

## **【DESCRIPTION】**

### **【Invention Title】**

#### **VESSEL CARGO HOLD HAVING VOID SPACE**

### **5      【Technical Field】**

        This disclosure relates to a vessel cargo hold, and more particularly, to a vessel cargo hold capable of prevent a danger such as fire and explosion, which may occur during the maintenance or repair of the vessel cargo hold for storing crude oil, and decreasing work or the like required for the maintenance  
10    or repair of the vessel cargo hold.

### **【Background Art】**

        Floating production storage offloading (FPSO) is a special ship equipped with an offshore plant suitable for the development of small-scale  
15    deep-sea oil fields because it is capable of mining, storing and unloading crude oil on the sea and moving freely.

        The FPSO refines the crude oil extracted from an offshore plant or drillship and stores the crude oil in a shuttle tanker or other transporting place. The FPSO includes a hull that is a lower ship structure for storing refined crude  
20    oil and a top side that is an upper equipment for producing and processing the crude oil.

        Hereinafter, the special ships such as FPSO and FPU, which store refined crude oil, are collectively referred to as 'vessels'.

FIG. 1 is a planar sectional view showing a cargo hold according to the conventional art, and FIG. 2 is a planar sectional view showing that cargo is unloaded from the cargo hold depicted in FIG. 1 in order to maintain and repair corners of the cargo hold.

5 As shown in FIG. 1, a vessel 1 refines mined crude oil at the top side and then stores the refined crude oil in a cargo hold 10 constructed in the hull.

In order to store the purified crude oil to be classified depending on types, the cargo hold 10 is configured such that a longitudinal bulkhead 21 located in a longitudinal direction of the vessel 1 and a transverse bulkhead 22  
10 located in a transverse direction of the vessel 1 intersect each other, and the intersections are welded for sealing.

The cargo hold 10 configured as above needs to be checked for welding conditions at the intersections of the longitudinal bulkhead 21 and the transverse bulkhead 22, and if the repair is necessary, the crude oil stored in  
15 the cargo hold 10 should be emptied before repairing.

More specifically, as shown in FIG. 2, four corners 11C, 12C, 13C, 14C are formed at the intersections of the longitudinal bulkhead 21 and the transverse bulkhead 22. If one corner among the four corners 11C, 12C, 13C, 14C is repaired, the crude oil in all of the four corners 11C, 12C, 13C, 14C is  
20 emptied out in order to prevent fire and explosion which may occur during the repair process since flame spatters to the oil stored in the longitudinal bulkhead 21 or transverse bulkhead 22 at an opposite side.

As an example, when the first corner 11C depicted in FIG. 2 is repaired, the first cargo hold 10 including the first corner 11C should be emptied so that a

worker may work at the first corner 11C. In addition, in order to prevent any possible fire and explosion during welding, all of the second cargo hold 10 at the second corner 12C, the third cargo hold 10 at the third corner 13C and the fourth cargo hold 10 at the fourth corner 14C should also be emptied.

5           Moreover, if the crude oil stored in all of the four neighboring cargo holds 11, 12, 13, 14 including the corners 11C, 12C, 13C, 14C is emptied, the storage space is insufficient, which results in a reduced yield to cause a loss. In addition since the cargo quantity at one side of the vessel is seriously reduced, the vessel is inclined. At this time, the inclination and depth of the  
10       vessel is controlled by the ballast water for compensation, but the amount of the ballast water necessary for the adjustment is increased as the amount of the reduced cargo quantity is increased, thereby deteriorating the work efficiency.

### **【Disclosure】**

#### **15       【Technical Problem】**

          This disclosure is directed to providing a vessel cargo hold configured to increase efficiency during a repair work by mounting a structure to form an empty space by wrapping the intersections of a longitudinal bulkhead and a transverse bulkhead that partition the vessel cargo hold, thereby reducing the  
20       number of cargo holds that should be emptied when repair such as welding is required.

          Also, this disclosure is directed to providing a vessel cargo hold configured to reinforce the longitudinal bulkhead and the transverse bulkhead by installing a structure to the intersections of the longitudinal bulkhead and the

transverse bulkhead.

### 【Technical Solution】

In one general aspect, there is provided a vessel cargo hold having a  
5 plurality of spaces, which are formed by a longitudinal bulkhead and a  
transverse bulkhead intersecting each other and store crude oil, the vessel  
cargo hold comprising a void space located to at least one corner of corners  
formed by intersection of the longitudinal bulkhead and the transverse bulkhead,  
wherein the void space has one side end and the other side end sealed by and  
10 fixed to the longitudinal bulkhead and the transverse bulkhead, respectively,  
thereby forming an empty space therein.

According to an embodiment, the void space may fixed to one or two  
corners among four corners formed by intersection of the longitudinal bulkhead  
and the transverse bulkhead.

15 According to an embodiment, a top of the void space may be fixed to a  
top deck and a bottom of the void space may be fixed to a bottom deck to  
prevent fluid stored in the cargo hold from flowing into the void space.

According to an embodiment, one side end of void space may be  
welded in contact with the transverse bulkhead, the other side end of the void  
20 space may be welded in contact with the longitudinal bulkhead, a top of the void  
space may be welded and fixed to a top deck, and a bottom of the void space  
may be welded and fixed to a bottom deck.

According to an embodiment, in a state where the void space is  
mounted to both sides based on the longitudinal bulkhead or the transverse

bulkhead, a passage may be formed at the longitudinal bulkhead or the transverse bulkhead to correspond to an empty space in the void space.

#### **【Advantageous Effects】**

5           As described above, in the vessel cargo hold having a void space according to an embodiment of the present disclosure, since a void space surrounding an intersecting vertical line at the intersection of a longitudinal bulkhead and a transverse bulkhead, which form a cargo hold, is welded, it is possible to safely perform the repair work in a state of emptying only two or  
10   three cargo holds, compared to a conventional art where four neighboring cargo holds are emptied to repair the intersecting vertical line. Accordingly, the loss caused by the reduction in production amount is decreased and the working efficiency is improved.

          Also, as the number of cargo holds to be emptied is reduced, the flow  
15   rate of the ballast water to control the inclination and depth of the vessel may be reduced, thereby increasing the working efficiency.

          In addition, the vessel cargo hold according to an embodiment of the present disclosure may improve the rigidity of the longitudinal bulkhead and the transverse bulkhead of the cargo hold by installing a void space, thereby  
20   reducing the amount of reinforcing members installed at the existing longitudinal bulkhead and transverse bulkhead.

#### **【Description of Drawings】**

FIG. 1 is a planar sectional view showing a cargo hold according to the

conventional art.

FIG. 2 is a planar sectional view showing that cargo is unloaded from the cargo hold depicted in FIG. 1 in order to maintain and repair corners of the cargo hold.

5        FIGS. 3A and 3B are planar sectional views showing a vessel cargo hold according to the first embodiment of the present disclosure.

FIG. 4A is a diagram showing that a void space is mounted to the vessel cargo hold.

FIG. 4B is a diagram showing a passage formed at a transverse  
10        bulkhead to correspond to an inner space of the void space.

FIGS. 5A and 5B are planar sectional views showing the cargo hold that is empty for repairing the first cargo hold in FIGS. 3A and 3B, respectively.

FIGS. 6A to 6C are planar sectional views showing the void space mounted to the vessel cargo hold according to the second embodiment of the  
15        present disclosure and the cargo hold that is empty for repairing the cargo hold.

### **【Best Mode】**

Hereinafter, a vessel cargo hold having a void space according to the present disclosure will be described in detail with reference to the  
20        accompanying drawings.

### **[First Embodiment]**

In the drawings, FIGS. 3A and 3B are planar sectional views showing a vessel cargo hold according to the first embodiment of the present disclosure.

FIG. 4A is a diagram showing that a void space is mounted to the vessel cargo hold, and FIG. 4B is a diagram showing a passage formed at a transverse bulkhead to correspond to an inner space of the void space. FIGS. 5A and 5B are planar sectional views showing the cargo hold that is empty for repairing the  
5 first cargo hold in FIGS. 3A and 3B, respectively.

As shown in FIGS. 3A and 3B, a plurality of cargo holds 111, 112, 113, 114 partitioned by intersecting a longitudinal bulkhead 121 and a transverse bulkhead 122 with each other at a right angle are formed inside a hull of a vessel 100, and refined crude oil is stored in each of the cargo holds 111, 112,  
10 113, 114.

Meanwhile, as the longitudinal bulkhead 121 and the transverse bulkhead 122 intersect each other at a right angle, four cargo holds 111, 112, 113, 114 are located around the intersection point.

Hereinafter, the four cargo holds 111, 112, 113, 114 will be called a first  
15 cargo hold 111, a second cargo hold 112, a third cargo hold 113 and a fourth cargo hold 114 in a clockwise direction about the intersection point (see FIGS. 3 and 4). In addition, four corners formed at the intersection point are called a first corner 111C of the first cargo hold 111, a second corner 112C of the second cargo hold 112, a third corner 113C of the third cargo hold 113, and a  
20 fourth corner 114C of the fourth cargo hold 114.

In the cargo holds 111, 112, 113, 114 configured as above, at any one corner and another corner adjacent thereto, a void space 130 is welded and fixed to the longitudinal bulkhead 121 and the transverse bulkhead 122 along an intersecting vertical line VL of the intersection point.

In detail, in the cargo hold to which the void space 130 is mounted, as shown in FIG. 4A, based on any one bulkhead made of steel sheet between the longitudinal bulkhead 121 and the transverse bulkhead 122, the void space 130 is mounted to both sides of the bulkhead. In other words, both side ends of the void space 130 are welded in contact with the longitudinal bulkhead 121 and the transverse bulkhead 122, and a top and a bottom of the void space 130 are welded in contact with a top deck (not shown) and a bottom deck 101.

In the figures, FIG. 3A shows a state where the void space 130 is fixed to the first corner 111C and the second corner 112C, and FIG. 3B shows a state where the void space 130 is fixed to the second corner 112C and the third corner 113C.

In the cargo holds 111, 112, 113, 114 configured as above, when it is intended to repair an intersection point of any one cargo hold to which the void space 130 is not fixed, the intersection point may be repaired after emptying crude oil out of the cargo hold to be repaired and another cargo hold among three cargo holds adjacent thereto to which the void space 130 is not fixed.

In detail, as shown in FIG. 5A, when it is intended to repair the fourth corner 114C of the fourth cargo hold 114 to which the void space 130 is not fixed, the fourth corner 114C of the fourth cargo hold 114 is repaired in a state of emptying the crude oil out of the third cargo hold 113 and the fourth cargo hold 114.

When a worker repairs the fourth corner 114C of the fourth cargo hold 114, at the first cargo hold 111 and the second cargo hold 112 in which the crude oil is stored, the void space 130 is mounted to the first corner 111C and

the second corner 112C, respectively, thereby preventing a danger such as fire and explosion during repair in advance.

Meanwhile, as shown in FIG. 5B, if it is intended to repair the fourth corner 114C of the fourth cargo hold 114 to which the void space 130 is not fixed, the fourth corner 114C of the fourth cargo hold 114 is repaired in a state where the crude oil of the fourth cargo hold 114 and the first cargo hold 111 is emptied.

When the worker repairs the fourth corner 114C of the fourth cargo hold 114, at the second cargo hold 112 and the third cargo hold 113 in which the crude oil is stored, the void space 130 is mounted to the second corner 112C and the third corner 113C, respectively, thereby preventing a danger such as fire and explosion during repair in advance.

In addition, as shown in FIG. 4A, when the cargo hold 111 to which the void space 130 is mounted is repaired, a welded vertical line VL1 formed by welding the void space 130 and the transverse bulkhead 122 in contact or a welded vertical line VL2 formed by welding the void space 130 and the longitudinal bulkhead 121 in contact is repaired, and thus it is possible to repair the cargo hold 111 in a state where the cargo hold to be repaired, namely only one cargo hold 111 at which the void space 130 is installed, is emptied.

Specifically, in the cargo hold structure shown in FIG. 4A, when it is intended to repair the vertical line VL1 welded with the transverse bulkhead 122 or the vertical line VL2 welded with the longitudinal bulkhead 121 among both side ends of the void space 130 mounted to the first cargo hold 111, it is repaired in a state where the crude oil of the first cargo hold 111 is emptied.

This is because there is no risk of fire or explosion even if the vertical lines VL1, VL2 are welded since the ends of the void space 130 in the width direction are not welded to the corners 111C, 112C, 113C, 114C but welded to a middle of the width of the longitudinal bulkhead 121 or the transverse bulkhead 122.

5            Since the empty space S is formed at two corners among four corners 111C, 112C, 113C, 114C by the void space 130 as described above, in the vessel cargo hold according to the present disclosure, the repair work may be performed in a state one or two cargo holds are emptied, different from the conventional case where the crude oil is emptied from four cargo holds.

10           Meanwhile, as shown in FIG. 4B, as the void space 130 is mounted, spaces S are formed at both sides based on the transverse bulkhead 122. The space S is maintained as an empty space. If necessary, a worker performs the repair work inside the space S. Here, a passage 125 through which the worker may move may be formed at a bottom of the transverse  
15 bulkhead 122 to correspond to the empty space S, and in this case, a facility required for the worker to pass may be installed in only one space S.

             In addition, as the void space 130 is welded in contact with the longitudinal bulkhead 121 and the transverse bulkhead 122, the rigidity of the longitudinal bulkhead 121 and the transverse bulkhead 122 may be reinforced.  
20 Thus, it is advantageous that the amount of a reinforcing member conventionally fixed to give the same rigidity may be reduced.

             Meanwhile, it has been described in the first embodiment that two void spaces 130 are mounted to both sides based on the longitudinal bulkhead 121 or the transverse bulkhead 122. However, the effect realized by the void

spaces described above may be obtained in the same manner even though void spaces are mounted to two diagonal corners among the four corners, namely to the first corner 111C and the third corner 113C or to the second corner 112C and the fourth corner 114C.

5

#### [Second Embodiment]

It has been described in the first embodiment that the repair work may be performed in a state where two cargo holds are emptied by mounting the void spaces to two corners among four corners.

10

Meanwhile, in the following, a second embodiment where a void space is mounted to one corner among four corners is described. Any component of the second embodiment, which is similar to that of the first embodiment and thus described already, will not be described in detail.

In the drawings, FIGS. 6A to 6C are planar sectional views showing the void space mounted to the vessel cargo hold according to the second embodiment of the present disclosure and the cargo hold that is empty for repairing the cargo hold.

As shown in FIG. 6A, when the void space 130 is mounted only to the first corner 111C among the first corner 111C to the fourth corner 114C, if it is intended to perform a repair work between the one end of the void space 130 and the transverse bulkhead 122 adjacent to one end of the void space 130, it is possible to perform the repair work in a state where the crude oil of the first cargo hold 111 and the second cargo hold 112 is emptied.

In addition, as shown in FIG. 6B, if it is intended to perform a repair work

between the other end of the void space 130 and the longitudinal bulkhead 121 adjacent to the other end of the void space 130, it is possible to perform the repair work in a state where the crude oil of the first cargo hold 111 and the fourth cargo hold 114 is emptied.

5           Meanwhile, as shown in, FIG. 6C, if it is intended to repair the third corner 113C of the third cargo hold 113 in a state where the void space 130 is not mounted to the third cargo hold 113, it is possible to repair the third corner 113C, namely along the intersecting vertical line VL at which the longitudinal bulkhead 121 and the transverse bulkhead 122 intersect, in a state where the  
10       crude oil of the second cargo hold 112, the third cargo hold 113 and the fourth cargo hold 114 is emptied.

          Even though the void space 130 is mounted to one corner among four corners 111C, 112C, 113C, 114C, the repair work may be performed in a state where two or three cargo holds are emptied, thereby ensuring excellent work  
15       efficiency in comparison to the conventional art where four cargo holds should be emptied.

          In the former embodiments, a level switch (not shown) may be mounted in the empty space S formed by mounting the void space 130 so as to detect whether crude oil is introduced into the empty space S.

**【CLAIMS】****【Claim 1】**

A vessel cargo hold having a plurality of spaces, which are formed by a longitudinal bulkhead and a transverse bulkhead intersecting each other and store crude oil, the vessel cargo hold comprising a void space located to at least one corner of corners formed by intersection of the longitudinal bulkhead and the transverse bulkhead, wherein the void space has one side end and the other side end sealed by and fixed to the longitudinal bulkhead and the transverse bulkhead, respectively, thereby forming an empty space therein, and wherein one of the longitudinal bulkhead and the transverse bulkhead is made of one steel sheet, the other are welded on both sides of the bulkhead made of steel sheet, and the void space is welded and fixed to the longitudinal bulkhead and the transverse bulkhead so as to be symmetrical on both sides with respect to the bulkhead made of steel sheet.

15

**【Claim 2】**

The vessel cargo hold according to claim 1, wherein the void space is fixed to one or two corners among four corners formed by intersection of the longitudinal bulkhead and the transverse bulkhead.

20

**【Claim 3】**

The vessel cargo hold according to claim 2, wherein a top of the void space is fixed to a top deck and a bottom of the void space is fixed to a bottom

deck to prevent fluid stored in the cargo hold from flowing into the void space.

**【Claim 4】**

5       The vessel cargo hold according to claim 2, wherein one side end of  
void space is welded in contact with the transverse bulkhead, the other side end  
of the void space is welded in contact with the longitudinal bulkhead, a top of  
the void space is welded and fixed to a top deck, and a bottom of the void  
space is welded and fixed to a bottom deck.

10       **【Claim 5】**

The vessel cargo hold according to claim 1, wherein in a state where the  
void space is mounted to both sides based on the longitudinal bulkhead or the  
transverse bulkhead, a passage is formed at the longitudinal bulkhead or the  
transverse bulkhead to correspond to an empty space in the void space.

15