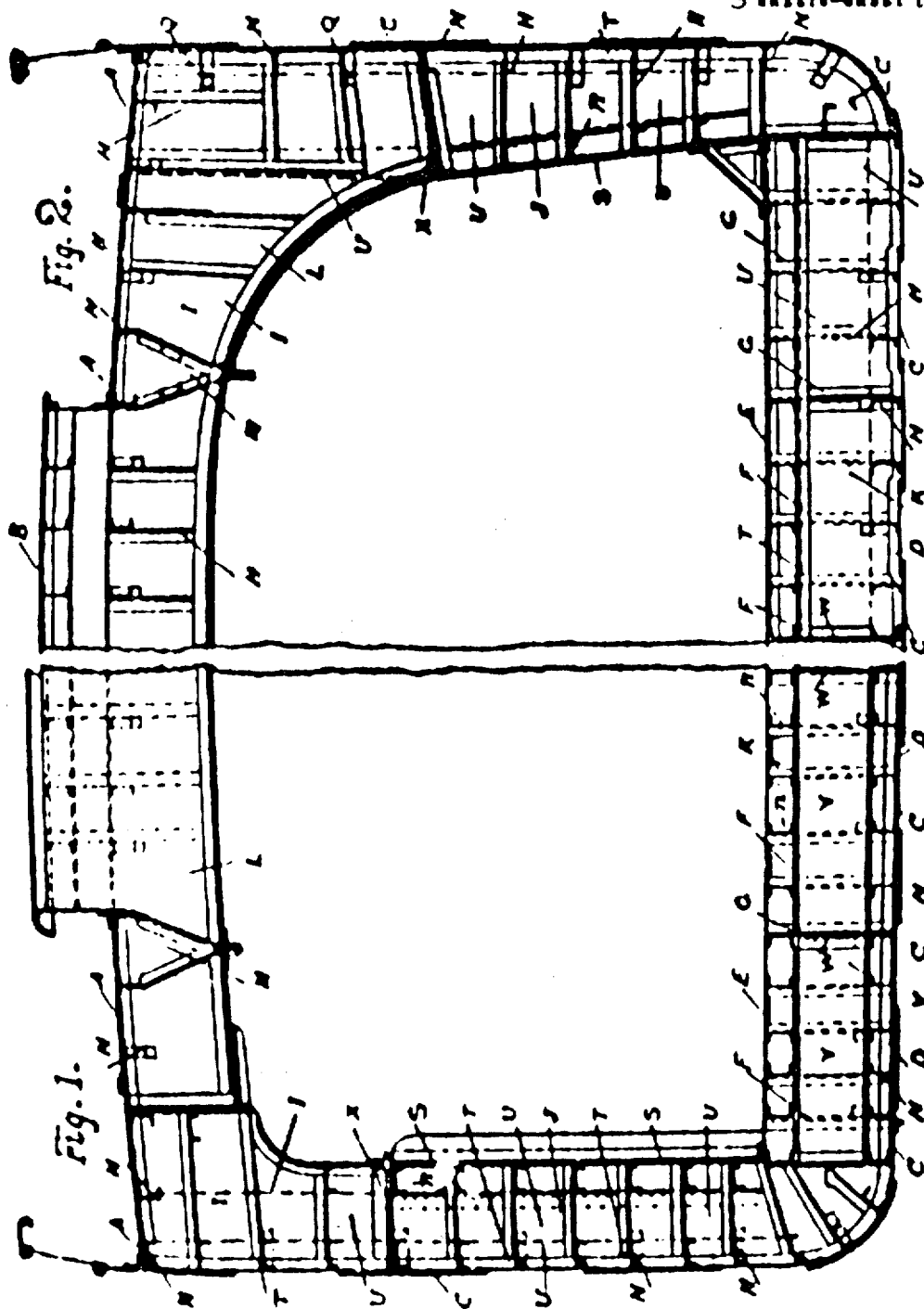


1,020,365.

J. R. OLDHAM.
 BRIP CONSTRUCTION.
 APPLICATION FILED DEC. 10, 1910.

Patented Mar. 12, 1912.

3 SHEETS-SHEET 1



WITNESSES:
A. H. ...
 F. P. ...

INVENTOR
Joseph R. Oldham

1,020,865.

J. R. OLDHAM.
SHIP CONSTRUCTION.
APPLICATION FILED DEC. 28, 1910.

Patented Mar. 12, 1912.

3 SHEETS-SHEET 2

Fig. 5.

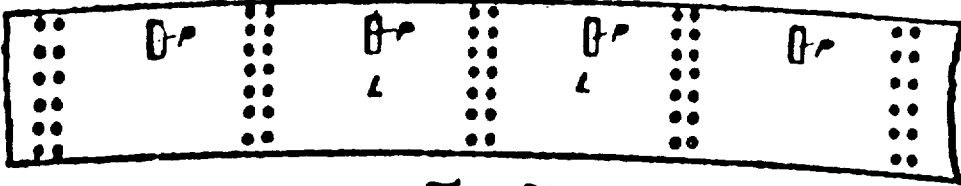


Fig. 6.

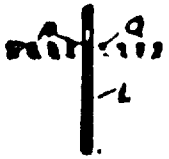


Fig. 7.

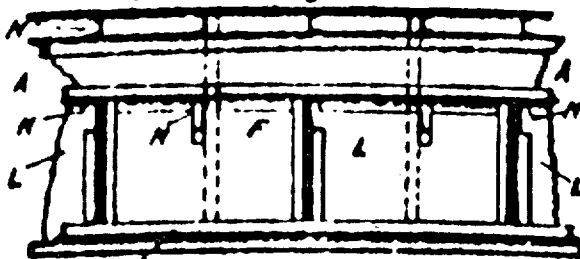


Fig. 8.

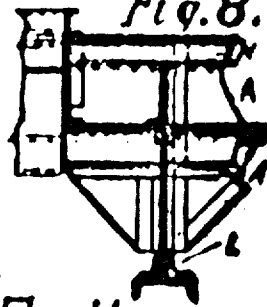


Fig. 9.

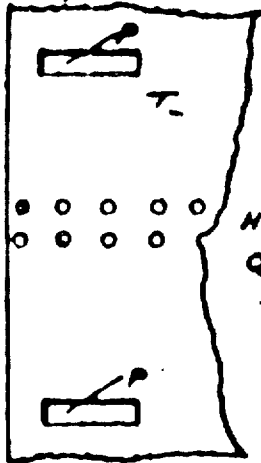


Fig. 10.

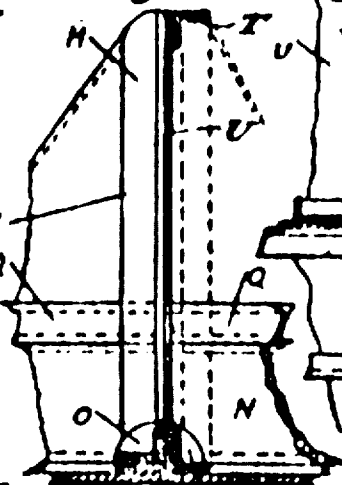


Fig. 11.

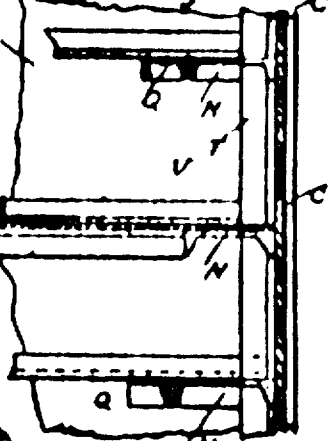


Fig. 12.

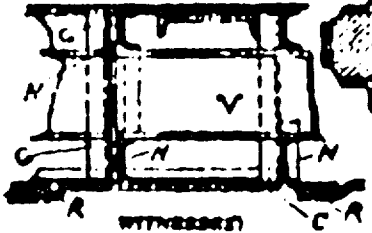


Fig. 13.

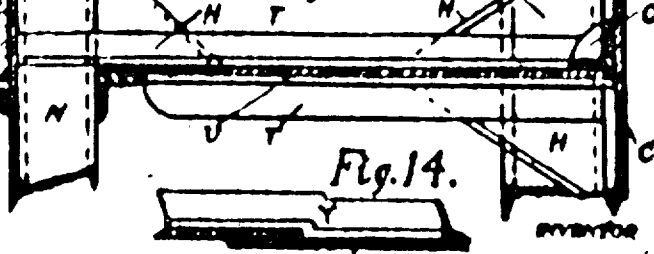


Fig. 14.



BY Schaeffer

Attorney at Law

J. R. Oldham

1,020,365.

J. E. OLDHAM.
SHIP CONSTRUCTION.
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3 SHEETS-SHEET 3

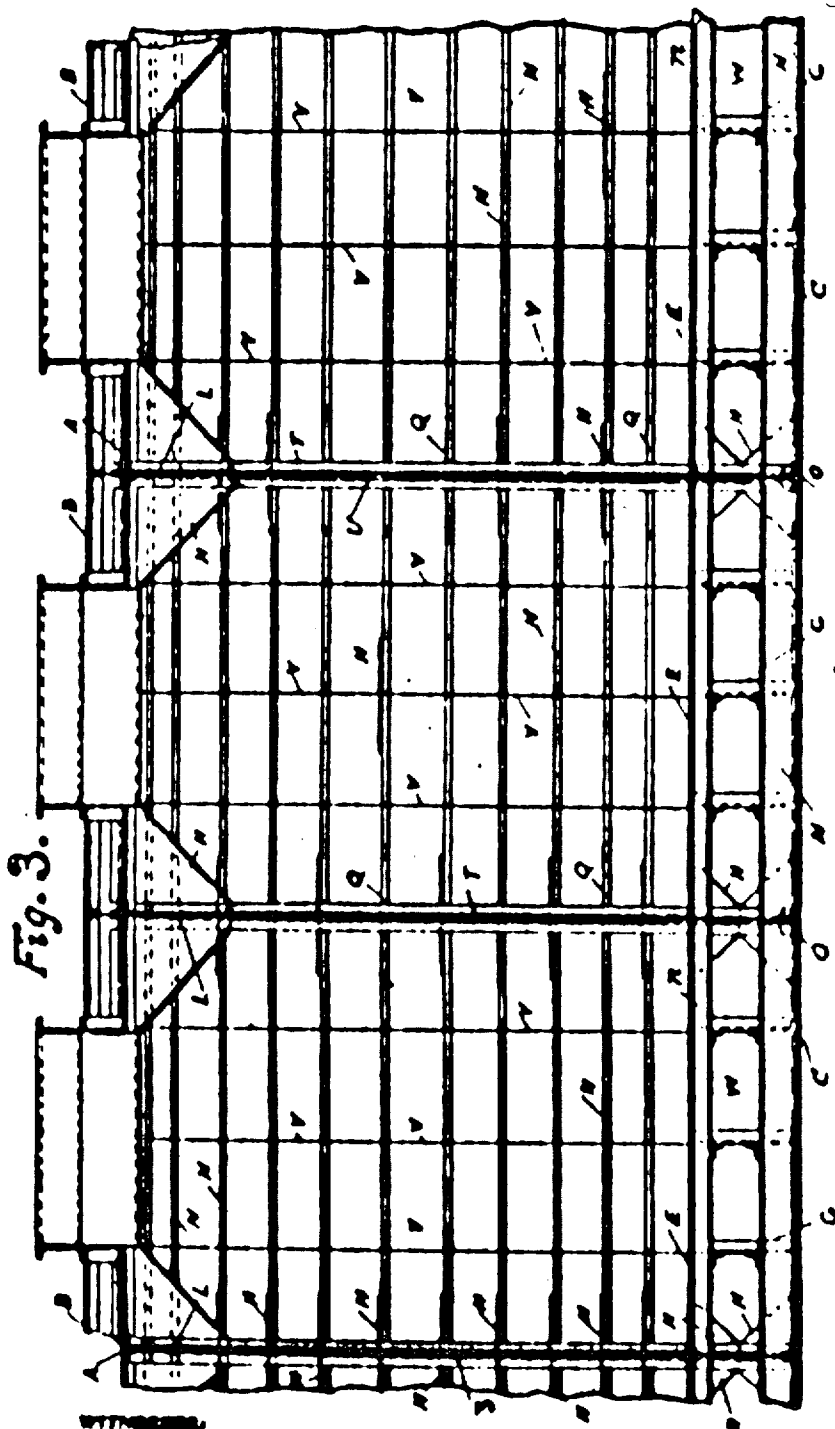


Fig. 3.

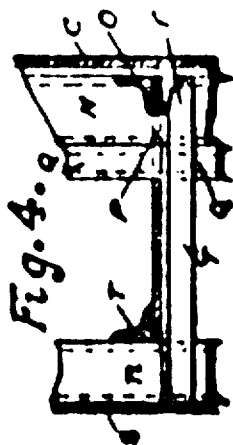


Fig. 4.

WITNESSES:
J. J. Dewart
H. J. Currier

INVENTOR
Joseph E. Oldham

1,020,365. SHIP CONSTRUCTION. JOSEPH R. OLDHAM, Cleveland, Ohio. Filed Dec. 23, 1910. Serial No. 599,041.

To all whom it may concern:

Be it known that I, JOSEPH R. OLDHAM, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Ship Constructions, of which the following is a specification.

This invention relates to the construction of steel ships or vessels, especially those of great length and breadth; as it seems that large vessels of the future will have a greater ratio of length and breadth in proportion to depth than is now common. The tendency of this relative increase is to augment the tensile stress on the upper part of hull and to increase the compressive stress on the lower part of hull. To efficiently resist this increase it seems desirable to increase the members primarily contributing to the longitudinal stiffening of the hull.

To economically accomplish this desiderata, with stronger transverse members, than are generally adopted in ships constructed on what is denominated the longitu-

dinal system, is one object of my invention, moreover, as great length and breadth tend to lower the center of gravity abnormally; another object is to raise this center by means of upper water-ballast tanks or chambers, and to increase the strength of the hull with the construction of these compartments. Authoritative exception has been taken both with reference to classic and modern longitudinal ship-constructions, on the ground that the transverse strength has been unduly impaired by too much cutting or notching of the transverse web-frame bars and margins of plates, to secure, or maintain, the unimpaired strength of the longitudinal frames or girders.

The primary object, therefore of my invention is to maintain the full strength of the bars of the transverse web frames or arched girders, while only slightly weakening the structure by perforating the web-plates to secure direct skin or metallic connections for my longitudinal frame or girder bars, which are slightly notched to admit, or to pass over, the web plate margins and bars. I also increase the strength of the sides and the upper bottom, by inner, and upper, longitudinal bars respectively, and I further support the water ballast tanks beneath the deck stringer plates in the upper wings, and strengthen the decks by augmenting the strength of the arched girders about their central portion and by longitudinal plates or bars attached to a girder deck, and to the main deck, which is

supported by notched longitudinals and by perforated transverse girder web plates with solid bars.

As, next to the deck stringer plates abreast of large hatchways, the bilges are most severely stressed, I extend my web frames almost straight down onto the bilge plates, to which they are strongly attached. On the inner margin of these web frames solid longitudinal bars are attached, and to these is secured the inner skin, extending fore and aft throughout the holds, down on a line nearly perpendicular to the bottom: the lower plates of this inner skin being connected to the shell and made strong and watertight by bars and plates which form a part of the structure of the outer walls of the double bottom. The inner skin will support and strengthen the upper water ballast chambers.

This invention may be said to consist in the novel construction and combination of parts hereinafter described and illustrated by the accompanying drawings, which indicate one form by which my invention may be carried into effect.

Figure 1, represents a transverse view of a bulk cargo vessel with ballast tanks in the upper wings, supported by an inner skin,

and a double bottom with longitudinals supported by an intermediate transverse web plate. Fig. 2, is also a transverse section showing a main transverse web frame and arched girder, with a girder deck between pairs of hatchways and improved side water ballast compartments. Fig. 3, is a partial longitudinal section showing a transverse bulkhead, web frames, arched girders and a deep double bottom having water ballast tanks. Fig. 4, is a fragmentary horizontal section showing the perforations of the main transverse web plates, a notched, or slotted longitudinal member, a strengthening or filling bar, and an inner longitudinal member connected to the inner skin. Fig. 5, is a fragmentary view of an arched girder plate perforated for the reception of the notched longitudinals, and punched for brackets. Fig. 6, is a vertical section near the center of an arched girder plate. Fig. 7, is a fragmentary view between a pair of hatchways showing the raised girder deck, which is supported by continuous and intercostal longitudinal plates and bars, and a transverse deck girder riveted thereto, with an arched girder perforated for the notched and abutted longitudinals fitted below. Fig. 8, is a fragmentary longitudinal section of same. Fig. 9, is a fragmentary view of a main transverse web plate before the bars are fitted, showing perforations for the reception of alternately notched longitudinals, and bracket rivet holes for securing the ends of abutted longitudinals. Fig.

10, is a fragmentary section showing a notched longitudinal and perforated web plate attached to the shell plating. Fig. 11, is a fragmentary transverse section showing the notched, and the ends of the abutted longitudinals, respectively, web-plate and bars, bracket-plate and strengthening bars. Fig. 12, shows joggled shell plate connections, intermediate transverse girder and butt cover plate, or bar, connecting the upper bottom plates, between the longitudinal members. Fig. 13, is a sectional view showing longitudinal members secured by bracket plates; also ties or struts. Fig. 14, shows a joggled bar.

Similar letters refer to similar parts throughout the several views.

In this novel construction the deck of the ship or vessel is marked A. The raised deck B, between pairs of hatchways. The shell or skin, forming the side walls and bottom plates C. The bottom, or outer bottom D. The upper bottom E, is supported by longitudinally extending bars resting on, and secured to the unnotched and unperforated upper edge of transverse web plates with bars F, and is further secured by vertical bars G, embracing these longitudinals and the notched longitudinal frames riveted to

the lower bottom (D), and connected to the transverse members by bracket plates and bars H. The upper wing chambers are marked I. Side water ballast chambers J. Double bottom chambers K. Arched girders L. Girder, water ballast, deck chambers M.

The longitudinal frames or girders, which I may call "longitudinals," are marked N, and the solid longitudinal members O. The notches in the longitudinals are marked O. Perforations of plates, clear of the bars and near to the outer margins of plates, P. Strengthening, or filling bars, within the perforations, Q. Joggling of shell plating R. The inner skin is designated S. The main transverse members, made up of bars T, and plates U, are called web-frames. The intermediate transverse members between the web frames, are marked V. Keelson plates W. Shelf plates X. Joggled angle bar Y. Plate liners Z. Transverse bulkhead z.

My web plates are not notched, but have solid margins for the full molded depth of the solid, or uncut, frame bars, and in some cases a little more, for when the shell plates are neither joggled nor doubled, the web plates may project outward to effect contact with and secure direct metallic connection with the outside strakes of shell, or deck plating, by means of an angle bar which may be joggled over the inside strakes. When the outside strakes are doubled in way

of the transverse bulkheads, these will be equipped with double bulkhead-frame bars in the usual manner, and be bracketed to the longitudinal members so as to efficiently connect them with the decks and to the shell plating. Between the main web frames are fitted the intermediate transverse frames; these do not extend to the outer or inner skins, but only between the longitudinal members, and are neither notched nor perforated but have unbroken margins fitted with angle bars, to which the longitudinal members, both outer and inner, are connected, and they are further braced transversely by bars extending from skin to skin, and from the lower to the upper bottoms, and may be bracketed at their ends. In small vessels, or when the double bottom, or side web plates, are not required to be very deep or broad, these intermediate transverse members may economically be formed or constructed, of deep channel bars strongly secured to the longitudinal members by vertical, horizontal, transverse, or diagonal bars connecting the outer and inner longitudinal members, and they may have bracket or knee plates secured to their ends and to the inner skin, and to the keelsons. The moment of inertia being so much greater with my web-frame and arched girder bars and plate mar-

gins unnotched; I can afford to give these members wider spacing than is common and efficiently resist the fluid pressures and bending moments. In the annexed drawings, I show these about twenty four feet apart, this being the original hatchway spacing on the Great Lakes. But these main web frames, and arched girders, may be spaced from about ten feet to about thirty feet; and there may be from one to three intermediate transverse members between pairs of main web frames, or between a main web-frame and a transverse bulkhead. In the drawings I have shown these intermediates, spaced about six feet apart; but this spacing may vary greatly according to the size, form, and arrangements of the other structural elements.

In the annexed drawings, the perforations near to the plate margins, for the reception of the longitudinals, are of rectangular form, but these cuttings, or perforations may partake of the shape of the bars of which the longitudinals are constructed, so long as the holes are sufficiently large to permit of the longitudinals passing freely through them at a considerable angle, while framing the ship, to that at which they will be finally placed and riveted to the shell, stringers or deck plating, and bulkheads; the excess of space, fully equal to the molded depth of the transverse frame, or deck-frame bars, will be closed by a strengthening, or filling bar.

The longitudinal frames or girder bars will be of bulb angles, Z bars, or of bars of other suitable section. In the annexed drawings I have adopted the channel bar section almost throughout. These may be of any practicable length, according to the spacing of the transverse bulkheads, which spacing may vary from about fifty feet to about one hundred feet, but these longitudinal units will seldom require to exceed sixty feet in any hold to secure connection between pairs of transverse bulkheads, and there may be from one to three longitudinal frames, or girders, or deck-frames to each strake of plating; in the annexed plans most of the plating is supported and stiffened, by two longitudinals, but the keel and sheer strakes are frequently adequately supported by the usual keelson and stringer plates and bars, respectively. The longitudinal frame bars at, or about their mid-length, when there is only one main web frame between a pair of transverse bulkheads,—or at other points when there is a plurality of main web frames in a hold,—have about one fourth, or one third, of their outer or upper section cut away, this I call "notched," to adapt them to pass out or over, the web frame or arched girder bars, so as to secure contact and metallic connection with the skin and deck plating. This notching may be of semi-

circular or other form, sufficient to allow of their passing the unimpaired bars and margins of the transverse plate. Preferably, where one longitudinal is notched over the transverse web-frame bar, or arched girder bars, the longitudinal above or below, or at either side, will abut on that transverse frame and be strongly attached thereto by brackets or knee plates, flanged or fitted with bars. By this means is secured what I term a "shift of butts" between the transverse bulkheads. To make this shift of butts more efficient the longitudinals may pass through perforations in the intermediate partial transverse bulkhead plate margins clear of the transverse web frame bars.

The slight weakening of the longitudinals by notching, is at least partly compensated by the filling bar, or by the bracket or knee plates and bars. These will contribute largely in resisting the stresses borne by the longitudinals which may abut on the web frames, and on the transverse bulkheads with bracket connections thereto. To further strengthen the longitudinals, instead of the usual frame plate liners, broad plate liners, tapering to the edges of the plates above and below, or on either side, may be fitted outside of the notches or the abutments of the longitudinals. The inner and upper longitudinal members, connected to the lower surface of the inner skin, to the girder deck, and to the upper bottom, which are not arranged to

pass through perforations in the transverse members, and which I call "solid longitudinals," will be strongly connected to these transverse members, to the notched longitudinals, and to the transverse bulkheads by angle bars and by bracket or knee plates. Ordinary ballast tanks in the upper wings have frequently given trouble through leakage; this was at least partly due to lack of efficient longitudinal stiffening when the transverse bulkheads were widely spaced.

My ballast tanks in the upper wings are supported by strong longitudinal bars connected with partial bulkheads within these chambers, and with the support and continuation of the inner skin vertically below, stiffened by broad transverse, and by solid longitudinal members, there should be no danger of leakage due to straining. These chambers may be further supported by decks strengthened by double longitudinal members near to the quarter breadth, the girder decks having deep and continuous longitudinal girders secured to the main deck over the notched longitudinals at the sides of hatchways, with intercostal longitudinals and a transverse girder over the arched girder, between pairs of hatchways. Or in lieu of this girder-deck, tubular girders (M) depending from the main deck may be constructed. The hatches may be of any ef-

ficient arrangement, number, or form. As there is a redundancy of strength supplied by the plating of the outer and inner, or upper bottom, I do not continue my transverse members, except bulkheads, or watertight divisions, up to the upper bottom, but only to the under, or inner edge of the solid longitudinal members, which are strongly connected to the transverse members by vertical, horizontal or diagonal bars and knee plates. These transverse members span the bottom from the center keelson to the lower turn of bilges and connect to the lower plates of the inner skin. This novel construction is designed to extend continuously throughout the holds and generally from stem to stern of the vessel, but, when desired, it may be discontinued at the after end of the holds, or even at the bow, and the familiar close-spaced transverse frame, hold beam and pillar system, be adopted in the construction of the stern and bows, due regard being had to a proper arrangement of stringers for efficiently scraping the old system onto this novel structural device.

I do not wish to be limited as to structural details, as these may be modified in many particulars without departing from the spirit of my invention.

Having now fully described my invention, what I claim is:—

1. In a ship or vessel construction, transverse web plates having perforations near

their outer margins, longitudinal frames or girders, notched at intervals adapted to be inserted in the perforations of the web plates, the uncut outer margins of the web plates and bars seated in the notches of the longitudinal frames, the edges of said frames or girders being brought to a position in contact with the shell or deck plating, or flush with the edges of the web plates; filling bars inserted in the perforations abreast of the notches in the longitudinal frames or girders, transverse angle bars and bracket plates for securing said parts together, substantially as and for the purpose set forth.

2. In ship construction, transverse web plates having perforations near their outer margins clear of the web frame bars, longitudinal girders, or frames, notched at their mid-length, adapted to be inserted in the perforations of the web plates, the uncut outer margins of the web plate and bars seated in the notches of the longitudinal frames or girders, the edges of said frames or girders being brought to a position flush with the edges of the web plates, or in contact with the skin and deck plating; filling bars inserted in the perforations abreast of the notches in the longitudinal frames or girders, transverse and vertical bars and bracket plates for securing said parts together substantially as and for the purpose specified.

3. In a navigable vessel, a plurality of continuous, notched and abutted, longitudinal frames or girders, appropriately spaced transversely and vertically of the hull to support the shell and decks, transverse web plates and arched girder plates perforated clear of their angle bars near their upper and outer margins respectively, adapted for the reception of said longitudinal girders to bring them into direct contact with the shell and deck plating for riveting thereto, filling bars, angle bars and bracket plates for securing said parts together substantially as and for the purpose set forth.

4. In a bulk cargo vessel, without hold beams or pillars, the combination of transverse web frame bars with web plates having perforations near their outer margins, longitudinal frames or girders notched at intervals, adapted to be inserted in the perforations of the web plates with their bars seated in the notches of the longitudinal frames or girders, said girders being moved out over the bars and plate margins to secure direct connection with the shell and deck plating, filling bars inserted in the perforations abreast of the notches in the longitudinal frames or girders, unperforated, or solid, intermediate web frames, perforated transverse arched girders, brackets and knee plates and connecting angle bars substantially as shown and described.

5. In vessel construction, the combination of transverse arched girders and transverse web frames having perforations near their outer margins, longitudinal frames or girders notched at intervals adapted to be inserted in the perforations of the arched girders and web frames and being brought to a position in contact with the shell and deck plating; solid upper and inner longitudinal members supporting the upper bottom and the inner skin, filling bars, transverse and vertical angle bars and bracket plates for securing said parts together substantially as shown and described.

6. In a steel ship with a double bottom, the combination of a main deck supported by transverse arched girders having perforations near their upper margins and below their upper angle bars, longitudinal deck frames or girders notched at intervals adapted to be inserted in the arched girder plates, the uncut, or unperforated upper margins of the arched girder plates and bars seated in the notches of the longitudinal deck frames, the edges of said frames being brought to a position in contact with the stringer or deck plating, or flush with the upper edge of the arched girder plate, solid longitudinal members riveted to the upper bottom and resting on the uncut, or unperforated upper margins of the transverse web-plates or bars, transverse strengthening

bars, brackets and knee plates for securing said parts together substantially as and for the purpose set forth.

7. In a ship having holds divided by a plurality of transverse bulkheads, and constructed with in and out strakes of plating, the combination of a plurality of longitudinals supporting each strake of plating between the keel and sheer strakes, with perforated transverse web-frames and arched girders intermediate the transverse bulkheads, secured to the plating by joggled transverse angle bars; said longitudinals being adapted by notching near their mid-length, to pass out through perforations in said web frames flush with their outer edge, to effect contact and connection with the plating; water ballast chambers along the upper wings of the holds supported by an inner skin; strengthening bars, bracket or knee plates and bars connecting the ends of longitudinals with the transverse bulkheads substantially as and for the purpose specified.

8. In a "single deck" vessel with lower ballast tanks, the combination of an upper or inner bottom and inner skin supported by a plurality of continuous longitudinal girders attached to wide spaced web frames, with a lower bottom, or shell, constructed with transverse web plates having perfora-

tions near their outer margins, longitudinal frames, or girders, notched at intervals adapted to be inserted in the perforations of the web plates, the uncut outer margins of the web plates, and their bars, seated in the notches of the longitudinal frames, the edges of said frames being brought to a position in contact with the bottom and shell plating, or flush with the edges of the web plates, intermediate transverse web plates located between the lower and the upper longitudinal girders, transverse, horizontal, and vertical angle bars and bracket plates for securing said parts together substantially as shown and described.

9. In a hull the combination with transverse web plates having perforations near their outer margins, and longitudinal frames or girders extending throughout the hull, notched at intervals adapted to be inserted in the perforations of the web plates, the uncut outer margins of the web plates and bars seated in the notches of the longitudinal frames, the edges of said frames being brought to a position flush with the edges of the web plates and bars, and in contact with the shell plating; transverse bulkheads, vertical and transverse angle bars, plate liners, bracket and knee plates with bars for securing said parts together substantially as set forth.

10. In ship construction the combination of transverse arched girders and transverse

web frames, the plates of which are perforated near their upper and outer margins respectively, placed throughout the holds with appropriate intervals from bow to stern of the ship, longitudinal frames or girders notched and adapted to be inserted in the perforations of the web plates, with alternate longitudinal frames or girders abutting on said web plates and secured thereto by brackets and angle bars; unnotched longitudinal and unperforated transverse members, vertical and transverse angle bars for securing parts together substantially as and for the purpose set forth.

JOSEPH R. OLDHAM.

Witnesses:

E. H. FREY,

F. F. DURANT.