J. R. OLDHAM.

SHIP CONSTRUCTION.

APPLICATION FILED OCT. 11, 1912.

1,066,039.

Patented July 1, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

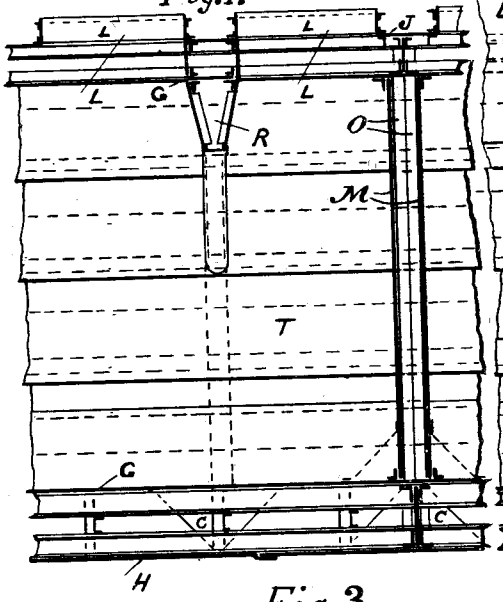


Fig. 2.

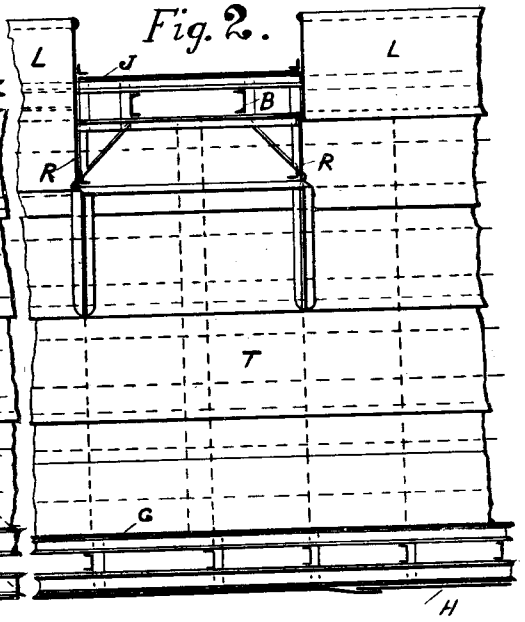


Fig. 3.

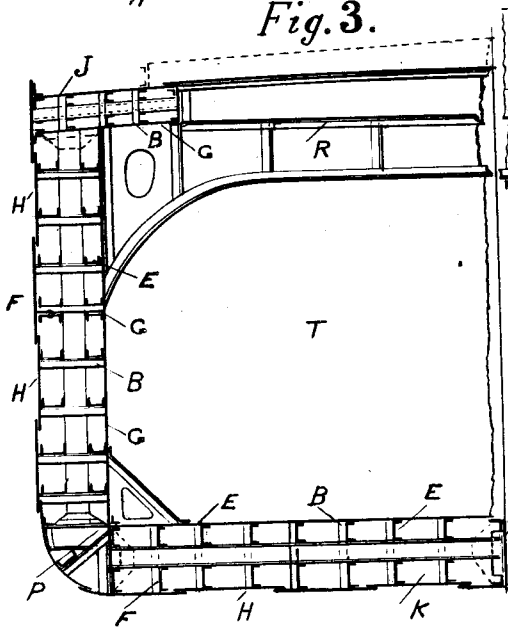
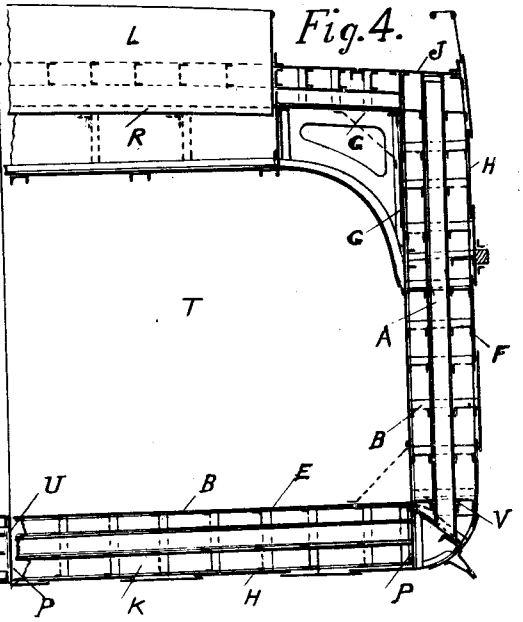


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

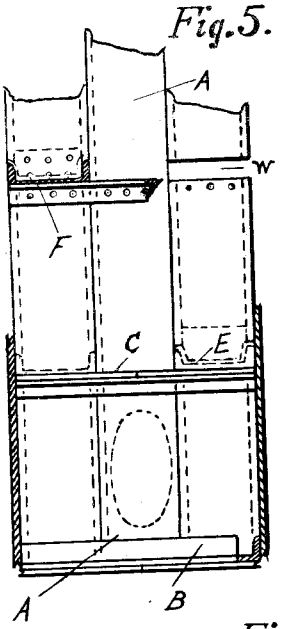


Fig. 6.

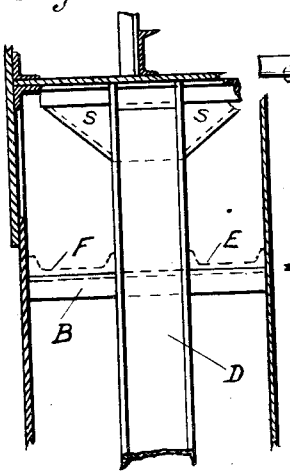


Fig. 7.

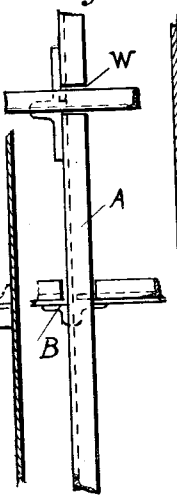


Fig. 8.

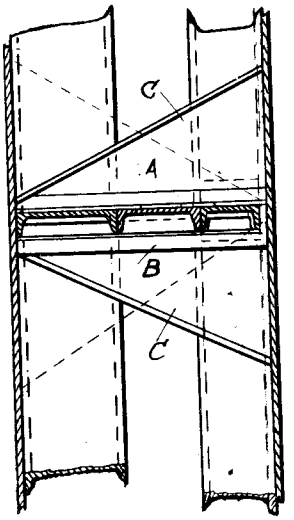


Fig. 9.

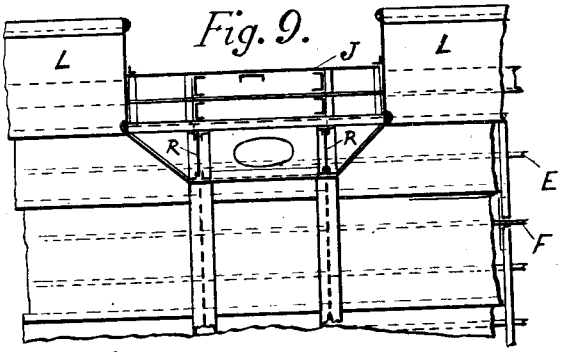


Fig. 10.

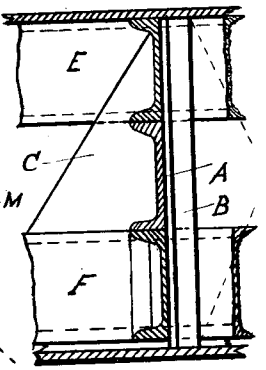
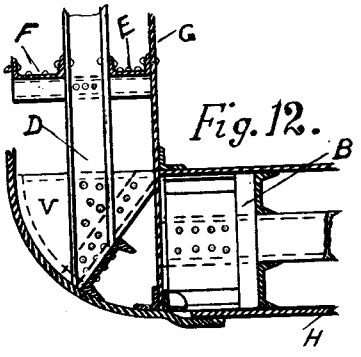


Fig. 11.

Fig. 12.



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SHIP CONSTRUCTION.

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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 a certain new and useful Improvement in Ship Construction, of which the following is a specification, reference being had to the accompanying drawings.

The ponderous unloading machinery employed on the Great Lakes, comprising grabs or buckets lifting seventeen tons weight of ore at one lift, frequently cause serious injury to, or destroy projecting angle or channel bars of exposed web frames, stringers and hold bulkheads, and even the strongest upper bottoms and side water ballast tanks hitherto constructed are commonly found injured and leaking through impact with such unloading mechanisms; and it seems that a surface having no greater projections than the edges of thin plates, strongly supported from within, cannot, for any length of time, resist the energy of about twenty tons weight moving in all directions within the cargo holds of ore carrying vessels.

The primary object, therefore, of my invention is the construction of a steel vessel, especially a large ore carrier, having unobstructed cargo holds, without hold beams or pillars, or other projecting bars below the transverse deck girders, and with the framing of the sides, deck, and bottom, as well as the stiffening bars of the hold division bulkheads, inclosed and protected from the unloading mechanisms and the loading of heavy cargoes, by an inner skin and double skin bulkheads.

Another object of my invention is the adoption of homogeneous elements for the framing and stiffening of the hull as far as possible whereby great strength and increased rigidity is obtained with a moderate amount of riveting, which is probably the heaviest item of expense in steel ship or vessel construction. In this novel structural device the transverse and longitudinal framing, as well as the bulkhead stiffening, is composed almost entirely of channel bars, constructed in close connection and having metallic contact with each other; but an angle bar section will be most economical for cross tieing the inner fabric together, and for supporting the inner and outer longitudinal frames, for securing the bracket-plates to the channel bar web frames and the watertight transverse division plates within the two skins,—thus securing augmented transverse and longitudinal strength with economical construction.

This invention may be said to consist in the construction and combination of elements and members hereinafter described and definitely indicated in the claims.

In the accompanying drawings, which indicate forms in which my invention may be carried into practical effect; Figure 1 is a fragmentary longitudinal section with close spaced hatchways of large dimensions transversely of the hull. Fig. 2 is a similar section with wide spaced hatchways. Fig. 3 is a transverse section between hatchways, or pairs of hatchways. Fig. 4 is another transverse section abreast of narrow hatchways. Fig. 5 is a fragmentary view of three tiers of transverse channel bars forming part of a main web frame and showing three longitudinal frames in place, and a space between two of the intercostal channel bars, through which the longitudinal frames are passed and where they are secured by the cross bars. Fig. 6 is a similar view showing a portion of an intermediate transverse frame bar, three longitudinal frames, bracket plates and bars. Fig. 7 is a fragmentary end elevation of a transverse web frame bar with two longitudinal frames broken off. Fig. 8 is a fragmentary plan view showing two longitudinal frame bars abutting on a main transverse web frame, also a longitudinal frame passing through, or between, the intercostal transverse channel bars; also bracket plates and angle bars. Fig. 9 is a fragmentary longitudinal section between pairs of narrow hatchways, showing the decks supported by double, or twin, transverse deck-girders. Fig. 10 is a fragmentary longitudinal section showing a main transverse web frame with a continuous, and an abutted longitudinal frame secured to same. Fig. 11 is a fragmentary horizontal section, or exposed plan view, of the inner and outer skins, showing a portion of double skinned transverse hold division bulkheads, stiffened by vertical channel bars and supporting struts. Fig. 12 is a fragmentary transverse section showing an intermediate girder connected to the bilge.

The structural details shown in the drawings may be considerably varied without departing from the spirit of my invention

which, however, they will serve to make clear.

Like letters indicate like parts throughout the drawings.

A represents the main transverse frames, each composed of a central channel bar extending from the center keelson to the bilge, and from the bilge to the deck plating respectively, with channel bars in several pieces, or units, on either side of the central bar, all riveted together and tied and supported by cross bars B, and brackets C. The intermediate channel bar girders are marked D. The inner longitudinal channel bar frames are marked E. Outer frames F. The inner skin, extending over the bottom, sides, and under the decks throughout the cargo holds, is marked G. The outer skin, or external walls, which may be of familiar construction throughout, though supported and strengthened by this novel framing device; and with an inner skin throughout the cargo holds,—is marked H. The deck, also of familiar construction, except as regards this novel support or strengthening, is marked J. Bottom K. Hatchways L. Transverse hold division bulkhead-skins are marked M. Vertical stiffening bars of same, O. Watertight plate divisions within the double skins or walls of hull, P. Transverse deck girders R. Knee plates S. The cargo holds, which may be arranged all in consecutive order between the bow and the machinery space aft, or separated by the machinery space, when arranged near midlength of the hull, with the double skin and novel framing, constructed continuously through such space, are marked T. The center keelson is designated U. Bilge futtocks V. The space between the ends of the marginal bars of main web frames, to permit of the longitudinal frames passing between them, is marked W.

According to this invention the familiar transverse frames and broad plate web frames with vertical angle bars, are eliminated throughout the cargo holds, or from the after part of bow almost to the fore part of stern, with ordinary freight steamer boiler and engine equipment located at the after end; but in way of the "run" and forward, from the fore end of the fore hold to the stem, the familiar arrangement of close spaced angle, or channel bar, frames and plate web-frames may be adopted. My transverse web-frames are constructed of channel bars, widely spaced longitudinally of the hull, say from about eighteen to about thirty-six feet with angle cross bars between the two skins at each longitudinal frame. My longitudinal frames are also formed of channel bars, closely spaced, say, with from one to three frames to each strake of bottom, side, and deck stringer plating; though the keel strake, sheer strakes, and narrow bilge strakes will frequently be sufficiently supported without a longitudinal channel bar frame. These longitudinal frames abut on the watertight plate divisions within the double bottom and double sides, and when the hold division bulkheads are widely spaced, and this spacing may vary from about sixty to about one hundred and twenty feet, alternate or most of the alternate longitudinal frames will pass through, between, the upper and lower, or inner and outer ends of marginal bars, of the main transverse web frames, while the remaining frames, will abut on the main transverse web-frame marginal bars, and be attached thereto by bracket plates and bars. With my transverse hold division bulkheads and watertight division plates within the double skins, closely spaced, this structural device can readily be adopted for the construction of oil carrying vessels; and the double skins form a space eminently suitable for the stowage of bunker oil fuel in bulk, when the longitudinal frames, in one length if practicable, will pass between the transverse web-frames and abut on the watertight divisions within the two skins, and be secured by knees or brackets.

My inner skin, or shell, is constructed throughout the holds, or from the entrance to the run of the vessel; the decks also having an upper and lower skin, thus providing with the double bottom, a vessel of "cellular" construction throughout the cargo holds, or from the bow to the stern.

Another novel feature of my invention is that the hold division bulkheads are constructed with a double skin, abutting on the inner skin of the hull and supported by a novel construction of stiffening bars and struts to save space, these being inclosed by the double skins to prevent them being injured by the ponderous mechanisms which are now being used for unloading iron ore, or other cargoes.

Having an inner and outer tier, or series, of longitudinal frames and an extra skin, which is made extra strong to withstand the impact and weight associated with the carrying of large ore or coal cargoes, I dispense with the usual broad plate web frames, and their angle bars, whether perforated or notched; and substitute central transverse, or vertical, channel bars passing between, and connected directly to, both series of longitudinal frames. These channel bars extend in one length from the center keelson to the bilge futtock, and from the upper bottom, or bilge futtock, to the inner, or under skin of the deck respectively, to which they are attached. These central bars form struts or ties and also tend to hold the longitudinal frames at practically a right angle to the inner and outer skins. On either side of these long central bars, side, or marginal

bars, in several units or lengths, are fitted, filling up the space between either flange of the long central bar, and the inner and outer skins, to which they are directly attached, being flush with the longitudinal frames. These side, or marginal bars, are made in several lengths, varying from about three feet to about nine feet so as to leave an opening of about three or four inches between their ends to allow of alternate or most of the alternate longitudinal frames passing through between, while the remaining frames abut near to the middle of these marginal bars.

The side bars being flush with the longitudinal frames and in metallic contact with the inner and outer skins, are all securely riveted together and thus form my transverse web frames. Bars, preferably angle bars, are fitted across the three transverse channel bars, upon which the longitudinal frames rest and to which they are riveted; these main web frames, with my extra strong hold division bulkheads and intermediate girders, while supporting the outer and inner skins, will provide, with the strong watertight-plate-divisions within the two skins, ample general transverse strength for the hull. Between the main web frames are placed intermediate transverse bars, about two to three between pairs of main web frames; these girders are of the same breadth, and of similar section, to the central element of the main web frames, they pass between the inner and outer longitudinal frames, and are in metallic contact and attached thereto, and further secured by cross-bars, spanning the space between the inner and outer skins, at each longitudinal frame, thus tying the longitudinal frames and the inner and outer skins, securely together. To make more clear the economy of this structural device as applied to the framing; my longitudinal frames may be thinner than those of a single skin ship, though I prefer to make these for a very large vessel, of the greatest breadth procurable at moderate cost where the maximum stresses, or strains, may be experienced; and I prefer a length of about sixty feet for some half of these frame-bars; part of the remainder being shorter, and some of slightly greater length, when procurable, their weight will vary greatly, but the mean breadth should not be less than eight inches.

Augmented strength of hull may be secured economically by arranging a good shift of butts for the longitudinal frames; thus, when the outer longitudinal frame bar abuts on a certain marginal transverse channel bar, the inner longitudinal frame, at the same level or plane, will pass through between the ends, of the transverse frame marginal, or side bars; while the next frame will abut thereon and be secured thereto, as well as to the central transverse bar, by bracket plates, and be further secured, as also the longitudinal frame passing between, by a cross bar, preferably an angle bar. This in brief is one arrangement for procuring what is termed a "shift of butts" with wide spaced bulkheads.

The extra security against foundering by the adoption of a strong double skin is another object of this invention. Though the breadth of channel bars as commonly rolled, and placed on the market, gives a somewhat restricted space within the bottom and sides—the structural economy of this device being based largely on the close assemblage of channel bars—this invention would permit of the construction of special channel bars, larger than have hitherto been on the market, if a greater breadth than here shown between the two skins, were desired. The extra weight of my inner frames and skin will be largely compensated by the extra strength of these elements, or members, permitting of a large reduction in weight of the outer shell and deck plating, while maintaining, or retaining, the full strength of the ship considered as a girder, both transversely and longitudinally of the hull.

This structural device of longitudinal and transverse framing, strengthening and supporting the bottom, sides and decks, with the double skin transverse hold division bulkheads, as well as the inner skin, is mainly designed for the construction throughout the cargo holds of a steel vessel, but the deck framing, supporting the upper plating of the deck, may economically be extended beyond the holds, or even from stem to stern. The deck framing will be constructed of three tiers, similar to the sides with broad hatchways extending transversely of the hull, but with narrower hatchways, say not exceeding sixty per cent. of the breadth of beam, I prefer to make the deck framing of two tiers, the upper bars extending longitudinally of the hull, attached to the upper plating, and the lower bars attached to the lower plating, extending transversely of the hull, and further secured by cross bars in a similar manner to the sides.

When the longitudinal space between pairs of hatchways is only about three feet, the top flange of the transverse deck-girders will cover in that space, thus joining the lower skin of deck across the center from side to side. To strengthen the decks in way of long hatchways, partial transverse girders, or channel bar struts arranged diagonally between the sides of hull and the hatch coamings, may be fitted. Though my longitudinal frames will usually pass between, and abut, on the transverse web-frames, alternately; to prevent short lengths of marginal

web-frame bars, pairs of longitudinal frames may be abutted consecutively on the marginal bars. The deck and sides of hull are further strengthened and supported by transverse deck-girders attached to the inner skin of sides and deck, one, or two, twin-girders being located between pairs of hatchways. These hatchways and coamings may be of any efficient design and dimensions, and the hatches of any approved type or construction. Deck and side stringer plates and bottom keelsons may be of familiar construction.

A requisite number, or all of the watertight compartments, may be adapted for carrying water ballast.

When the marginal bars of my main web frames, in construction, or erection, are "built up" or erected in place, after the longitudinal frames are fitted, the web of the transverse frame marginal bars may be continued into touch with the web of the longitudinal frames and be connected thereto by an angle bar clip for stronger connections.

To deflect the cargo from the junction of the inner skin and the transverse bulkheads with the upper bottom, what I term deflecting plates, formed, preferably, of corrugated metal, may be fitted; these plates, with their necessary bar connections, will also strengthen the connection of the inner sides and the hold bulkheads at their base, as well as facilitate the removal of a bulk cargo.

The cellular space within the double skins may be entered through manholes in the upper bottom, inner side, or lower skin of deck respectively.

Having described my invention, what I desire to secure by Letters Patent is:—

1. A steel ship or vessel, having inner and outer skins and comprising a plurality of longitudinal inner and outer spaced channel bar frames, transverse frames each comprising central channel bars extending across the bottom and sides between the inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames and intercostal transverse bars filling the spaces between the central transverse frame bars and the inner and outer skins and secured thereto and to the transverse bars with angle bars and bracket plates substantially as and for the purpose specified.

2. A bulk cargo vessel having inner and outer skins and comprising a plurality of longitudinal inner and outer spaced channel bar frames, central transverse channel bars extending across the bottom and sides respectively between the inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames, and intercostal transverse bars, with longitudinal frames abutting thereon, and passing their ends alternately, and filling the spaces between the central transverse frame bars and the inner and outer skins, and secured thereto and to the transverse frame bars; also angle bar and bracket plate connections substantially as and for the purpose set forth.

3. A steel vessel having inner and outer skins and comprising a plurality of longitudinal inner and outer spaced channel bar frames, transverse frames each comprising central channel bars extending across the bottom and sides between inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames, and intercostal transverse bars filling the spaces between the central frame bars and the inner and outer skins and secured thereto, and to the transverse bars, with angle bars and bracket plates; substantially as and for the purpose set forth.

4. A steel ship having unobstructed cargo holds with inner and outer skins, and comprising a plurality of longitudinal inner and outer spaced channel bar frames, transverse frames each comprising central channel bars extending across the bottom and sides between the inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames, and intercostal, marginal, transverse bars filling the spaces between the central transverse frame bars and the inner and outer skins and secured thereto, to the central channel bars, and to the longitudinal frames by angle bars and bracket plates; substantially as and for the purpose specified.

5. In ship construction, the combination of a hull having inner and outer skins and comprising a plurality of closely spaced longitudinal inner and outer channel bar frames, central transverse frame bars each comprising channel bars extending across the bottom and sides between inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames, and intercostal transverse bars, in several lengths, filling the spaces between the central transverse frame bars and the inner and outer skins and secured thereto and to the longitudinal frames and to the central transverse bars; longitudinal deck frames supported by intercostal transverse bars and intermediate channel bar girders and angle bars with brackets and knee plates, substantially as and for the purpose set forth.

6. In ship construction, the combination of a hull with cellular deck and double skins throughout the cargo holds, and comprising a plurality of inner and outer spaced channel bar frames, which alternately abut on and pass between the adjacent ends of marginal, intercostal, channel bars which are secured to central transverse channel bars, forming wide spaced main web frames filling the spaces between the double skins, to which they are secured with metallic con-

tact; cross bars secured to longitudinal and transverse main web frames and to intermediate transverse channel bar frames with angle bars and bracket plates; substantially as and for the purpose set forth.

7. In ship construction, the combination with double skins at bottom, sides and deck, of close spaced longitudinal channel bar frames and wide spaced channel bar main web frames filling the spaces between the inner and outer skins and secured directly thereto, cross bars, secured to each longitudinal frame, intermediate transverse channel bar frames; transverse deck girders, secured to the inner skins, transverse watertight plate divisions within the double skins, knee-plates and bars; substantially as and for the purpose set forth.

8. A steel vessel having a double bottom and cellular sides and deck throughout the cargo holds, a plurality of longitudinal inner and outer spaced channel bar frames, transverse frames each comprising central channel bars secured between the inner and outer longitudinal frames, cross bars secured to the longitudinal and transverse frames, and marginal transverse bars fitted intercostally between the longitudinal frames, which pass through the spaces left between the adjacent ends of the transverse marginal, intercostal bars, and are secured thereto and to the longitudinal frames abutting thereon, and to the inner and outer skins, substantially as and for the purpose specified.

9. In a bulk cargo vessel having unobstructed cargo holds, a combination of cellular decks, sides and bottom, comprising a plurality of longitudinal inner and outer spaced channel bar frames, transverse frames each comprising central channel bars extending from keelson to bilge, and from bilge to deck, and secured thereto; cross bars secured to the longitudinal and transverse frames, and to marginal bars fitted intercostally, leaving space between their ends sufficient for longitudinal frames to pass through, to which they are secured by the transverse angle cross-bars; substantially as and for the purpose specified.

10. A bulk cargo vessel having a double skin over the bottom, sides, and decks, and unobstructed cargo holds, the combination of inner and outer bottom and side channel bar longitudinal frames, with channel bar main web frames and channel bar intermediate transverse frames, in metallic contact and tied together by angle cross bars; longitudinal and transverse channel bar deck frames tied together by angle cross bars and secured to the double skins, transverse deck girders secured to the inner skins, watertight plate division bulkheads within the two skins; knees and bracket plates and bars; substantially as and for the purpose specified.

11. In ship construction, the combination of a hull without hold beams or pillars, or other projecting bars below the transverse deck girders, throughout the cargo holds, with inner and outer skins and comprising a plurality of longitudinal inner and outer spaced channel bar frames secured in metallic contact to the inner and outer skins, transverse channel bar main web frames filling the spaces between the inner and outer skins, and secured thereto, extending across the bottom from the center keelson to the bilges, and from the bilges to the deck plating, to which they are secured; intermediate transverse channel bar frames, extending across the bottom and sides between the inner and outer longitudinal frames to which they are secured; cross bars secured to all of the longitudinal and transverse frames; channel bar longitudinal and transverse deck frames secured to the upper and lower skins of deck; transverse deck girders secured to the inner skins by plates and angle bars and brackets; substantially as and for the purpose set forth.

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Witnesses:
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E. J. BROWN.