

Transverse Frameless Ship

The present invention relates to a transverse frameless ship, and more particularly to a structure for tankers and like cargo ships.

With a navigating tanker, various forces act on the hull. For example, the hull itself is subjected to a longitudinal bending moment and torsional forces, the outer bottom plating and the outer side plating to the pressure of water, and the inner bottom plating and side wall of the hold (oil tank) to the load of oil cargo under gravity. To withstand these forces, the hull includes a large number of structural members such as longitudinals (side longitudinals, bottom longitudinals, central girder, etc) extending longitudinally of the ship and transverses (side transverses, bottom transverses, etc) provided transversely of the ship. In the case of such a structure, however, longitudinals and transverses are provided in an intersecting arrangement, so that difficulties are encountered in building the hull by automatic work procedures (e.g. automatic welding). To assure automatic work procedures, therefore, a transverse frameless ship has been proposed, that is, a ship of a double shell structure which comprises longitudinals only and include no transverse frames, other than transverse bulkheads and which comprise an inner hull plating and outer hull plating connected together only by plate-to-plate longitudinals fixed to the transverse bulkheads and the transverse bulkheads. In this case, however, forces acting on the inner and outer hull platings are all transmitted to the transverse bulkheads through the connecting longitudinals, so that the proposed structure has problems in respect of strength when the transverse bulkheads are of conventional structure.

An object of the present invention is to provide a transverse frameless ship having a double shell structure which comprises an inner hull plating and an outer hull plating connected together only by connecting longitudinals
5 transverse bulkheads and which can be realised without any problems of strength.

The present invention provides a ship comprising at least at opposite side portions and a bottom portion a double shell structure consisting of an inner hull plating
10 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, a plurality of plate-to-plate longitudinals fixed to the transverse bulkheads, said inner and outer hull platings being
15 connected together solely by the longitudinals and by the transverse bulkheads, wherein each of the transverse bulkheads comprises a central corrugated plate and a flaring box surrounding the corrugated plate.

With the transverse frameless ship described, each
20 transverse bulkhead has a double shell structure at least at a peripheral portion thereof, so that even when a force acting



on the inner or outer hull plating is transmitted to the transverse bulkhead through the connecting longitudinals, the transverse bulkhead fully withstands the force without abnormal bending or buckling.

5 Further because the double shell structure has an inner hull plating and an outer hull plating which are connected together substantially by connecting longitudinals only, the ~~frameless~~^{transverse frameless} ship has the following advantages.

10 (1) Absence of transverses decreases the number of components, while absence of intersections between the connecting longitudinals with transverses makes it possible to build the hull by automatic work procedures (e.g. automatic welding) with a greatly improved efficiency, further facilitating perfect inspection of the space
15 defined by the inner and outer hull platings.

 (2) Because the connecting longitudinals have no intersections with transverses, cracking is avoidable that would otherwise result from stress concentration at such intersections.

20 (3) Spaces defined by the inner and outer hull platings and divided by the connecting longitudinals only can be utilized as ballast tanks. Moreover, the ballast tank, which is not divided by transverses longitudinally of the ship drains completely with ease.

25 (4) Even if a flammable liquid or gas should ingress

into a space between the inner and outer hull platings
owing to damage to the inner plating, the liquid or gas
can be easily drawn off from the space to eliminate an
explosion hazard since there is no transverse dividing
5 the space longitudinally of the ship.

(5) Absence of transverses facilitates stress analysis
for the hull and assures a rational arrangement of
components for a weight reduction.

(6) The double shell structure prevents outflow of
10 cargo oil in the event of a collision with other ship
or stranding.

(7) Since the hold has no inside projections such
as stiffeners, the inside wall of the hold can be coated,
washed or stripped efficiently and properly and is
15 smaller in the surface area to be coated.

Various features and advantages of the present
invention will become apparent from the following descrip-
tion of embodiments with reference to the accompanying
drawings, in which:

20 Fig. 1 is a diagram in transverse section showing
a ^{transverse frameless} ~~transverse~~ ship according to a first embodiment of the
invention;

Fig. 2 is a diagram in section taken along the
line II-II in Fig. 1;

25 Fig. 3 is a diagram in section taken along the

line III-III in Fig. 1;

Fig. 4 is a diagrams in transverse section showing
a ~~transless~~^{transverse frameless} ship according to a second embodiment of the
invention;

5 Fig. 5 is a diagram in section taken along the
line V-V in Fig. 4;

Fig. 6 is a diagram in section taken along the
line VI-VI in Fig. 4;

10 Fig. 7 is a diagram in transverse section showing
a ~~transless~~^{transverse frameless} ship according to a third embodiment of the
invention;

Fig. 8 is a diagram in section taken along the
line VIII-VIII in Fig. 7;

15 Fig. 9 is a diagram in section taken along the
line IX-IX in Fig. 7;

Fig. 10 is a diagram in transverse section showing
a ~~transless~~^{transverse frameless} ship according to a fourth embodiment of the
invention;

20 Fig. 11 is a diagram in section taken along the
line XI-XI in Fig. 10;

Fig. 12 is a diagram in section taken along the
line XII-XII in Fig. 10;

25 Fig. 13 is a diagram in transverse section showing
a ~~transless~~^{transverse frameless} ship according to a fifth embodiment of the
invention;

Fig. 14 is a diagram in section taken along the line XIV-XIV in Fig. 13;

Fig. 15 is a diagram in section taken along the line XV-XV in Fig. 14;

5 Fig. 16 is a diagram in longitudinal section of a ~~transless~~^{transverse frameless} ship according to a sixth embodiment of the invention;

Fig. 17 is a diagram in transverse section showing a ~~transless~~^{transverse frameless} ship according to a seventh embodiment of the
10 invention;

Fig. 18 is a diagram in section taken along the line XVIII-XVIII in Fig. 17;

Fig. 19 is a diagram in section taken along the line XIX-XIX in Fig. 17; and

15 Fig. 20 is a perspective view showing the same ship.

With reference to Figs. 1 to 3 showing a first embodiment of the invention, the ~~transless~~^{transverse frameless} ship comprises a deck portion, a bottom portion and opposite side portions
20 each having a double shell structure. The structure comprises an inner hull plating 1 and an outer hull plating 2 which are connected together by connecting longitudinals 3. Additionally, the inner and outer hull platings 2, 3 are interconnected by transverse bulkheads 4 (only one illustrated)
25 which are spaced apart longitudinally of the ship. Each of

the transverse bulkheads 4 has a double shell structure comprising two vertical plates 5 which are connected together by connecting members 6 extending in the direction of height of the ship. Weight reduction holes 7 and 8 are
5 formed in the connecting longitudinal 3 and the connecting member 6, respectively.

Figs. 4 to 6 show a second embodiment wherein each transverse bulkhead 4 comprises two vertical plates 5 which are connected together by connecting members 6 extending
10 ing in the direction of height of the ship, and a flaring box 9 which is attached to the lower ends of the vertical plates 5. (The flaring box 5 can be regarded as a double shell structure.) The flaring box 9, because of its shape, gives increased strength to the lower portion of the trans-
15 verse bulkhead 4. Further because the transverse bulkhead 4 has an increased thickness at the portion of flaring box 9, the length of the connecting longitudinals 3 of the bottom portion interposed between two adjacent transverse bulkheads 4 is smaller by a corresponding amount. This
20 leads to the advantage of giving enhanced strength to the hull.

Figs. 7 to 9 show a third embodiment wherein each transverse bulkhead 4 comprises two vertical plates 5 which are connected together by connecting members 6 extending
25 in the direction of height of the ship, and an upper flaring

box 10 and a lower flaring box 9 attached respectively to the upper ends and lower ends of these vertical plates 5. The upper flaring box 10 not only produces the same effect as the lower flaring box 9 in giving increased strength but also has the advantage to be described later.

Figs. 10 to 12 show a fourth embodiment wherein each transverse bulkhead 4 comprises two vertical plates 5 positioned in the center of the bulkhead 4 and connected together by connecting members 6 extending in the direction of height of the ship, and a flaring box 11 in the form of a rectangular ring and surrounding these vertical plates 5. This embodiment is more advantageous than the three foregoing embodiments in that the transverse bulkhead 4 is reinforced by the flaring box 11 at its entire peripheral portion.

According to the four embodiments described, each of the deck portion, the bottom portion and the opposite side portions has a double shell structure, but the deck portion need not always have the double shell structure. When the flaring box 11 is provided, the interior space of the box 11 can be utilized as a passage for workers or is usable for the installation of pumps, etc.

According to a fifth embodiment shown in Figs. 13 to 15, the bottom portion and the opposite side portions only of the ship have a double shell structure. Each transverse bulkhead 4 comprises a vertical corrugated plate 12 in the

center and a flaring box 11 in the form of a rectangular ring and surrounding the corrugated plate 12. The drawings further show reinforcing deck longitudinals 13 attached to the inner side of the outer hull plating 2, a hold 14 formed
5 between and defined by two adjacent transverse bulkheads 4, and oil or like liquid 15 loaded in the hold 14 with an upper space left unoccupied.

During navigation, the ship will pitch or roll, sloshing the liquid 15 within the hold 14 and causing the
10 liquid to strike an upper portion of the flaring box 11 of the bulkhead 4 as illustrated in Fig. 15. In such an event, the liquid 15, without being restrained from further movement, moves along the slanting surface of this portion of the flaring box 11. Consequently the upper corner of the hold
15 14 will not be subjected to a great force and can be prevented from cracking due to stress concentration. The embodiments of Figs. 7 to 9 and Figs. 10 to 12 also have the same advantage.

Fig. 16 shows another embodiment which has the
20 same construction as the one shown in Figs. 13 to 15 except that the deck portion of the ship, like other portions thereof, has a double shell structure including inner and outer hull platings 1 and 2.

Figs. 17 to 20 show another embodiment wherein
25 each transverse bulkhead 4 comprises a generally rectangular

central corrugated plate 12' having four curved corners 12a',
and a flaring box 11' in the form of a generally rectangular
ring and having four curved corners 11a' which are in
conformity with the shape of the corners 12a'. The four
5 curved corners 11a' of the flaring box 11' give still
increased strength to the transverse bulkhead 4 because the
forces delivered to the bulkhead 4 can be prevented from
concentrating on the four corners of the bulkhead 4.

CLAIMS:

1. A ship comprising at least at opposite side portions and a bottom portion a double shell structure 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, a plurality of plate-to-plate longitudinals fixed to the transverse bulkheads, said inner and outer hull platings being connected together solely by the longitudinals and by the transverse bulkheads, wherein each of the transverse bulkheads comprises a central corrugated plate and a flaring box surrounding the corrugated plate.
2. A ship as defined in claim 1 wherein the corrugated plate is generally rectangular and has four curved corners, and the flaring box is in the form of a generally rectangular ring and has four curved corners in conformity with the shape of the said curved corners of the corrugated plate.
3. A ship substantially as described herein with reference to, and as illustrated in, Figures 1 to 3, 4 to 6, 7 to 9, 10-12, 13-15, 16 or 17 to 20 of the accompanying drawings.
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