Nov. 10, 1931. H. C. T. BRYANT 1,831,479

CONSTRUCTION OF SHIPS AND OTHER STRUCTURES

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Fig. 1.

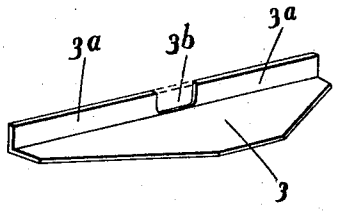
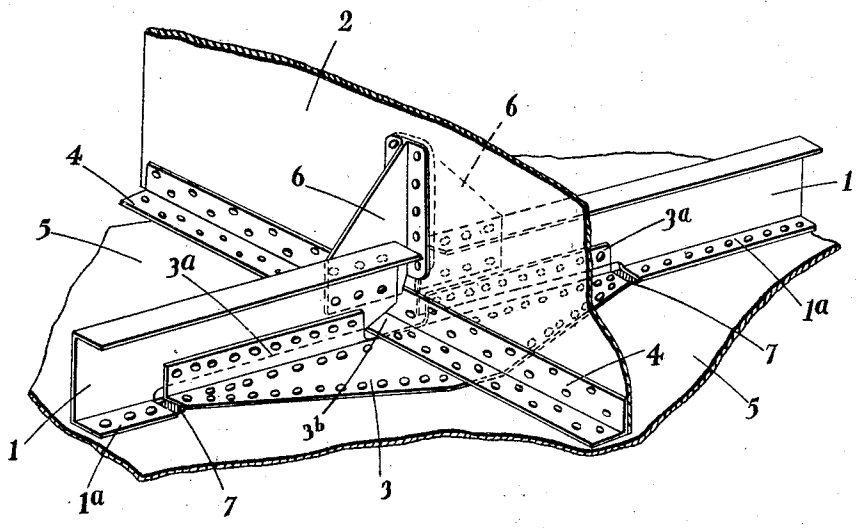


Fig. 2.



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UNITED STATES PATENT OFFICE

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CONSTRUCTION OF SHIPS AND OTHER STRUCTURES

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In the design and construction of ships, and barges and other constructions, and particularly in the design and construction of oil tankers, difficulty has been experienced in securing continuity of strength of longitudinal, transverse and other framing, and also in ensuring a sound structural design in the regions where framing members adjoin a bulk-head requiring to be oil-tight or water-tight which is attached to the shell plating of the hull or other bulk-head plating.

In one form of usual ship construction, the longitudinal framing girders are separated to accommodate a transverse bulk-head, the bulk-head being attached to the hull or shell plating by a boundary bar comprising one or more angle bars or other shaped section or sections, and the longitudinal framing girders and bulk-head being locally supported by bracke s of substantial dimensions attached to the bulk-head on opposite sides and having webs or arms riveted to the ends of the longitudinals. With such a construction, the brackets limit the amount of local flexibility permitted to the bulk-head, and when the latter is submitted to repeated stresses in opposite senses the stresses are transmitted through the brackets to the ends of the longitudinals which tend to lift away from the shell plates. This is resisted only by the strength of the rivets and trouble arises either through fracture of the shell plates or through progressive starting of the rivets usually commencing with the end rivet and extending along the longitudinals. Doublers in the form of straps or plates have also been used connected to the shell plating either inside or outside with a view to improving the continuity of strength.

The present invention has for its primary object to provide a form of construction possessing continuous strength of the longitudinal framing through or transversely of the transverse bulk-heads, adapted to ensure a more rigid joint at the parts in question and affording the additional advantages of involving less weight of steel and fewer manual and riveting operations, but it is not confined in its wider aspect to longitudinal framing since it may apply also to transverse, diagonal or other framing in analogous circumstances. Other specific applications will be mentioned hereinafter by way of example and it will be evident that it may be utilized in conjunction with various known methods of construction.

According to the present invention the discontinuous or separated frame or stiffening members are connected to flanges of one or more flanged doublers, each doubler being thus connected to both members, and the doubler having a continuous portion attached to the shell plating (or analogous plating against which the bulk-head or other plating separating the discontinuous members is secured for example by a boundary angle; such analogous plating is hereinafter included in the term "shell plating" in so far as the invention applies to discontinuous frame members supporting plating other than the actual shell plating).

In one form of the invention, the foundation or shell flanges of the longitudinal or like frames on each side of the bulk-head or relatively transverse plating are terminated a certain distance therefrom and the exterior angle or flange of a flanged doubler of angle T or other section lies in the gap so that its junction with the shell plating can be readily caulked; alternatively an angle-sectioned doubler could back against the web of a channel or other sectioned longitudinal or against that of a longitudinal of inverted angle, inverted T or other appropriate section. Further the aligned ends of the longitudinals may be further secured by attachment to the bulk-head by appropriate angle, T or other section lugs or brackets and appropriate attachment lugs.

The accompanying drawings illustrate a typical form of the invention,

Figure 1 being a perspective view of one form of a flanged doubler and

Figure 2 a perspective view of the junction of bottom frame members, shell plating and bulk-head.

As illustrated, the foundation or shell flanges 1*a* of the longitudinal frames 1 on each side of the bulk-head 2 are shown as terminated a substantial distance therefrom, for example, two to four feet from either side.

Within the gap is positioned a flanged doubler or doublers comprising an angle, T or other section or sections having the vertical web or webs 3*a* cut away locally at 3*b* to receive the bulk-head 2 and the boundary bar 4 by means of which the bulk-head is secured to the shell plating 5 of the hull. The horizontal facing web 3 of the flanged doubler thus forms a stiff structural element possessing nevertheless the requirement of elasticity, and extending for a substantial distance on either side of the bulk-head. The horizontal web 3 preferably increases in width from the ends to the mid-length as shown so as to compensate in strength and resilience for the cut-away portion 3*b* of the vertical web 3*a* and the discontinuity of the longitudinal framing 1 in way of or transversely of the bulk-head. The vertical web 3*a* of the doubler is riveted to the lower edges of the vertical webs of the adjacent aligned longitudinals. These aligned ends of longitudinal frames on opposite sides of a common bulkhead are additionally supported and/or stiffened by means of angle or T, or other shaped section lugs 6, or bracket plates and attachment lugs set up on each side of the bulkhead and riveted, welded or otherwise attached thereto, and the standing flanges being riveted or otherwise attached to the ends of the longitudinal frames. The standing flanges or these lugs may be fitted parallel or at right angles to the standing web of the longitudinal framing members 1 to which they are attached, and may be of appreciably less dimensions than the brackets referred to above in respect of known constructions, thus affording an additional advantage that the lowest stiffening structure of the bulk-head can be brought to a substantially lower level. Alternatively, the lugs or brackets or other attachments securing the ends of longitudinal frames to the bulk-head may be omitted.

For larger constructions, where the longitudinals are compound and are constructed of a vertical plate provided with upper and lower angle bar or other section mounts, I may extend within the gap referred to above, the ends of a pair of mutilated longitudinal frames comprising only the vertical plate and the upper angle bar or other mount, the vertical web of the doubler being riveted to the vertical plate of the mutilated longitudinals so as to form, as it were, a continuous longitudinal girder of compound or channel section having its upper web and vertical portion cut away to form a slot to receive the bulk-head and its boundary bar, and its continuous lower web broadened out centrally to provide compensating strength as previously described. Where two flanged doublers are employed they may be placed back to back, one against each side of the vertical web of the longitudinals, or alternatively, a single doubler may be used on one side of the said web and a pair of back bars, one on each side of the bulk-head, on the other side of the said web. Moreover, it will be apparent that where two bulk-heads or partitions are closely spaced together the longitudinal or main frame members may terminate outside the spaced bulkheads and be connected by doublers of sufficient length to bridge the resultant gap either with or without further bulk-head connecting lugs and/or intermediate stiffening lugs, spacers, or framing.

With the construction according to the present invention owing to the provision of a continuous metal section, rigidly secured to the ends of aligned longitudinal frames and extending for a substantial distance on either side of the bulk-head, continuity of frame strength is preserved or increased and stresses of various kinds are adapted to be transmitted through the joint with gradualness and without abrupt change in distribution throughout the stiffening members. Further the resistance of rivets to shear is utilized almost exclusively to meet the main stresses, the rivets holding the shell plates, which remain chiefly in tension as heretofore in known constructions, being according to the invention, secured to elements possessing continuity and flexibility instead of to elements of a discontinuous and rigid character.

In making the joint oil tight, the edges of the shell plating flange of the doubler may be caulked all round, and the boundary bars for the bulk-heads may also be caulked: in addition there may be an electric butt weld as at 7 or the flange 3*a* may be continued a little further from the bulk-head along the vertical web of the longitudinal 1. The shell plating flanges of adjacent flanged doublers may either look towards each other, or alternatively, they may all be directed one way.

Where the spacing of the longitudinal framing permits, it may also be advantageous to provide doublers of slotted channel bar section and to arrange for each doubler to serve two aligned contiguous longitudinals on each side of the bulk-head.

Slotted channel bar sections with one flange removed also angle bar sections make suitable doublers for large vessels and slotted angle bars and T bars for coasters and small craft. The large range in the scantlings of standard sections would appear to provide an adequate selection for all sizes of doublers, but if necessary they could be prepared from ordinary mild steel plating by cutting and flanging, etc. If desired, the flange or flanges of doublers may be shaped off at suitable angles. Bulk-head boundary bars may either be joggled over the flanged doublers or slip and/or parallel liners may be fitted. To avoid unnecessary linering or joggling of the bulk-head boundary bars, the thickness of doublers on raised strakes of shell plating should be

made equal to the adjoining sunken shell plate.

The invention is particularly adaptable to ordinary longitudinal framing in tankers etc., especially to the bottom longitudinals in cargo oil, fuel oil, water ballast and double bottom tanks. It is equally applicable to many other purposes, however, a few of which are as follows:—

(1) To produce continuity of strength of longitudinal framing under decks and on ships bottom in vessels framed on the "combination" system.

(2) To produce continuity of strength of longitudinal framing on ships bottom, sides, bulkheads and under decks and double-bottom tank top plating in general cargo and passenger vessels.

(3) To produce continuity of strength of ship side framing where stopped in the way of water-tight decks or flats.

(4) To produce continuity of strength of aligned transverse floors or frames on either side of unpierced centre-line and wing bulkheads.

(5) To produce continuity of strength of aligned strong beams under decks on either side of unpierced centre-line and wing bulkheads.

(6) To produce continuity of strength of aligned ship side stringers also centre-line and wing bulk-head shelf plates on either side of unpierced transverse bulk-heads.

(7) To connect bulk-head stiffeners as well as the bulk-head plating to ships skin longitudinal frames.

(8) The new system provides an exceptionally strong and economical form of construction in way of cofferdams, pump rooms and narrow oil fuel cross-bunkers. In these compartments the usual channel bar bottom longitudinals may be replaced by ordinary inverted angle bars, the connection to the shell plating being obtained by means of flanged doublers extending continuously between and through the bounding transverse bulk-heads. The ends of the longitudinals may be connected to the transverse bulkheads by T or other section lugs, as already described.

(9) To all land, marine and other structures where it is required to pass the strength of one aligned member to another through an intervening unpierced partition or bulkhead.

I claim:—

1. A construction of the type including frame members carrying a shell and discontinued at a bulkhead or like partition comprising a flanged doubler having a portion continuous across the plane of the bulkhead, with the flanges connected to the frame members on each side of the bulkhead, that portion of the doubler extending across the plane of the bulkhead being attached to the shell.

2. A construction of the type including frame members carrying a shell and discontinued at a bulkhead or like partition comprising a plurality of flanged doublers having portions continuous across the plane of the bulkhead, the said portion secured to the shell, said doublers including flanges connected to the discontinuous frame members on each side of the bulkhead.

3. A construction of the type involving means for connecting the ends of frame or stiffening members interrupted at a bulkhead and secured to a shell, including a flanged doubler, the flanges of which are connected to the stiffening members on each side of the bulkhead, the flanged doubler having a portion extending across the plane of the bulkhead and secured to the shell, and a boundary bar secured to the shell and seating in a gap formed in the flange of the doubler connected to the stiffening member.

4. A construction of the type involving means for connecting the ends of frame or stiffening members interrupted at a bulkhead and secured to a shell, including a flanged doubler, the flanges of which are connected to the stiffening members on each side of the bulkhead, the flanged doubler having a portion extending across the plane of the bulkhead and secured to the shell, and brackets connected to the discontinuous stiffening members and to the bulkhead on each side of the latter.

5. A construction of the type involving means for connecting the ends of frame or stiffening members interrupted at a bulkhead and secured to a shell, including a flanged doubler, the flanges of which are connected to the stiffening members on each side of the bulkhead, the flanged doubler having a portion extending across the plane of the bulkhead and secured to the shell, that portion of the flanged doubler extending across the plane of the bulkhead being of relatively increased width.

6. A ship's construction of the type including flanged stiffening members interrupted at the bulkhead and to one flange of which the shell is secured, comprising doublers having a portion secured to the shell and extending across the plane of the bulkhead and angularly related flanged portions to be secured to the discontinuous stiffening members, a flange of said discontinuous stiffening members being cut away to permit the flange of the doubler to be directly connected to said members without interrupting the contact of the shell and the shell-engaging portion of the doubler.

7. A ship's construction of the type involving discontinuous stiffening members interrupted at the bulkhead and to which the shell is secured, comprising a flanged doubler secured to each side of the stiffening members and having a portion extending across

the plane of the bulkhead at each side of the stiffening members, with such portions secured to the shell.

8. A ship's construction of the type involving discontinuous stiffening members interrupted at the bulkhead and to which the shell is secured, comprising a flanged doubler secured to each side of the stiffening members and having a portion extending across the plane of the bulkhead at each side of the stiffening members, with such portions secured to the shell, said flanged doublers being employed to bridge the space between closely spaced bulkheads.

9. A ship's construction of the type including flanged stiffening members interrupted at the bulkhead and to one flange of which the shell is secured, comprising doublers having a portion secured to the shell and extending across the plane of the bulkhead and angularly related flanged portions to be secured to the discontinuous stiffening members, a flange of said discontinuous stiffening members being cut away to permit the flange of the doubler to be directly connected to said members without interrupting the contact of the shell and the shell-engaging portion of the doubler, and a welded joint between the doubler and stiffening members.

10. An element of ship's construction including a flanged doubler having a continuous portion attached to the shell or plating, and upstanding, interrupted, flanged portions to be connected to the terminals of the discontinuous frame member on each side of a bulkhead or partition.

In testimony whereof I affix my signature.

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