

# **SHIPBUILDING METHOD EMPLOYING NON-FLOATING TANDEM METHOD IN DRY DOCK**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

The present invention relates to a shipbuilding method employing non-floating tandem method in drydock through which a launching ship and a partially launching ship may be simultaneously built, the partially launching ship may be balanced and stably non-floated when the launching ship is carried out, and correspondingly and differently to shipbuilding of the partially launching ship, water may be forcibly poured so as not to affect launching of the ship, in case of building same or different kinds of ships in one dry dock.

### **2. Description of the Related Art**

As well known in the prior art, a dry dock method is used to efficiently build a large vessel. Here, a ship block is built in a dry dock, seawater flows into the dry dock, and then, the vessel is floated, raised to a quay wall, and carried out.

Also, a tandem method is applied to use a spare space in the dry dock and to simultaneously build a launching ship and a partially launching ship.

For example, when a tandem method is applied to a launching ship of an ultra large container ship and a partially launching ship of a Very Large Crude oil Carrier (VLCC) and when seawater flows into the dry dock, the partially launching ship is floated, unbalanced, and

inclined towards an end part of the stern of the ship due to buoyancy of a cargo tank area where a bulkhead of the partially launching ship are formed. Accordingly, when the launching ship is raised by a tugboat, a keel block supporting the partially launching ship may fall by screw rotation generated from the tugboat and thus, the partially launching ship may be overturned. In this regard, there are limitations on simultaneously building of the launching ship of an ultra large container ship and the partially launching ship.

In order to solve such an issue, Korean Patent Application Pub. No.10-0796410 is disclosed and includes an inundation method applying to a general tandem method, wherein the inundation method includes building of a ship block using the tandem method in a dock, installing of main loads in a main engine, tail and intermediate shafts, an aft block, a lashing bridge, or a hatch cover onto a ship to be inundated, inundating of a ship to be inundated at the same position by naturally flowing water into cargo/hold ballast and a part of double-floor tanks, when a launching ship is floated, and building of the inundated ship after towing the launching ship. Accordingly, after moving all loads onto a body of the ship, the body of the ship is inundated and building of the ship is completed at the same position without moving the body of the ship.

The partially launching ship is inundated by naturally flowed water used to float the launching ship into cargo/hold ballast and a part of double-floor tank, when the main loads are placed onto the partially launching ship. However, as illustrated in FIG. 1, the launching ship may be launched only after the completion of placing all main loads onto the partially launching ship. Accordingly, when building of the launching ship is completed, the time for raising of the launching ship may be delayed according to a process of building the partially launching ship,

the body of the ship may be corroded due to salt and chlorine generated after inundating the partially launching ship in water naturally flowed into a dock, that is, seawater, and pre-processes or post-processes for preventing corrosion of the body of the ship may be needed so as to delay a construction period.

In this regard, an improved tandem method is required to minimize delay of a construction period in such a way that the launching ship is raised regardless of building of the partially launching ship, and to minimize corrosion of the body of the ship for preparing inundation of the partially launching ship.

### SUMMARY OF THE INVENTION

The present invention provides a shipbuilding method employing non-floating tandem method in drydock through which delay of a construction period may be minimized in such a way that a launching ship is raised regardless of building of a partially launching ship, and corrosion of a body of the ship may be minimized for preparing inundation of the partially launching ship.

According to an aspect of the present invention, there is provided a shipbuilding method employing non-floating tandem method in drydock including: respectively building ship blocks of a plurality of same or different kinds of ships in one or two rows within one identical dry dock, wherein construction work on the hull for a partially launching ship is performed at an adjacent area of a dock head and partial construction work on the hull for a launching ship is performed at an adjacent area of a dock gate; forcibly pouring water into the partially launching ship through a pump; making an inflow of seawater by opening the dock gate of the dry dock to

float the launching ship and to non-float the partially launching ship; carrying out the floated launching ship to an outer quay wall of the dock gate; draining seawater from the dry dock by closing the dock gate; and performing remaining partial construction work on the hull for the partially launching ship at the same position.

Here, fresh water or seawater may be forcibly poured into a cargo tank, where a bulkhead of the partially launching ship is formed, through the pump, in order to offset buoyancy of the partially launching ship and to balance with COG.

When a deck house and an engine casing of the partially launching ship are loaded, water may be forcibly poured into each of a pair of left and right SCO tanks adjacent to the engine casing, and when a deck house and an engine casing of the partially launching ship are not loaded, water may be mostly poured into each of the pair of left and right SCO tanks adjacent to the engine casing and the rest may be poured into each of a pair of left and right SLOP tanks.

Fresh water or seawater may be forcibly poured into the SCO tanks and the SLOP tanks.

When seawater is forcibly poured, seawater may be poured after removing salt and chlorine through a seawater desalination equipment.

The shipbuilding method may further include performing partial construction work on the hull for a next ship at the position where the launching ship is carried out.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

FIG. 1 illustrates an inundation method applied to a general tandem shipbuilding method;

FIG. 2 is a flowchart illustrating a shipbuilding method employing non-floating tandem method in drydock according to an embodiment of the present invention;

FIG. 3 illustrates a dry dock where the shipbuilding method employing non-floating tandem method in drydock of FIG. 2 is applied;

FIG. 4 is a cross-sectional view of the stern of a partially launching ship in which the shipbuilding method employing non-floating tandem method in drydock of FIG. 2 is applied; and

FIG. 5 illustrates process drawings of a non-floating tandem method in the dry dock of FIG. 3.

### DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the present invention will be described in more detail with reference to the accompanying drawings to be easily implemented by those of ordinary skill in the art. This invention may be embodied in many alternate forms and should not be construed as limited to only the exemplary embodiments set forth herein.

Referring to FIG. 2, a shipbuilding method employing non-floating tandem method in drydock according to an embodiment of the present invention includes performing construction work and partial construction work on the hull in operation S110, forcibly pouring water in

operation S120, making an inflow of seawater in operation S130, carrying out a launching ship in operation S140, draining seawater in operation S150, performing remaining partial construction work on the hull in operation S160, and performing partial construction work on the hull for a next ship in operation S170 and enables continuous tandem shipbuilding.

More specifically, the shipbuilding method employing non-floating tandem method in drydock according to an embodiment of the present invention will be described in more detail below with reference to FIGS. 2 through 5.

Firstly, in performing construction work and partial construction work on the hull in operation S110, ship blocks of a plurality of same or different kinds of ships are respectively built in one or two rows within one identical dry dock, as illustrated in FIGS. 3 and 5A. Here, construction work on the hull for a partially launching ship is performed at an adjacent area of a dock head and partial construction work on the hull for a launching ship is performed at an adjacent area of a dock gate.

Here, the launching ship or the partially launching ship is not particularly restricted, however, may be a large vessel such as a very large crude oil carrier (VLCC), an ultra large container ship, a liquefied natural gas (LNG) carrier, an LNG propulsion ship, or a chemical tanker. The launching ship having a length of overall (LOA) of around 400m and the partially launching ship having a LOA of around 120m may be simultaneously built in one or two rows within one identical dry dock having a length of over 500m.

For reference, a gap between the dock head and the partially launching ship and a gap between the dock gate and the launching ship need to be around 5m. Also, the distance between the partially launching ship and the launching ship needs to be around 10m.

Next, as illustrated in FIG. 3, in forcibly pouring water in operation S120, water is forcibly poured into the partially launching ship through a pump P and thereby, the partially launching ship, that is the bow of the partially launching ship, may not be floated by its own buoyancy when seawater flows into the dock.

That is, in order to offset buoyancy of the partially launching ship generated by seawater density which varies according to water temperature, salt, and water pressure and to balance with COG, fresh water or seawater is forcibly poured into a cargo tank, where a bulkhead of the partially launching ship is formed, through the pump P and thereby, the partially launching ship may not be floated at its own position from a keel block used to prevent inversion of blocks.

Referring to FIG. 4, in forcibly pouring water, when a deck house (D/H) A and an engine casing B of the partially launching ship are loaded, water is forcibly poured into the bow of the partially launching ship, that is, each of a pair of left and right SCO tanks (TK) (P) and (S) adjacent to the engine casing B. Here, in case of a VLCC, around 8000 tons of water is respectively poured so that the bow of the partially launching ship may not be floated and may be balanced with COG which inclines towards an end part of the stern. Accordingly, the front and the back of the stern may not be asymmetrically inclined and partially floated. For example, 8000 tons of water may be poured into No.5 SCO TK (P) and 7,950 tons of water may be poured into No.5 SCO TK(S) so that a total of 15,950 tons of water may be poured.

Also, when the D/H A and the engine casing B of the partially launching ship are not loaded, COG is less inclined towards the end part of the stern compared with the D/H A and the engine casing B being loaded. Accordingly, water is mostly poured into each of the pair of

left and right SCO tanks (TK) (P) and (S) adjacent to the engine casing B and the rest is poured into each of a pair of left and right SLOP tanks (TK) (P) and (S). In case of a VLCC, around 7000 tons of water is respectively poured into each of the pair of left and right SCO tanks (TK) (P) and (S) and around 800 tons of water is respectively poured into each of the pair of left and right SLOP tanks (TK) (P) and (S). Accordingly, the stern may not be floated and may be balanced with COG which relatively less inclines towards the end part of the stern so that the front and the back of the stern may not be asymmetrically inclined and partially floated. For example, 7100 tons of water may be respectively poured into No.5 SCO TK (P, S), 860 tons of water may be poured into SLOP TK (P), and 750 tons of water may be poured into SLOP TK (S), so that a total of 15,810 tons of water may be poured.

Here, fresh water or seawater may be forcibly poured into the SCO TKs and the SLOP TKs through the pump P. When seawater is forcibly poured, a seawater desalination equipment may be used before to remove salt and chlorine in order to minimize corrosion of the body of the ship generated by salt and chlorine.

In this regard, correspondingly and differently to shipbuilding of the partially launching ship, fresh water or seawater is forcibly poured so that the partially launching ship may be balanced and stably non-floated and launching of the launching ship may not be affected. Accordingly, delay of a construction period may be minimized.

For reference, it is illustrated that the pump P is disposed in the dry dock, however, may be loaded onto the partially launching ship and used in forcibly pouring water. Also, the SLOP tanks store and keep mixture of oil and seawater made after cleaning various tanks, or

oil mixture of waste oil flowing from an engine room and are disposed to prevent sea pollution occurring due to oil and to reduce loss of cargo.

Next, as illustrated in FIG. 5B, in making an inflow of seawater in operation S130, the dock gate of the dry dock is opened for an inflow of seawater to float the launching ship and the partially launching ship is not floated from its position.

Next, as illustrated in FIGS. 3 and 5C, in carrying out the launching ship in operation S140, the floated launching ship is raised to an outer quay wall of the dock gate by a tugboat and carried out.

Next, in draining seawater in operation S150, the dock gate is closed to drain seawater from the dry dock.

Next, as illustrated in FIG. 5D, in performing remaining partial construction work on the hull in operation S160, fresh water or seawater forcibly poured into the partially launching ship is drained and remaining partial construction work on the hull for the partially launching ship is performed at the inundated position to build the launching ship.

Next, as illustrated in FIG. 5D, in performing partial construction work on the hull for a next ship in operation S170, partial construction work on the hull for a next ship is performed at the position where the launching ship is carried out.

According to the shipbuilding method employing non-floating tandem method in drydock described above, fresh water or seawater may be separately and forcibly poured so that corrosion of the body of the ship may be minimized. Also, in case of building same or different kinds of ships in one dry dock, the partially launching ship may be non-floated, the launching ship and the partially launching ship may be simultaneously built, the partially

launching ship may be balanced and stably non-floated when the launching ship is carried out, water may be forcibly poured correspondingly and differently to shipbuilding of the partially launching ship so as not to affect launching of the ship, a construction period may be shortened by the tandem method, and shipbuilding of large vessels may be continuously performed, compared with a conventional inundation method in which the partially launching ship having main loads thereon is inundated by seawater naturally flowed thereto for floating the launching ship.

According to the present invention, fresh water or seawater may be separately and forcibly poured so that corrosion of the body of the ship may be minimized and in case of building same or different kinds of ships in one dry dock, the partially launching ship may be non-floated, the launching ship and the partially launching ship may be simultaneously built, the partially launching ship may be balanced and stably non-floated when the launching ship is carried out, water may be forcibly poured correspondingly and differently to shipbuilding of the partially launching ship so as not to affect launching of the ship, a construction period may be shortened by the tandem method, and shipbuilding of large vessels may be continuously performed.

While the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A shipbuilding method employing non-floating tandem method in drydock comprising:

respectively building ship blocks of a plurality of same or different kinds of ships in one or two rows within one identical dry dock, wherein construction work on the hull for a partially launching ship is performed at an adjacent area of a dock head and partial construction work on the hull for a launching ship is performed at an adjacent area of a dock gate;

forcibly pouring water into the partially launching ship through a pump;

making an inflow of seawater by opening the dock gate of the dry dock to float the launching ship and to non-float the partially launching ship;

carrying out the floated launching ship to an outer quay wall of the dock gate;

draining seawater from the dry dock by closing the dock gate; and

performing remaining partial construction work on the hull for the partially launching ship at the same position.

2. The shipbuilding method of claim 1, wherein fresh water or seawater is forcibly poured into a cargo tank, where a bulkhead of the partially launching ship is formed, through the pump, in order to offset buoyancy of the partially launching ship and to balance with COG.

3. The shipbuilding method of claim 2, wherein when a deck house and an engine casing of the partially launching ship are loaded, water is forcibly poured into each of a pair of left and right SCO tanks adjacent to the engine casing.

4. The shipbuilding method of claim 2, wherein when a deck house and an engine casing of the partially launching ship are not loaded, water is mostly poured into each of the pair of left and right SCO tanks adjacent to the engine casing and the rest is poured into each of a pair of left and right SLOP tanks.

5. The shipbuilding method of claim 3 or 4, wherein fresh water or seawater is forcibly poured into the SCO tanks and the SLOP tanks.

6. The shipbuilding method of claim 5, wherein when seawater is forcibly poured, seawater is poured after removing salt and chlorine through a seawater desalination equipment.

7. The shipbuilding method of claim 1, further comprising performing partial construction work on the hull for a next ship at the position where the launching ship is carried out.