being mounted to the marine structure, whether the equipment normally operates is tested.
- [3] Particularly, in the case of a large rotatable structure such as a turret that is mounted to a marine structure, rotatability of the structure should be tested before the structure is mounted. In conventional cases, the turret has been placed on a rotating member and rotated by a hydraulic cylinder to test rotatability of the turret.
- [4] According to the conventional art as above, an angle that a support plate rotates per operation of the hydraulic cylinder is too small, and thus a large amount of time is taken to fully rotate the large structure once. Thereby, the total time to test the rotatability of the large structure increases.

Disclosure of Invention

Technical Problem

- [5] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a turret test method and apparatus to check performance of a turret by rotating the turret.

Solution to Problem

- [6] In accordance with an aspect of the present invention, the above and other objects can be accomplished by the provision of a turret test method including rotatably installing a turret at an adjacent structure, installing a winding drum, the winding drum being disposed in a rotation direction of the turret and rotating along with the turret, winding both parts of a rope about the winding drum in the same direction about a rotation axis of the turret, and providing tension to the rope.
- [7] In the providing of the tension, when the both parts of the rope are unwound from the winding drum, withdrawing directions of the both parts may form 180 degrees with respect to the winding drum.
- [8] The providing of the tension may include installing a movable pulley on the rope, and lifting the movable pulley using a crane.

- [9] In accordance with another aspect of the present invention, there is provided a turret test apparatus including a winding drum disposed in a rotation direction of the turret and configured to rotate according to rotation of the turret, a rope having both side ends fixed to the winding drum, both parts of the rope being wound about an outer circumferential surface of the winding drum in the same direction about a rotation axis of the turret, and a drive unit to pull the rope to provide tension to the rope, wherein, when the tension is provided to the rope by the drive unit, the both parts of the rope are unwound from the winding drum, and the turret is rotated.
- [10] The turret test apparatus may further include a flange to rotatably support the turret with respect to a counterpart object adjacent to the turret, wherein the winding drum is fixed to the turret or the flange.
- [11] When the both parts of the rope are unwound from the winding drum, withdrawing directions of the both parts may form 180 degrees with respect to the winding drum.
- [12] The winding drum may include a plurality of winding parts spaced apart from each other in a rotation direction of the turret.
- [13] The turret may rotate clockwise or counterclockwise depending upon a winding direction of the rope.
- [14] The winding drum may be provided with a first through hole and a second through hole, both side ends of the rope penetrating the first through hole and the second through hole, wherein the both side end of the rope may be fixed to an inner circumferential surface of the winding drum via the first through hole and the second through hole.
- [15] The first through hole and the second through hole may be provided in pair to the winding drum such that the first through hole and the second through hole are selectively used depending upon the winding direction of the rope.
- [16] The drive unit may include a movable pulley hung on the rope, and a crane to pull the movable pulley.
- [17] The drive unit may include at least one fixed pulley to guide the rope when the rope is unwound.

Advantageous Effects of Invention

- [18] According to embodiments of the present invention, when a rope is tensioned, both parts of the rope are pulled toward a movable pulley and unwound from a winding drum. Thereby, the turret may rotate and testing of the turret may be enabled.

Brief Description of Drawings

- [19] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

- [20] FIG. 1 is a view illustrating a turret test apparatus according to an exemplary embodiment of the present invention;
- [21] FIG. 2 is a cross-sectional view illustrating a winding drum;
- [22] FIG. 3 is a view illustrating a rope having one end fixed to the winding drum;
- [23] FIG. 4 is a cross-sectional view taken along line A-A of FIG. 3; and
- [24] FIG. 5 is a flowchart illustrating a turret test method according to one embodiment of the present invention.

Best Mode for Carrying out the Invention

- [25] It would be appreciated by those skilled in the art that changes may be made to the embodiments. Specific embodiments will be described below, examples of which are illustrated in the drawings. It should be understood that the present invention is not limited to the specific embodiments, but covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents. In describing the present invention, a detailed description may not be given of well-known technologies if such description could unnecessarily obscure the main point of the present invention.
- [26] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.
- [27] FIG. 1 is a view illustrating a turret test apparatus according to an exemplary embodiment of the present invention. Referring to FIG. 1, the turret test apparatus 10 includes a flange 100, a winding drum 200, a rope 300, and a drive unit 400. A turret T rotated by the turret test apparatus 10 may be a structure that is rotatably mounted on, for example, a drillship and a marine structure.
- [28] The flange 100 rotatably supports the turret T. The turret T may rotate with respect to a counterpart object such as, for example, a drillship and a marine structure by being supported on the flange 100. At this time, the turret T rotates about a rotation axis X.
- [29] As shown in FIG. 1, the flange 100 may be formed in the shape of a rotating plate by protruding outward in a radial direction of the turret T. In this case, bearings (not shown) may be interposed between the flange 100 and the counterpart object, and the outer part and inner part of each bearing may be fixedly coupled the counterpart object and the flange 100, respectively. When external force is applied to the turret T having the flange 100 fixed thereto, the turret T rotates relative to the counterpart object.
- [30] Alternatively, the flange 100 may include a plurality of rollers (not shown) interposed between the turret T and a support surface. The rollers may be spaced apart from in the direction of rotation of the turret T. Each of the rollers may be disposed to rotate about a rotation axis oriented to the rotation axis X of the turret T. When

external force is applied to the turret T placed on the rollers, the turret T rotates relative to the support surface.

[31] In addition, various types of flange other than the illustrated flange may be alternatively provided to rotatably support the turret T.

[32] The winding drum 200 is provided to wind a rope 300, which will be described later. As shown in FIG. 1, the winding drum 200 may be fixedly supported by the flange 100. Herein, the winding drum 200 may be disposed on one surface of the flange 100 on which the turret T is placed. However, embodiments of the present invention are not limited thereto.

[33] Alternatively, the winding drum 200 may be fixedly supported by the turret T, which is not shown in FIG. 1.

[34] The winding drum 200 is disposed in the direction of rotation of the turret T. At this time, the winding drum 200 may be arranged to surround the turret T.

[35] Although not shown in FIG. 1, the winding drum 200 may include a single ring-shaped member.

[36] Alternatively, the winding drum 200 may include a plurality of winding parts 210, as shown in FIG. 1. In this case, the winding parts 210 are disposed in the direction of rotation of the turret T such that they are spaced apart from each other. Alternatively, the winding parts 210 may be disposed in the direction of rotation of the turret T such that they adjoin each other.

[37] The rope 300 is wound about the winding drum 200. Both sides of the rope 300 are wound on the outer circumferential surface of the flange 100. At this time, both parts of the rope 300 are wound about the rotation axis X of the turret T in the same direction. For example, as shown in FIG. 1, both parts of the rope 300 are respectively wound counterclockwise about the rotation axis X. Alternatively, both parts of the rope 300 may be wound clockwise about the rotation axis X, which is not shown in FIG. 1.

[38] FIG. 2 is a cross-sectional view illustrating a winding drum, FIG. 3 is a view illustrating a rope having one end fixed to the winding drum, and FIG. 4 is a cross-sectional view taken along line A-A of FIG. 3. Referring to FIGS. 2 to 4, one end of the rope 300 is fixed to the winding drum 200.

[39] The one end of the rope 300 is fixed to the inner circumferential surface of the winding drum 200 via a first through hole 211 formed in the winding drum 200. For example, the one end of the rope 300 may be fixed to the winding drum 200 by providing a fixing member 213 such that the one end of the rope 300 is placed between the fixing member 213 and the winding drum 200 and coupling the fixing member 213 to the winding drum 200 with a bolt 214.

[40] The first through hole 211 is formed in the winding drum 200. The first through hole 211 may extend in a direction inclined with respect to the thickness direction of the

winding drum 200. In this case, the rope 300 may be prevented from being sharply bent at the inlet and outlet of the first through hole 211, and accordingly possibility of damage to the rope 300 may be reduced.

- [41] One pair of first through holes 211 may be provided to the winding drum 200. The one pair of first through holes 211a and 211b is selectively used according to the winding direction of the rope 300. For example, referring to FIG. 2, one first through hole 211a is used when the rope 300 is wound counterclockwise and the other first through hole 211b is used when the rope 300 is wound clockwise. Bolt holes 215a and 215b to fix the fixing member 213 are respectively formed around the one pair of first through holes 211a and 211b.
- [42] Although not shown in FIGS. 2 to 4, the other end of the rope 300 is also fixed to the winding drum 200. In this case, the other end of the rope 300 is fixed to the inner circumferential surface of the winding drum 200 via a second through hole formed in the winding drum 200. The other end of the rope 300 is fixed to the winding drum 200 in the same manner that the one end of the rope 300 is fixed. For details of the second through hole, refer to the description of the first through hole given above.
- [43] The drive unit 400 provides tension to the rope 300. The drive unit 400 pulls a portion of the rope 300 that is not wound about the winding drum 200 to provide tension to the rope 300. Once tension is applied to the rope 300 by the drive unit 400, both parts of the rope 300 are unwound from the winding drum 200, rotating the turret T.
- [44] The drive unit 400 includes a movable pulley 410 and a crane 430. The movable pulley 410 is caught by the rope 300. The movable pulley 410 is caught by a part of the rope 300 that is not wound about the winding drum 200. The movable pulley 410 may have the shape of a snatch block, but embodiments of the present invention are not limited thereto.
- [45] The movable pulley 410 is pulled by the crane 430. The crane 430 may be an overhead crane (not shown) that is disposed around the flange 100. When the crane 430 pulls the movable pulley 410, tension is generated in the rope 300, and the rope 300 is unwound from the winding drum 200, rotating the turret T.
- [46] The drive unit 400 may include at least one fixed pulley 450. The fixed pulley 450 guides the rope 300 when the rope 300 is unwound from the winding drum 200. For example, as shown in FIG. 1, eight fixed pulleys 450 may be provided. The fixed pulley 450 guides the rope 300 such that the rope 300 is smoothly unwound toward the movable pulley 410 when the movable pulley 410 is pulled by the crane 430.
- [47] The number and positions of the fixed pulleys 450 may vary depending upon the length of the rope 300, the position of the movable pulley 410, or the position of the crane 430.

- [48] According to this embodiment, when tension is applied to the rope 300, both parts of the rope 300 are simultaneously unwound from the winding drum 200, rotating the turret T. In other words, when tension is applied to the rope 300, both parts of the rope 300 are pulled toward the movable pulley 410, and the rope 300 is unwound from the winding drum 200, rotating the turret T. Thereby, the turret T is rotated by two external forces, and accordingly rapid rotation is possible.
- [49] FIG. 5 is a flowchart illustrating a turret test method according to one embodiment of the present invention. Hereinafter, a test method according to this embodiment will be described with reference to FIGS. 1 to 5. First, the turret T is rotatably installed at an adjacent counterpart object such as a drillship or a marine structure (S100). At this time, the turret T is rotatably supported by the flange 100 (S100).
- [50] Then, a winding drum 200 to rotate with the turret T is installed. Herein, the winding drum 200 is disposed in the direction of rotation of the turret T and fixed to the turret T or the flange 100 (S200).
- [51] Thereafter, both parts of the rope 300 are wound about the winding drum 200 in the same direction as the rotation axis X of the turret T (S300).
- [52] Thereafter, by pulling the rope 300 using the crane 430, tension is provided to the rope 300 (S400). Once the tension is provided to the rope 300, both parts of the rope 300 are unwound from the winding drum 200, rotating the turret T.
- [53] When the movable pulley 410 installed on the rope 300 is lifted using the crane 430, tension is applied to the rope 300.
- [54] Depending on the direction in which the rope 300 is wound about the winding drum 200, the turret T may rotate clockwise or counterclockwise about the rotation axis X.
- [55] For example, a rotating device 10 may be set to rotate clockwise about the rotation axis X of the turret T and then rotatability of the turret T may be tested by rotating the turret T 360 degrees or more. Then, the turret test apparatus 10 may be set to rotate counterclockwise about the rotation axis X of the turret T and rotatability of the turret T may be tested again by rotating the turret T 360 degrees or more.
- [56] In the case in which the above method is employed, the turret T may rapidly rotate, thereby effectively reducing the test time of the turret T.
- [57] Meanwhile, when tension is applied to the rope 300 and thus the both parts of the rope 300 are respectively unwound from the winding drum 200, the angle between the withdrawn directions of the both parts of the rope 300 with respect to the winding drum 200 may be 180 degrees, as shown in FIG. 1. In this case, the tension applied to the rope 300 may fully act as external force to rotate the turret T, thereby stably and effectively rotating the turret T without side force.
- [58] Various embodiments have been described in the best mode for carrying out the invention.

Industrial Applicability

- [59] According to embodiments of the present invention, when a rope is tensioned, both parts of the rope are pulled toward a movable pulley and unwound from a winding drum. Thereby, the turret may rotate and testing of the turret may be enabled.
- [60] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

- [Claim 1] A turret test method comprising:
rotatably installing a turret at an adjacent structure;
installing a winding drum, the winding drum being disposed in a rotation direction of the turret and rotating along with the turret;
winding both parts of a rope about the winding drum in the same direction about a rotation axis of the turret; and
providing tension to the rope.
- [Claim 2] The turret test method according to claim 1, wherein, in the providing of the tension, when the both parts of the rope are unwound from the winding drum, withdrawing directions of the both parts form 180 degrees with respect to the winding drum.
- [Claim 3] The turret test method according to claim 1, wherein the providing of the tension comprises:
installing a movable pulley on the rope; and
lifting the movable pulley using a crane.
- [Claim 4] A turret test apparatus comprising:
a winding drum disposed in a rotation direction of the turret and configured to rotate according to rotation of the turret;
a rope having both side ends fixed to the winding drum, both parts of the rope being wound about an outer circumferential surface of the winding drum in the same direction about a rotation axis of the turret; and
a drive unit to pull the rope to provide tension to the rope,
wherein, when the tension is provided to the rope by the drive unit, the both parts of the rope are unwound from the winding drum, and the turret is rotated.
- [Claim 5] The turret test apparatus according to claim 4, further comprising a flange to rotatably support the turret with respect to a counterpart object adjacent to the turret,
wherein the winding drum is fixed to the turret or the flange.
- [Claim 6] The turret test apparatus according to claim 4, wherein, when the both parts of the rope are unwound from the winding drum, withdrawing directions of the both parts form 180 degrees with respect to the winding drum.
- [Claim 7] The turret test apparatus according to claim 4, wherein the winding drum comprises a plurality of winding parts spaced apart from each

other in a rotation direction of the turret.

[Claim 8] The turret test apparatus according to claim 4, wherein the turret rotates clockwise or counterclockwise depending upon a winding direction of the rope.

[Claim 9] The turret test apparatus according to claim 8, wherein the winding drum is provided with a first through hole and a second through hole, both side ends of the rope penetrating the first through hole and the second through hole,
wherein the both side end of the rope are fixed to an inner circumferential surface of the winding drum via the first through hole and the second through hole.

[Claim 10] The turret test apparatus according to claim 9, wherein the first through hole and the second through hole are provided in pair to the winding drum such that the first through hole and the second through hole are selectively used depending upon the winding direction of the rope.

[Claim 11] The turret test apparatus according to claim 4, wherein the drive unit comprises:

a movable pulley hung on the rope; and
a crane to pull the movable pulley.

[Claim 12] The turret test apparatus according to claim 11, wherein the drive unit comprises at least one fixed pulley to guide the rope when the rope is unwound.