

Transverse-frameless Ship

The present invention relates to ships and more particularly to the hull construction of cargo ships such as tankers and the like.

When at sea, a tanker is subject to the influence of various forces, such as for example longitudinal bending moment and torsion, water pressure against its bottom and side platings, and load from the weight of the cargo oil as sustained by the inner bottom plating and side walls of its cargo holds (oil tanks). In order to cope with these forces, the hull of the tanker includes a multiplicity of longitudinals (such as side longitudinals, bottom longitudinals, and central girders) extending in the lengthwise direction thereof and a multiplicity of transverse (such as side and bottom transverses) extending in the widthwise direction thereof. In such hull construction, however, longitudinals and transverses are arranged in crossing relation, and this prevents automatization of certain works (such as, for example, welding) involved in the process of shipbuilding. With a view to facilitating the automatization of such works, therefore, the present inventors have come to the concept of a transverse frameless ship, that is, a ship of a double hull construction having longitudinals connecting the inner and outer hull plates and no transverses except for transverse bulkheads which extend the full depth of the ship and are spaced apart longitudinally. However, the adoption of such double-hull construction for a ship involves various problems to be solved. For example, if said double hull construction is employed for the bottom portion only of a ship of a conventional type, the trouble is that as external forces exerted on the outer side - plating are transmitted to the bottom portion through the transverses disposed

inside the outer side - plating, they would collapse the inner and outer platings of the bottom portion which has no transverse disposed therein in the widthwise direction of the ship. Similarly, if said double hull construction is employed for the side portions only of the ship, as external forces exerted on the bottom portion are transmitted to the side portions through the transverses disposed in the bottom portion, they would collapse the inner and outer platings of the side portions which have no transverse disposed therein in the vertical direction.

According to the present invention there is provided a ship comprising at least at its side portions and bottom portion a double hull construction consisting of an inner hull plating and an outer hull plating, transverse bulkheads extending the full depth of ship and spaced longitudinally of the ship and fixed to said inner and outer hull platings, and a plurality of plate-to-plate longitudinals fixed to said transverse bulkheads, said inner and outer hull platings being connected together solely by the longitudinals except by the bulkheads, at least one of said connecting longitudinals being reinforced by anti-buckling means comprising at least one straight bar extending widthwise of the corresponding connecting longitudinal.

According to this arrangement, it is possible to allow any external forces exerted to the ship to be transmitted to rigidly constructed bulkheads through plate-to-plate longitudinals so as to protect the inner and outer hull platings from buckling. Further, the fact that the ship is of double hull construction in which the inner and outer hull platings are integrally connected together essentially by plate-to-plate longitudinals only affords the following advantages:

(1) The absence of transverses means a smaller number of components; and the absence of connecting longitudinal transverse intersections greatly facilitates automatization of certain works (such as welding, for example) involved in the process of shipbuilding and also permits easy and complete inspection of spaces defined between the inner and outer hull platings.

(2) The absence of connecting longitudinal - transverse intersections eliminates possible crack occurrences due to stress concentration at any such intersection.

(3) Spaces partitioned only by plate-to-plate longitudinals between the inner and outer hull platings can be utilised as ballast tanks. Furthermore, the fact that none of such ballast tanks are partitioned by transverses in the lengthwise

direction of the ship facilitates complete discharge of water ballast.

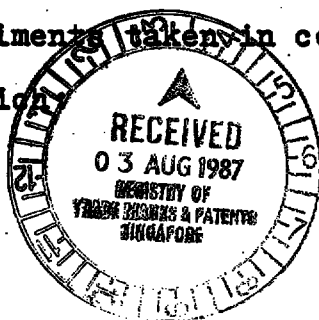
(4) In the event that any combustible liquid or gas in any of the holds of the ship should enter the spaces between the inner and outer hull platings as a result of a damage caused to the inner hull plating, such liquid or gas can easily be expelled therefrom, since none of the spaces are partitioned by transverses in the longitudinal direction, and accordingly the ship can be protected against the danger of explosion.

(5) The absence of transverses facilitates stress analysis of the hull construction and thus permits more reasonable arrangement of components for the purpose of weight reduction.

(6) The double hull construction prevents the run off of cargo oil in the event of a collision with any other ship or of stranding.

(7) The absence of any such projection as stiffener or the like in the interior of any of the holds permits efficient and accurate painting, cleaning, and/or stripping of the hold interior. That also means reduced painting area.

These and other features and advantages of the invention will become apparent from the following description of embodiments taken in connection with the accompanying drawings in which



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FIG. 1 is a cross-sectional view of one form of hull construction embodying the invention;

FIG. 2 is a longitudinal section of the hull construction;

5 FIG. 3 is a cross-sectional view of another form of hull construction according to the invention;

FIGS. 4 to 7, inclusive, are perspective views showing various forms of anti-buckling means for connecting longitudinals;

10 FIGS. 8 and 9 are sectional views in side and front elevations respectively showing other forms of anti-buckling means for connecting longitudinals;

FIG. 10 is a perspective view of anti-buckling means for inner and outer hull platings;

15 FIG. 11 is a perspective view showing a buckling mode of said anti-buckling means;

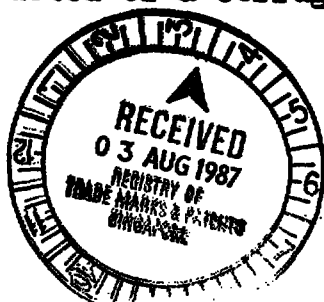
FIG. 12 is a perspective view showing a buckling mode in the case of there being provided no anti-buckling means;

20 FIGS. 13 to 15, inclusive, are front sectional views showing other forms of anti-buckling means for inner and outer hull platings.

In the drawings, it is to be noted, like reference numerals designate like or corresponding parts throughout.

Referring first to FIGS. 1 and 2, numeral 1 designates a ship, or a tanker, for example. In the tanker 1, portions
25 thereof defining holds 2 are comprised of a double hull

construction consisting of an inner hull plating 3 and an outer hull plating 4 connected together essentially solely by connecting longitudinals 5 extending in the lengthwise direction of the ship. Unlike a ship of a conventional hull construction, the ship in accordance with the invention has no transverse disposed therein, which fact would mean reduced strength of the inner hull plating 3 and outer hull plating 4 against buckling, if no compensating means are provided. By way of compensation, therefore, connecting longitudinals 5 are arranged in a larger number, with the individual longitudinals narrowly spaced from one another; and accordingly minor other longitudinals are dispensed with. Since no transverse is provided, forces exerted on the connecting longitudinals 5 in the bottom portion of the ship do not extend to the inner and outer hull platings 3, 4 of the side portions. For same reason, forces exerted on the connected longitudinals 5 in the side portions do not extend to the inner and outer hull platings 3, 4 of the bottom portion or upper deck portion. Instead, all these forces are transmitted from the bottom portion to the upper deck portion, or from one side portion to the other side portion, through the transverse bulkheads 6 separating the individual holds 2 from one another. As such, the transverse bulkheads 6 are reinforced accordingly. For example, each bulkhead 6 is constructed of a corrugated plate, with reinforcement ribs



provided in grooves thereof, so that the bulkhead 6 may well withstand omnidirectional external forces. Further, a box-shaped structure may be provided around the corrugated plate as required. Shown by numeral 7 are lightening holes provided
5 on each connecting longitudinal 5.

The ship shown in FIG. 3 is identical with the one shown in FIGS. 1 and 2, except that the upper deck portion thereof is not of double hull construction.

As Fig. 4 indicates, connecting longitudinals 5, and
10 more particularly those located in the bottom portion, may be reinforced by anti-buckling means 8 extending in the lengthwise direction thereof. Each anti-buckling means 8 comprise a straight flat bar projecting perpendicularly from the corresponding connecting longitudinal 5. In this
15 instance, each longitudinal 5 with anti-buckling means 8 has no lightening hole provided therein by reason of the disposition of the anti-buckling means 8, though it is possible to provide lightening holes in the longitudinal 5 by suitably selecting their size and positions.

20 In Fig. 5, each connecting longitudinal 5 in the bottom portion of the ship is reinforced by anti-buckling means 8' extending in the widthwise direction of the longitudinal 5 over the full width thereof. In this case, too, anti-buckling means 8' comprise straight flat bars projecting perpendicularly
25 from the corresponding connecting longitudinal 5. Where such

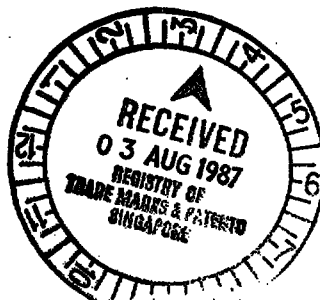
laterally extending anti-buckling means 8' are provided, each connecting longitudinal 5 may have lightening holes 7, 7' provided therein as shown. The lightening hole disposed centrally between the straight flat bars may be used as a
5 manhole, while the other lightening holes may be utilized for drainage or air vent purposes.

Referring to FIG. 6, each connecting longitudinal 5 in the bottom portion of the ship has in combination one longitudinally extending anti-buckling means 8 and a plurality
10 (shown as a pair) of laterally extending anti-buckling means 8'. In the instance shown, the lateral anti-buckling means 8' do not extend over the full width of the connecting longitudinal 5 for reasons of their disposition.

In FIG. 7, each connecting longitudinal 5 in the bottom
15 portion has in combination a pair of longitudinally extending anti-buckling means 8 and a plurality (shown as a pair) of laterally extending anti-buckling means 8'.

In FIGS. 8 and 9, each connecting longitudinal 5 in the bottom portion has in combination a pair of longitudinally
20 extending anti-buckling means 8 and a plurality of laterally extending anti-buckling means 8', the latter anti-buckling means 8' serving for preventing the former anti-buckling means from being inclined relative to the connecting longitudinal 5.

25 The inner hull plating 3 and outer hull plating 4,



particularly in the bottom portion of the ship, may have anti-buckling means 9 disposed centrally between each two adjacent connecting longitudinals 5 and extending in the lengthwise direction of the ship, as FIG. 10 illustrates.

5 Each anti-buckling means 9 comprise a straight flat bar projecting perpendicularly from the inner hull plating 3 or outer hull plating 4, as the case may be.

The provision of a straight flat bar 9 centrally between each two adjacent connecting longitudinals 5, as 10 above said, means that the center line between the longitudinals 5 may serve as a nodal line of buckling, the resulting buckling being of such mode as illustrated in FIG. 11. Thus, for the purpose of determining the required gauge of steel plates 3, 4, therefore, the distance S between 15 the longitudinals 3 may be taken as $1/2$ thereof. Accordingly, the elastic buckling strength of the platings 3, 4 becomes quadruple at the inverse square of said distance. Shown in FIG. 12 is a mode of buckling in the case where there is provided no anti-buckling means.

20 In FIG. 13, the inner hull plating 3 and outer hull plating 4 are provided with anti-buckling means 9' having an L-shaped section.

In FIG. 14, the inner hull plating 3 and outer hull plating 4 are provided with anti-buckling means 9" having 25 a T-shaped section.

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In FIG. 15, the inner hull plating 3 and outer hull plating 4 are provided with anti-buckling means 9 comprising straight flat bars parallel thereto.



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CLAIMS:

1. A ship comprising at least at its side portion and bottom portion a double hull construction consisting of an inner hull plating and an outer hull plating, transverse bulkheads extending the full depth of ship and spaced longitudinally of the ship and fixed to said inner and outer hull platings, and a plurality of plate-to-plate longitudinals fixed to said transverse bulkheads, said inner and outer hull platings being connected together solely by the longitudinals except by the bulkheads, at least one of said connecting longitudinals being reinforced by anti-buckling means comprising at least one straight bar extending widthwise of the corresponding connecting longitudinal.
2. A ship as set forth in claim 1, wherein said bar extends over the full width of the corresponding connecting longitudinal.
3. A ship as forth in claim 1 or 2, wherein said anti-buckling means further comprises at least one straight flat bar extending in the lengthwise direction of the corresponding connecting longitudinal.
4. A shop as set forth in claim 3 wherein both said widthwise and lengthwise anti-buckling bars project perpendicularly from the corresponding longitudinal and the widthwise anti-buckling bar acts to prevent the length-wise anti-buckling bar from becoming inclined.



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5. A ship substantially as described herein with reference to, and as illustrated in, Figures 1 and 2 or these Figures as modified by any one or more of Figures 3 to 15 of the accompanying drawings.

