

Nov. 5, 1968

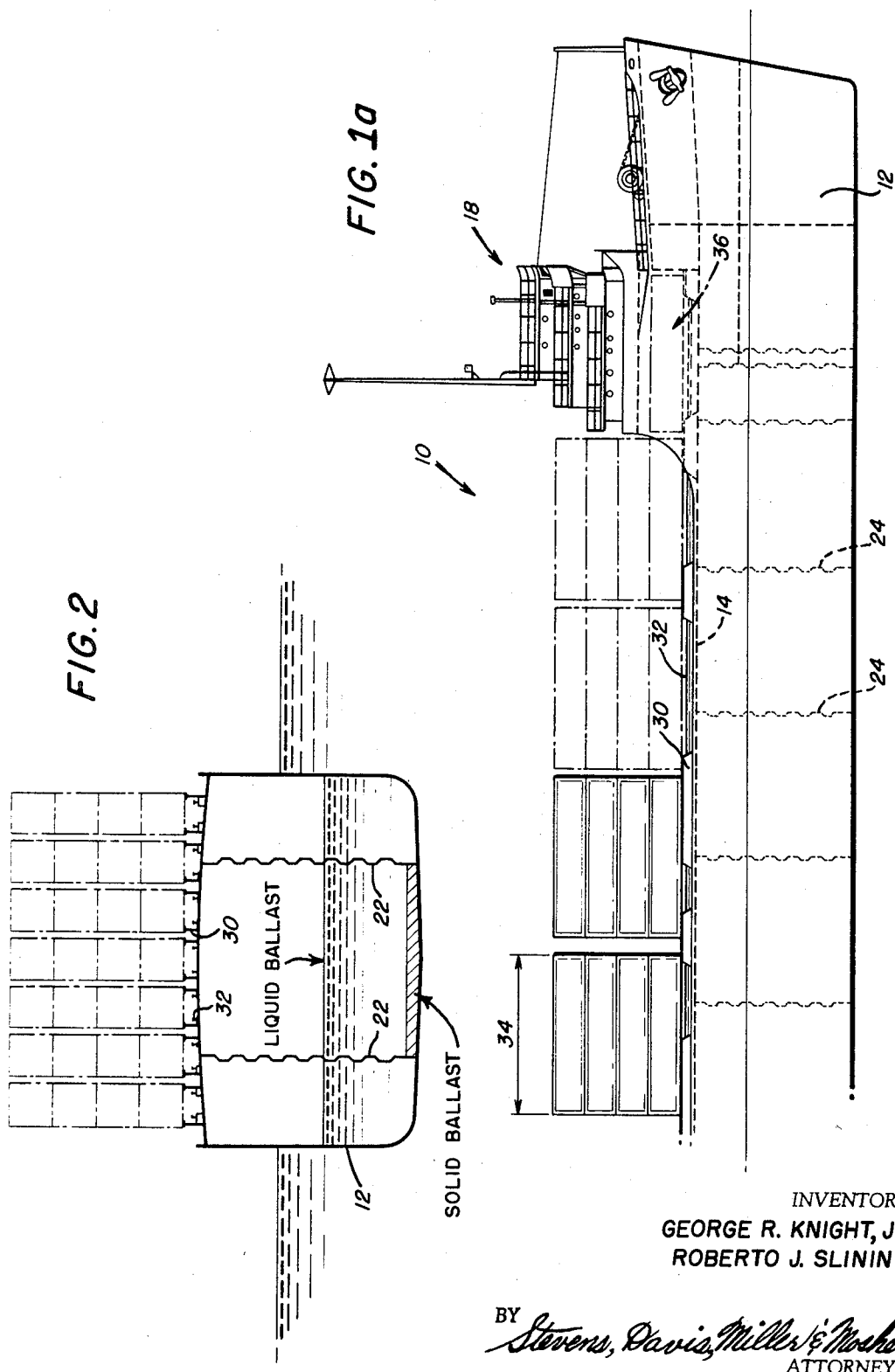
G. R. KNIGHT, JR., ETAL

3,408,972

CONTAINER SHIP WITH MAIN CARGO ABOVE MAIN DECK

Filed June 15, 1967

4 Sheets-Sheet 1



Nov. 5, 1968

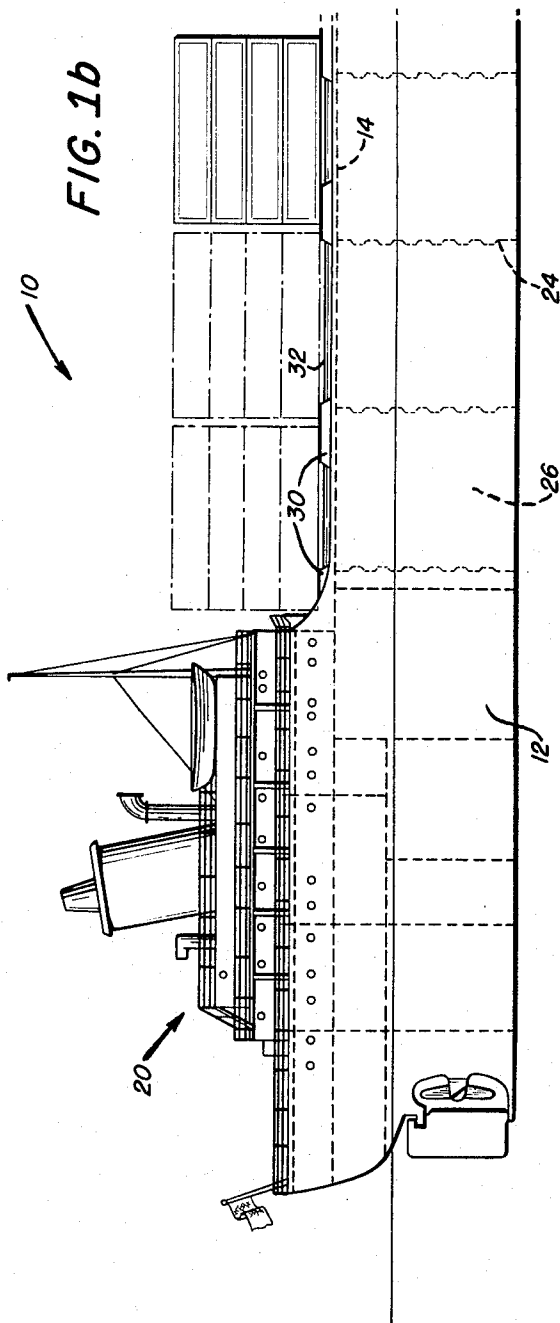
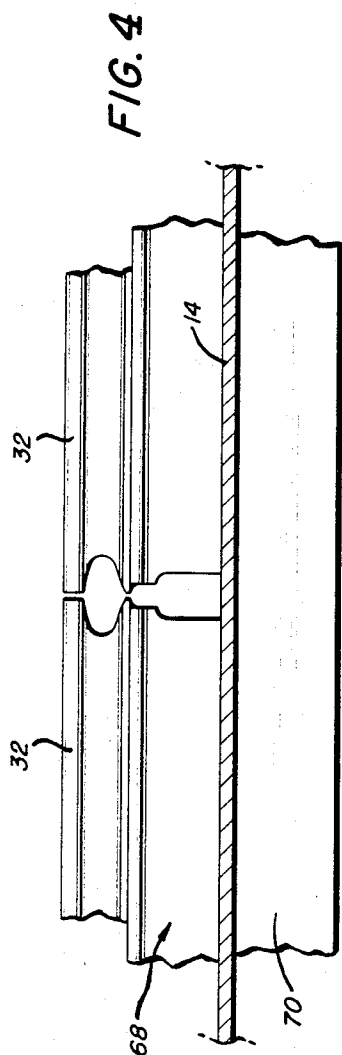
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CONTAINER SHIP WITH MAIN CARGO ABOVE MAIN DECK

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4 Sheets-Sheet 2



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CONTAINER SHIP WITH MAIN CARGO ABOVE MAIN DECK

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4 Sheets-Sheet 3

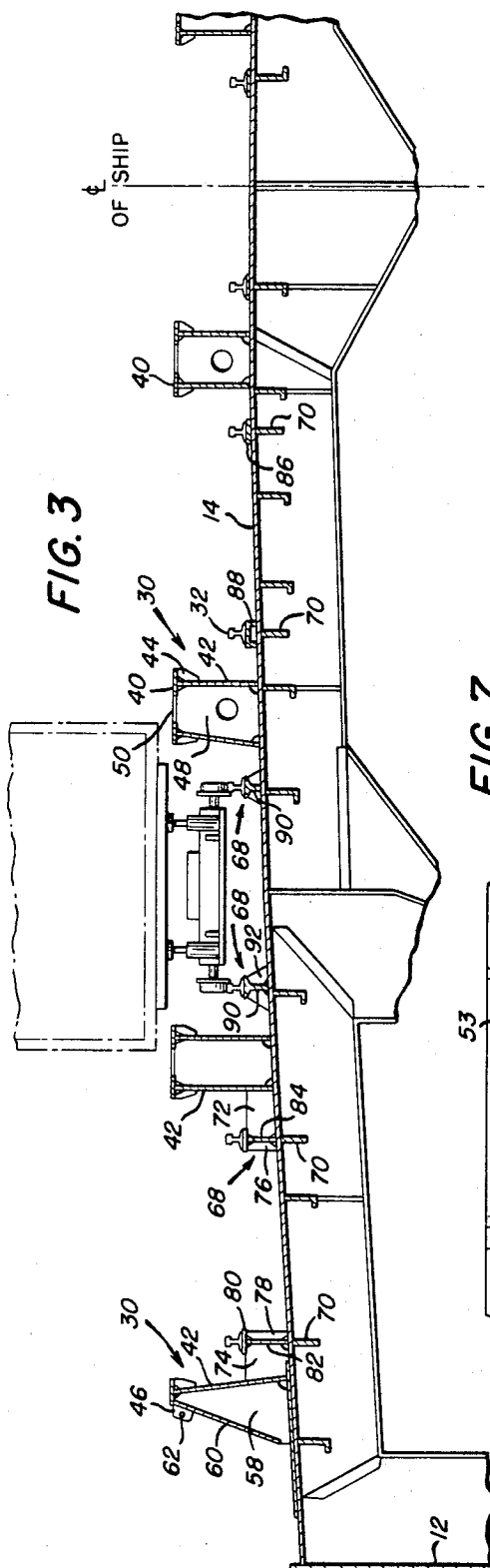


FIG. 1

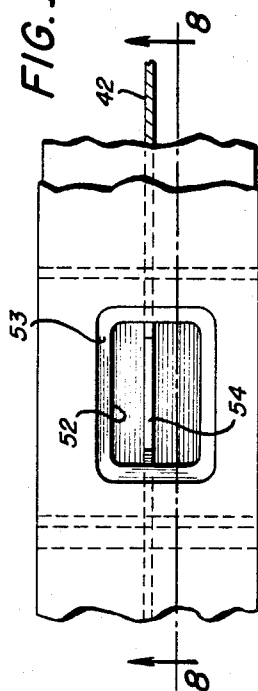
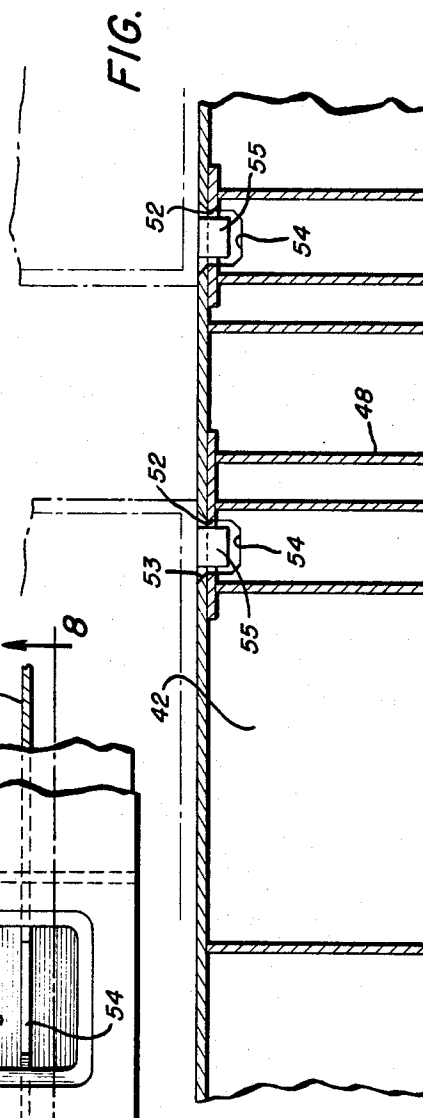


FIG. 8



Nov. 5, 1968

G. R. KNIGHT, JR., ETAL

3,408,972

CONTAINER SHIP WITH MAIN CARGO ABOVE MAIN DECK

Filed June 15, 1967

4 Sheets-Sheet 4

FIG. 5 (AT 1/4 OF SHIP)

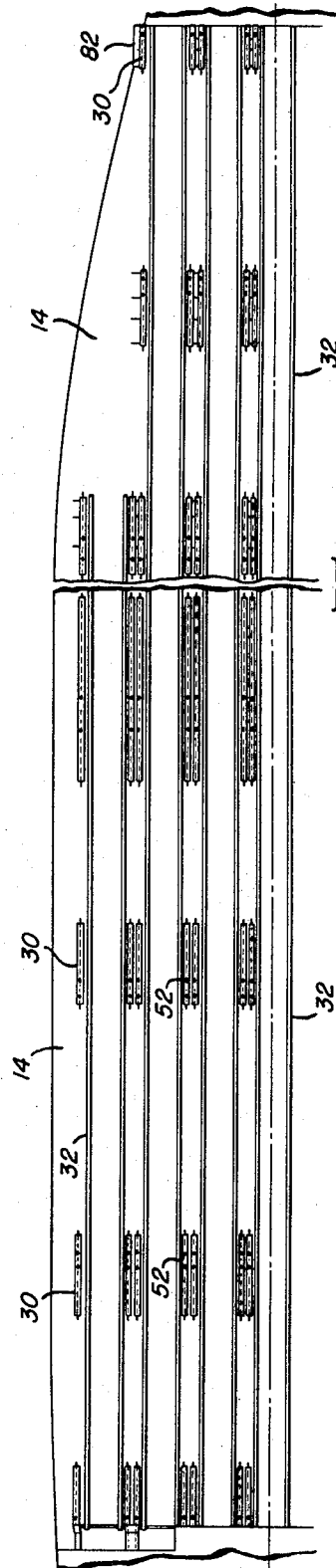
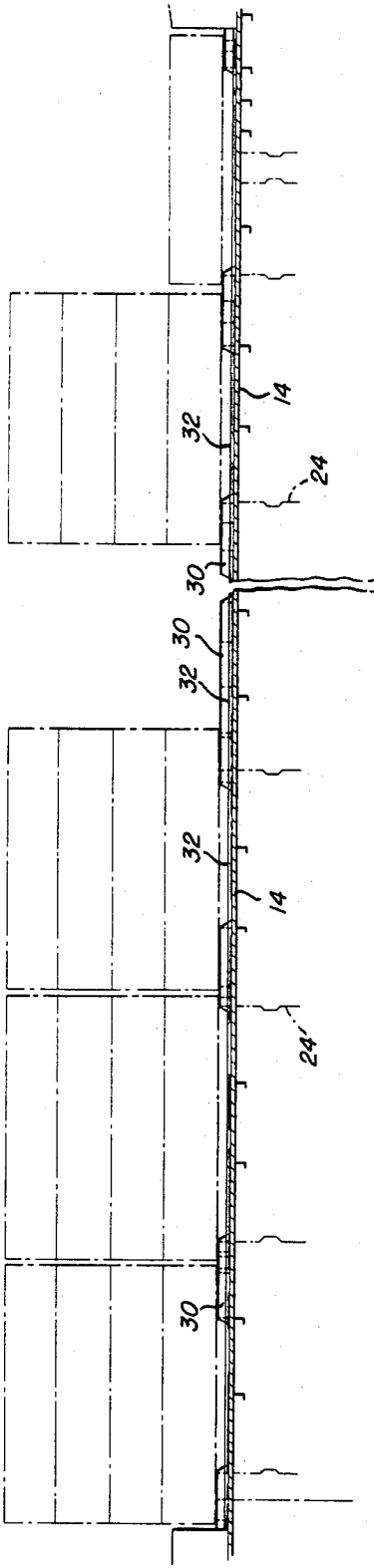


FIG. 6

1

3,408,972

CONTAINER SHIP WITH MAIN CARGO ABOVE MAIN DECK

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10 Claims. (Cl. 114-72)

ABSTRACT OF THE DISCLOSURE

A tanker converted to a container ship including a main deck provided with container supports throughout the free length of said deck for holding stacks of containers, the former liquid cargo section of the tanker forming ballast compartments which when partially filled lower the center of gravity and permit higher container stacking.

BACKGROUND

The present invention relates to a ship capable of carrying containers and more particularly to a converted tanker adapted to carry containers on the main deck thereof.

With the increase in foreign commerce, there has developed within the last ten years a tremendous volume of container traffic on the high seas. To meet this need, specially designed container ships have been built or converted to carry stacks of containers within cell guide systems extending the height of the ship's hull. Because of the great number of available small tankers, particularly the T-2 (which are being replaced by the jumbo tankers), some of these vessels are currently being converted to container ships. Conventional conversion includes fabricating the cell guide system within the former liquid cargo holds, cutting large hatches and closing them with new hatch covers. The longitudinal bulkheads are cut and relocated or alternately the spacing and volume of container cargo is limited due to the presence of these bulkheads.

It will be appreciated that the conventional conversion expense for labor and equipment is relatively high and the conversion time required for cutting, relocating, fabricating the various hatches, bulkheads, cranes, etc., is relatively extensive. Upon completion, the converted tanker is committed to a relatively high center of gravity because of the hull volume required for cargo so that the height of stored containers above the main deck is necessarily limited.

The invention avoids the above problems by providing a new and improved converted tanker arrangement for carrying containers which permits a much faster, less expensive conversion and which yields a container ship facilitating fast container cargo loading and unloading with shore-based cranes.

Unlike conventional tanker conversions, and according to one aspect of the invention, the inventive arrangement makes no attempt to transport containers below the main deck so that practically the entire former cargo section of the hull is available for ballast permitting the lowering of the center of gravity and stacking container cargo to greater heights above deck. This new approach affords the significant advantages of avoiding cell guide systems, hatches, coamings, covers, and ship-based cranes. The tanker becomes primarily a floating platform upon which stacks of containers are transported.

According to another aspect of the invention, since the main deck is free of hatches, container support and rail systems are provided on the stripped main deck extending

2

(in regions) the full free length thereof. For loading, container stacks can be formed at one deck location on a track mounted jack pallet which rides along the tracks to another desired location where the jacks lower the stack onto the container supports. The pallet is then withdrawn back to the first location to receive more containers forming another stack. The process is reversed for unloading.

It is therefore an object of the invention to provide a container ship design avoiding the problems and obtaining the advantages described above.

Other and further objects and advantages of the invention will become apparent with the following detailed description when taken in view of the appended drawings in which:

FIGURES 1a and 1b illustrate a side elevation of the inventive arrangement.

FIGURE 2 is a typical transverse vertical section through the cargo section of the vessel of FIGURES 1a and 1b.

FIGURE 3 is a partial exploded view of the main deck of FIGURE 2.

FIGURE 4 is a longitudinal vertical section illustrating the rail supports and rails on the main deck.

FIGURE 5 is a longitudinal section along the center line of the vessel.

FIGURE 6 is a top plan of the main deck of the cargo section of the ship.

FIGURE 7 is a partial top plan of a part of the container support of FIGURE 3.

FIGURE 8 is a partial longitudinal section along line 8-8 of FIGURE 7 illustrating the container supports on the main deck.

DETAILED DESCRIPTION

With reference to the drawings in detail, one exemplified vessel according to the present invention generally indicated as 10 includes a hull 12 a main deck 14 and typical forward houses 18 and aft houses 20. The hull is characterized by being divided by longitudinal bulkheads 22 and further compartmented by transverse bulkheads 24 within the cargo section of the ship. For reasons set forth below, the compartments serve to house solid and salt water ballast; however, the aft-most compartment 26 preferably serves as a fuel oil tank.

According to the invention, the entire upper deck of the cargo section of the hull is stripped and fitted with elongated container supports 30 and a parallel rail system 32 more fully described below. As seen in FIGURES 1a, 1b and 6, container supports 30 are discontinuous and longitudinally aligned along the length of the free part of upper deck 14. A space 36 is provided beneath the deck officer's quarters affording further room for container storage. Supports 30 are also aligned transversely across the deck 14 and cooperate in pairs to support one end of a stack of containers generally as shown. In this example, seven container stacks are arranged across deck 14 at the midship location and sufficient space is provided for seven longitudinally arranged container sections. The lengths and longitudinal, transverse spacing of supports 30 are predetermined and depend somewhat upon the dimensions of the anticipated container cargo (standard 20 or 40, 8 x 8 containers, refrigerator containers, and the like).

The supports 30 and rails 32 afford efficient container handling on deck 14 with the provision of a standard wheeled jack pallet riding on tracks 32. Shore-based cranes are used to form a stack of containers, in this case four, upon the container supports 30. When the stack is formed, the pallet jacks are operated to lift the stack and the pallet then travels along track 32 to the

desired location. The jacks are operated to lower the container stack onto supports 30. Standard locking or lash down members (not shown) securely fasten the stack to the supports. The pallet is then rolled back to the container loading area 34 to receive containers forming another stack. When only area 34 remains to be loaded, the pallet may be removed permitting the shore-based crane to deposit the containers directly on supports 30. It will be understood that the required use of the pallet depends upon the size and capability of the crane. For example, cranes of increased size and versatility may be capable of forming stacks on supports 30 at all locations in the cargo section without the need of the pallets.

In the case of conversion, ship 10 is cleared of all machinery, deck gear, structure, rigging, piping, deck fittings, miscellaneous stowage and other outfit material superfluous to the converted vessel or forming obstruction to its new arrangements. Removable include life boats, riggings, cat walks, main deck mooring fittings and warping winches with foundations, masts, king posts and the like, all deck piping, valves, manifolds, and the other miscellaneous tanker deck outfits. As is normally the case, some tankers are provided with a mid-ship house which should be removed below the bridge deck level and placed forward to provide a clear deck area in the cargo section. Support for the relocated house may be provided by new, extended forecastle super structure side plating. New vertical side web members and stanchions are provided as required. Support for the new house should be aligned to transmit stresses and forces into the primary hull structure.

Where the outboard profile of the ship may interfere with the container support function of the container supports 30, a deck extension 82 is provided which extends out beyond the ship's profile. In this way, the support forces of the container support 30 is directed downward into the primary ship structure notwithstanding a portion of the container being beyond the ship's profile.

Referring now to FIGURES 3 through 8, the container supports and rail system will be described in detail. The container supports 30 are arranged in sets of two parallel and longitudinally extending supports generally as shown. Each set of two container supports 30 cooperate with another pair of such supports spaced longitudinally therefrom so that the four supports present a foundation at least near the four corners of the associated containers. The alignment of the container supports 30 should be checked for a suitable tolerance. The container supports 30 are so arranged as to transmit container loads into the existing transverse bulkheads of the primary hull structure. Where necessary or desired, brackets are arranged in line with the ship's transverses to assist in load transfer.

As better seen in FIGURE 3 the flat tops formed by flanges 40 of all container supports 30 preferably lie in the same plane notwithstanding the sheer or camber of main deck 14. Each container support 30 includes an upstanding plate or web 42 extending from deck 14 and supporting the upper horizontal flange 40 generally as shown. Brackets 44 are provided at suitable locations for enhancing the bending modulus of the flange 40 and plate 42 combination. Openings 54 in webs 42 allow access to refrigerated container power plug in boxes (not shown).

Adjacent (non-cooperating) pairs of supports 30 are structurally coupled together by transverse diaphragms 48 located at suitable longitudinal intervals. Diaphragms 48 extend from deck 14 up to the top of the support and are topped with their own cooperating flange 50 lying in the same plane as flanges 40. The corners of brackets 44 and diaphragms 48 may be cut as desired.

The transverse diaphragm plates 48 between the container supports 30 may be adapted to accept the end fittings of conventional lash down equipment.

Rectangular openings 52 with downward and inward edge surfaces 53 are provided in the top flange face plate of container supports 30 and webs or plates 42 are provided with shear-key cuts 54 directly below openings 52. It is preferred that openings 52 and 54 not be cut until all welding has been completed on the ship. Openings 52 serve to guide and accept the shear key 55 on the bottom of the containers so as to secure the container stack on supports 30 in such a way so as to prevent undesirable relative motion when the ship is at sea.

The outboard support member 30 is also provided with diaphragms 58 welded to the upstanding outboard side of the web and the top of deck 14. The outboard edge slopes downward and outward and is provided with a flange 60 which acts as a stiffener. Bracket 46 secured in the top flange 60 is provided with an aperture 62 which receives conventional lashing equipment.

As mentioned above, secured to main deck 14 between each cooperating pair of container supports 30 is a pair of cargo transporter rails. Each rail 32 is held on a rail support 68, the vertical dimension of which increases in accordance with the outboard position of the rail so that the tops of all rails 32 lie in the same horizontal plane generally as shown in FIGURE 3. Each cooperating pair of rails is laid to any standard suitable gauge and is secured to the rail supports 68 along their lengths by welding. In a preferred embodiment for thermal growth purposes, the rails 32 and the supports 68 are noncontinuous (see FIGURE 4) each with a maximum length of about 40 feet. The space between the tops of rail sections 32 is preferably $\frac{3}{16}$ of an inch plus or minus $\frac{1}{16}$.

Below the upper deck 14 there is welded longitudinal plates 70 aligned below each associated rail 32. As better seen in FIGURE 4, each plate 70 spans the longitudinal distance on either side of the spacing between adjacent rail sections of the discontinuous rail 32.

Each rail support may have any suitable shape or form such as the flat plate design 86 which functions as a spacer, the U-shaped channel design 88, and the cruciform designs 90 with suitably spaced diaphragms or brackets 92. Rail supports 68 having a substantial height, such as those near the outboard sides of the ship, are provided with diaphragms 72, and 74, 76 and 78 extending from main deck 14 to the supporting flange 80 for the rail in order to reinforce the webs 82 and 84 of the rail supports 68. The diaphragms 72 and 74 preferably extend to and are secured to the vertical face of webs 42 of the container supports 30.

The operation of the invention is apparent from the above description including the stacking, loading, unloading, stack handling and the like.

What is claimed is:

1. A container ship comprising a hull having a main deck, the space defined within the hull and beneath the main deck constituting a large ballast compartment which extends generally the height of the hull and generally throughout the length and width thereof, container support means integrally formed on the top of the main deck, the space above the top of the main deck constituting the entire cargo-carrying space for the ship, containers occupying the cargo-carrying space arranged in vertical stacks and in rows across said main deck and along the substantially free length of the main deck, each stack being supported by said container support means, and ballast material contained in the space defined within the hull for lowering the center of gravity of the ship to enable safe transport of the vertical stacks and rows of containers.

2. A ship as set forth in claim 1 wherein said container support means includes four elongated container supports having flat tops and aligned in spaced and parallel relation to support above the main deck the bottom container of a stack of containers, each said con-

5

tainer support engaging the supported container near a different bottom corner thereof.

3. A ship as set forth in claim 1 wherein said container support means comprises a plurality of elongated container supports each spaced from the others and arranged in a pair of longitudinally extending transversely spaced rows with the container supports in one row transversely aligned with those of the other and being so spaced to support a plurality of longitudinally aligned and spaced stacks of containers.

4. A ship as set forth in claim 1 wherein said container support means comprises a plurality of elongated container supports each spaced from the others and arranged in a plurality of transversely spaced longitudinally extending rows, each row cooperating with an adjacent row to support a plurality of longitudinally aligned and spaced container stacks thereon, the container supports of one row being transversely aligned with those of its cooperating row.

5. A ship as set forth in claim 4 wherein the main deck has one of a sheer and camber characteristic and the heights of the container supports vary depending upon their position from the ship's center line such that the tops of all said container supports lie generally in the same plane.

6. A ship as set forth in claim 4 wherein each container support defines an opening to receive a depending pin-like member attached to a container near the corner casting thereof for preventing undue lateral shifting of the container on the support.

7. A ship as set forth in claim 4 wherein a pair of parallel tracks is secured to the top of the main deck

6

between each cooperating row of said container supports, the tops of said tracks being sufficiently below the tops of said container supports to permit free passage of a track mounted jack pallet beneath a container resting on the container supports.

8. A ship as set forth in claim 4 wherein the ship includes a forward house at least the aft part of which is supported above the main deck by side plating to define a container storage space opening to the rear, and at least a pair of cooperating rows of container supports extending within said space to support a container beneath said house.

9. A ship as set forth in claim 4 wherein a deck extension connected to the hull is provided to support a container support which at least partially extends beyond the main deck profile.

10. A ship as set forth in claim 4 wherein adjacent non-cooperating rows of container supports have at least some of the container supports thereof transversely aligned, and wherein upstanding transverse plate members are secured to said last-mentioned container supports and to the main deck to stiffen said last-mentioned supports.

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