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## **A METHOD OF CONTEMPORANEOUSLY CONSTRUCTING MORE THAN ONE SEMI-SUBMERSIBLE RIG USING TRANSVERSE SKIDDING**

### **CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation-in-part of our earlier application No. 200306086-0 filed on 17 October 2003 entitled "A Method of Constructing a Semi-submersible Vessel Using Dry Dock Mating," the full disclosure of which is incorporated by reference herein and a priority of which is hereby claimed.

### **FIELD OF THE INVENTION**

This invention generally relates to construction of offshore structures and more particularly to a method of building two (or more) semi-submersible drilling rigs simultaneously in a shipyard using a dry dock mating process.

### **BACKGROUND OF THE INVENTION**

Due to the rising trend of demand on energy, oil prices are likely to be sustained high in the foreseeable future and emphasis on exploration will markedly increased. The strong drive towards deepwater exploration is a key offshore activity, which means a high demand for newly built semi-submersible rigs. From the shipyard's point of view, it is important to shorten the delivery time by increasing productivity.

International application published under publication No. WO 2005/035354 A1 discloses a method which allows the upper hull and the lower hull to be constructed in a shipyard simultaneously and thereby shortening the overall construction schedule. The upper hull is completely erected on land on a skidding truss and supporting towers, while the lower hull is constructed in a dry dock adjacent to the skidding truss. A supporting truss is installed in the dry dock to support a plurality of skidding beams extending from the upper hull construction site at land side to the mating position above the lower hull in the dry dock. Once the upper hull and the lower hull are constructed, the upper hull is loaded out to the mating position by skidding on the skidding beams using a hydraulic jacking system. The mating operation is subsequently carried out by floating up the lower hull in the dry dock until it meets and supports the upper hull. The welding of the upper and lower hulls' joint is finally performed. In doing so, the complete mating operation is conducted in a controllable condition, which ensures the safety as well as the quality of the operation.



This method, however, allows building and assembling only one semi-submersible rig at a time. To construct a second rig, the upper hull will have to be erected and assembled on the skidding truss and therefore the second load-out and mating operation may only be carried out several months later. The present invention contemplates elimination of some drawbacks associated with prior methods and provision of a method of contemporaneous construction of two or more semi-submersible vessels.

### **SUMMARY OF THE INVENTION**

It is, therefore, an object of the present invention to provide a method of constructing two (or more) semi-submersible rigs simultaneously in a safe, secure manner at a relatively low cost.

It is another object of the present invention to provide a method of constructing two (or more) semi-submersible rigs simultaneously using land side and dry docks of a convention shipyard.

These and other objects of the present invention are achieved through a provision of a method, which allows the upper hulls and the lower hulls of two rigs to be constructed in a shipyard contemporaneously and thereby shorten the overall construction schedule. The upper hull of the first rig is completely erected at land side near the end of a dry dock on a skidding truss and supporting towers, while that of the second rig is completely erected at land side and positioned on a skid way oriented transversely to the skidding truss holding the first upper hull. The lower hull of the first rig is constructed in a dry dock adjacent to the skidding truss, whilst that of the second rig is constructed at another location in the yard.

A supporting truss is installed in the dry dock to support a plurality of skidding beams extending from the upper hull construction site at land side to the mating position above the lower hull in the dry dock.

Once the upper hull and the lower hull of the two rigs are constructed, the first upper hull is loaded out to the mating position by skidding on the skidding beams using a hydraulic jacking system. The mating operation is subsequently carried out by floating up the lower hull in the dry dock until it meets and supports the upper hull. The welding of the upper and lower hulls' joint is finally performed for the first rig.

During the mating operation of the first rig, the upper hull of the second rig is moved from its erection location to the load-out location by skidding transversely on a skid way. The second upper hull is subsequently jacked up to a height so that the

skidding truss can be retrieved from the mating location in the dry dock and positioned underneath the second upper hull. The upper hull is then lowered down and eventually rested on the skidding truss.

Upon the completion of the first rig's mating operation, the completed rig is pulled out of the dry dock and the lower hull of the second rig is towed into the mating location in the dry dock. The second rig's load-out and mating operation is then carried out in exactly the same way as that of the first rig.

In doing so, the complete mating operations for two rigs are conducted sequentially in a controllable condition, which ensures the safety as well as the quality of the operation.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

For a further understanding of the nature and objects of the present invention reference should be made to the following description, taken in conjunction with the attached drawings in which like parts are given like reference numerals, and wherein:

FIG. 1 is the plan view of the load-out, mating and transverse skidding operation arrangement.

FIG. 2 is a longitudinal profile view showing the first upper hull supported on the skidding truss and the load-out structures and equipment (such as longitudinal skidding beam and shoes, supporting truss in dry dock, tie bars, barges, jacking system, strand wire).

FIG. 3 is a transverse profile view showing the second upper hull supported on temporary blocks.

FIG. 4 is a detail view showing the transverse skidding-and-pushing-up shoes positioned under the upper hull and taking over the weight of the upper hull.

FIG. 5 shows the step of load-out and mating operation of the first rig in dry dock.

FIG. 6 shows a step of skidding the second upper hull transversally from its erection location to load-out location.

FIG. 7 shows the step of jacking up the second upper hull at the load-out location.

FIG. 8 illustrates the retrieval of skidding truss from mating location back to load-out location underneath the second upper hull.

FIG. 9 illustrates the operations of pulling completed first rig out and positioning the second rig lower hull in mating location.

FIG. 10 illustrates the steps of the load-out and mating of the second rig.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in more detail, Figures 1 - 3 show the general arrangement of the shipyard area including the dry dock 4, where the two -submersible rigs of the present invention are constructed and mated. As can be seen in Figures 2 and 3, the first semi-submersible rig comprises a first upper hull 1a and a first lower hull 2a. During construction, the first upper hull 1a is supported by a skidding truss 3 located on land adjacent to the dry dock 4. The truss 3 is designed to skid the completed upper hull 1a on longitudinal skidding beams 5 using longitudinal skidding shoes 6 during the load-out operation.

As can be seen in Figure 1, the longitudinal skidding beams 5 extend in parallel to a longitudinal axis of the skidding truss 3. A detailed configuration of the structures required for load-out and mating operation is disclosed in further detail in the earlier application entitled "A Method of Constructing a Semi-submersible Vessel Using Dry Dock Mating" (International Publication No. WO 2005/035354 A1).

Contemporaneously with the construction of the first upper hull 1a, the second upper hull 1b is being constructed next to the first upper hull 1a on a transverse skid way with a pair of stationary transverse skid beams 9. The second upper hull is supported on the skid beams 9 by temporary support blocks 7 (Fig. 3). The transverse skid beams 9 each have a longitudinal axis, which is oriented transversely to the longitudinal axis of the skidding truss 3. The temporary blocks 7 are stationary and are located at a level considerably lower than the skidding truss 3, which supports the first upper hull 1a.

Upon completion of construction of the second upper hull 1b, transverse-skidding-and-pushing-up shoes 8 are positioned underneath the second upper hull 1b on the transverse skid way 9 (Fig. 4). The shoes 8 are then pushed up to take over the weight of the second upper hull 1b from the temporary support blocks 7.

FIG. 5 illustrates the steps of load-out and mating of the first rig. The first upper hull 1a is pulled from the load-out location to the mating location above the dry dock 4. The first lower hull is floated by flooding the dry dock 4, and position of the lower hull is adjusted using the ballast tanks of the first lower hull 2a.

The first lower hull 2a is floated up until the column tops of the first lower hull 2a touch the bottom of the first upper hull 1a. Then, the temporary guide pieces at the upper and lower hulls joints are welded. Meanwhile, the first lower hull 2a is continuously floated until it supports the weight of the first upper hull 1a and the gap between the first

upper hull 1a and the first lower hull 2a is closed. Sufficient welding at upper and lower hulls joints permanently attaches the first lower hull 2a to the first upper hull 1a.

The next step in the process involves skidding the second upper hull 1b transversally from its erection location to load-out location near the end of dry dock 4 (FIG. 6). The skidding operation is performed by a plurality of skidding-and-pushing-up shoes 8 positioned on the transverse skid way beams 9.

Upon reaching the load-out location, the second upper hull 1b is pushed up by the skidding-and-pushing-up shoes 8 to a height sufficient to accommodate the skidding truss 3 (to be pulled back in next step) underneath with acceptable clearance in between (FIG. 7).

Once the second upper hull 1b reaches the necessary height, the skidding truss 3, which had been positioned at the first rig's mating location, is pulled back to the load-out location of the second upper hull 1b. This step is illustrated in Figure 8. After that, the first completed rig is towed away from the mating location, as schematically shown in the upper part of Figure 9, and the second lower hull 2b is positioned at the mating location, as illustrated in the lower part of Figure 9.

Following positioning of the second lower hull 2b in the mating location, the second upper hull 1b is pulled from the load-out location along the skidding truss 3 to the mating location above the dry dock 4. The second lower hull 2b is ballasted and floated up until the column tops of the second lower hull 2b touch the bottom of the first upper hull 1a. Similar to the construction process of the first rig, the temporary guide pieces at the upper and lower hulls joints are welded. During this time, the second lower hull 2b is continuously floated until it supports the weight of the second upper hull 1b and the gap between the second upper hull 1a and the second lower hull 2b is closed. The second upper hull 1b and the second lower hull 2b are then permanently joined together by welding. Figure 10 illustrates the second rig's load-out and mating operation which generally repeats the load-out and mating operation for the first rig.

The method of the present invention provides the advantages of allowing to construct two (or more) semi-submersible rigs substantially contemporaneously employing the steps of sequential longitudinal load-out and mating operations in dry dock and the transverse skidding operation at land side of dock end. By doing so, the overall construction period for two rigs is substantially shortened. In effect, two rigs can be fabricated at the same time using conventional shipyard facilities.

It will be understood that more than two rigs can be constructed contemporaneously in a conventional shipyard, with one of the upper hulls 1a being erected on the skidding truss 3, while other upper hulls 2a are being constructed in close vicinity thereto. After the first upper hull 1a is moved to a mating position with the first lower hull 2a, the second upper hull 1b can be elevated above the skidding truss 3 and transferred to the skidding truss 3. Once the skidding truss 3 becomes free again (following transfer of the second upper hull 2a to a mating position in the dock), the next upper hull is transferred to the skidding truss and so on. All final mating operations are conducted in the same dry dock.

The efficiency of the dry dock usage considerably increases by saving the period of time required to dismantling the skidding structures in the dry dock after first load-out and mating operation and re-installing before the second rig operation. Additional advantages of the method of the present invention relate to constructing the second upper hull on temporary supporting blocks 7 at a much lower level compared to the first upper hull, leading to a safer working environment and minimizing the requirements on heavy lift operation.

While the invention has been described with reference to a specific embodiment, the description is not meant to be construed in a limiting sense. Various modifications of the disclosed embodiment, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to this description. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as fall within the true scope of the invention.

## CLAIMS

We Claim:

1. A method of constructing two (or more) semi-submersible rigs, comprising the steps of:
  - providing a first upper hull of a first rig and a means for supporting the first upper hull on land;
  - providing a second upper hull of a second rig and a means for supporting the second upper hull on land in a location adjacent to the first upper hull;
  - providing a first lower hull of the first rig and positioning the first lower hull in a dry dock adjacent to the first upper hull;
  - moving the first upper hull to a position above the first lower hull and ballasting the first lower hull to align with the first upper hull;
  - mating the first upper hull to the first lower hull, thereby assembling the first rig and then moving the first rig a distance from the dry dock;
  - transferring the second upper hull to the means for supporting the first upper hull;
  - providing a second lower hull of the second rig and positioning the second lower hull in the dry dock adjacent the second upper hull;
  - transferring the second upper hull to a position above the second lower hull;
  - ballasting the second lower hull to align with the second upper hull; and
  - mating the second upper hull to the second lower hull, thereby assembling the second rig.
2. The method of Claim 1, wherein the means for supporting the first upper hull comprises a skidding truss.
3. The method of Claim 2, wherein said means for supporting the second upper hull comprises stationary support blocks positioned on a skid way located transversely to a longitudinal axis of the skidding truss.
4. The method of Claim 3, wherein said means for supporting the second upper hull further comprises a means for elevating the second upper hull.

5. The method of Claim 4, further comprising a step of transferring the second upper hull to the skidding truss; while the first upper hull is being mated to the first lower hull.
6. The method of Claim 3, wherein said means for supporting the second upper hull further comprises a means for elevating the second upper hull to a relative height above the skidding truss.
7. The method of Claim 6, further comprising a step of moving the skidding truss to a position below elevated second upper hull and transferring the weight of the second upper hull to the skidding truss before transferring the second upper hull to a position above the second lower hull.
8. The method of Claim 6, wherein said means for elevating the second upper hull comprises skidding and elevating shoes capable of elevating the second upper hull to a pre-determined height.
9. The method of Claim 8, further comprising the step of positioning the skidding and elevating shoes below the second upper hull and transferring the second upper hull to the skidding and elevating shoes prior to transferring the second upper hull to the means for supporting the first upper hull.
10. The method of Claim 1, wherein the second upper hull is transferred to the means for supporting the first upper hull after the first upper hull is transferred to a position above the first lower hull.
11. The method of Claim 1, further comprising the steps of constructing the first upper hull on a skidding truss, while contemporaneously constructing the second upper hull on a skid way adjacent the first upper hull.
12. The method of Claim 11, wherein said skid way supports the second upper hull at a level lower than a level of supporting the first upper hull on a skidding truss, thereby facilitating safety of construction.
13. The method of Claim 11, further comprising the steps of constructing the first lower hull and the second lower hull contemporaneously with the construction of the first upper hull and the second upper hull.
14. The method of Claim 13, further comprising the step of constructing more than two upper hulls and more than two lower hulls contemporaneously with the construction of the first upper hull, the second upper hull, the first lower hull and the second lower hull.