

SPECIFICATION

Surface vessel capable of operating in rough seas

- 5 This invention relates to vessels and is especially but not exclusively directed to a ferry-boat which is capable of operating in rough seas.

Known vessels are generally of a construction which includes an open hull and high closed sides to
 10 deflect waves and provide sufficient structural rigidity to withstand loads imposed by waves in those areas through which the vessel must operate. Where rough seas are anticipated, it has been necessary to build very heavy and therefore,
 15 expensive vessels to provide for the necessary safety and comfort for the occupants. It is noted that vessels which are designed to operate on inland waters or in sheltered bays cannot be operated in the open seas because they are incapable of safely
 20 withstanding the higher waves of the open seas. Certain areas of the world are lacking in adequate ferry service, because, in adverse weather conditions existing boats are unable to maintain a stable passenger deck for transporting of motor
 25 vehicles and passengers. In other areas where rough seas predominate a ferry service is lacking because a suitable vessel would be too costly to provide; in such areas personal motor vehicles can only be shipped by sea-going tug or cargo vessel.

- 30 It is an object of the present invention to obviate or mitigate the aforementioned disadvantage.

According to the present invention there is provided a surface vessel, particularly adapted for operation in rough seas, comprising an elongate and
 35 closed main hull, a deck mounted directly above said main hull on an open support structure extending upwardly from said main hull and with sufficient clearance from the latter to permit most waves to wash over the main hull and under the deck, an
 40 elongate and closed stabiliser hull which is small relative to said main hull, an outrigger structure integral with said deck and downturned remote therefrom and there connected with said stabiliser hull, and multiple drive means operatively
 45 connected to the deck and the outrigger structure for contacting the water and providing thrust to the vessel with the drive means differentially controllable to permit various modes of operation, including forward, reverse, steering, and turning in
 50 place, thereby permitting operation of the vessel with or without a rudder.

The combination of main hull, deck and open support structure comprise a rigid truss long enough and strong enough to bridge adjacent wave crests in
 55 rough water.

The multiple drive means preferably comprises three conventional propeller drive units with the centre unit positioned to drive the vessel straight ahead when the other drive units are not operating.

- 60 A closed passenger compartment may be provided adjacent to the deck for protecting the passengers from the weather.

An embodiment of the present invention will now be described, by way of example, with reference to
 65 the accompanying drawings, in which:

Figure 1 is a perspective view of a vessel according to the invention;

Figure 2 is a plan view;

Figure 3 is a side elevation; and

- 70 *Figure 4* is a front elevation.

Referring to the drawings the vessel includes an elongate and closed main hull 10, a stabiliser hull 12, a deck 14, mounted directly above the main hull 10 and an open support structure 16 extending
 75 upwardly from the main hull 10 with sufficient clearance from the latter to permit most waves to wash over the main hull 10 and under the deck 14, outrigger structure 18, connecting between the deck 14 and the stabiliser hull 12 and propulsion units 20.

- 80 The closed main hull 10 is of conventional construction such as steel, aluminium or fibreglass, and is completely enclosed to permit submersion of any portion thereof without water entering the hull. This closed configuration permits waves to roll over
 85 the hull. Compartments may be formed within the hull to restrict any flooding resulting from collisions with floating objects or the like. As can be seen from the various figures, the support hull 10 is of symmetrical configuration to permit operation of the vessel in either direction, fore or aft. The support hull may be of any desired configuration and can be
 90 several hundred feet in length depending upon the carrying capacity desired.

- Laterally spaced from the support hull 10 is the
 95 stabiliser hull 12 which is also of closed construction. The stabiliser hull 12 is very similar in configuration and construction to the support hull 10 although it is of much smaller size as can be seen from the various figures. The primary function of the stabiliser hull 12
 100 is to maintain the deck 14 in a generally horizontal position even in rough seas. Being spaced far apart from the support hull 10, the stabiliser hull 12 greatly reduces the rolling motion of the vessel. Like the support hull 10, the stabiliser hull 12 is relatively
 105 long which permits the stabiliser hull to bridge adjacent wave crests.

- In the embodiment shown the deck 14 includes a vehicle area 22 for transporting motor vehicles. This deck, in the embodiment shown, would carry eleven
 110 rows of automobiles with four automobiles in each row, thereby providing a carrying capacity of forty-four automobiles. A safety guard rail 24 extends around the outer edge of the deck 22 to prevent accidental loss of vehicles or passengers.
 115 The opposite ends 26 of the guard rail are removable to permit driving the motor vehicles on to and off the deck 14 at either end of the boat. Conventional means for fastening the motor vehicles to the deck could be provided.

- 120 The outrigger structure 18 includes a centre spar 59 and fore and aft spars 58 spaced therefrom. The spars 58 and 59 are on a level with and are integral with the underframe of the deck 14. The centre spar 59 is straight in the plane of the deck underframe and has a downturned length 50 at its outboard end,
 125 whereas the fore and aft spars have initial straight lengths in the plane of the deck underframe prior to curvature in said plane, each in the direction of the centre spar 59, and finally extend substantially
 130 parallel to the latter with downturned lengths 52 at

their outboard ends. The downturned end lengths 50 and 52 of the three spars 58 and 59 are similar and parallel to one another and the lower ends 54 and 56 thereof are attached to the stabiliser hull 12. Due to this spar arrangement, upward thrust caused by the buoyancy of the stabiliser hull 12 is transmitted through the deck 14 and the support structure 16 to the main hull 10.

The spars 58 and 59, over a major part of their lengths, support a platform in surface continuity with the deck 14. On this platform and adjacent the deck 14 is a passenger compartment 28 which has glass end walls 30 and 32 and a glass side wall 34 with doors 36 and provides protection for the passengers who do not desire to spend their time on an open passenger area 38 provided by the remainder of the platform. Appropriate restrooms, lounges, restaurants and the like are provided within the passenger compartment 28 for the comfort of the passengers. The passenger deck area 38 is surrounded by a guard rail 40 similar to guard rail 24 to provide protection for the passengers on the deck.

Deck 14 may be formed of conventional truss members as required to achieve the desired structural strength and rigidity.

Extending upwardly and outwardly from the main hull 10 are truss members 42 which are connected at their lower ends 44 to the support hull 10 and at their upper ends 46 to the deck 14. The truss members 42 are positioned to create an open triangulated truss configuration with the support hull 10 forming the lower chords and the deck 14 forming the upper chords with the truss members 42 as the connecting web. This configuration produces a very rigid structure which is capable of bridging the crests of adjacent waves to reduce the pitching, yawing and rolling of the deck 14 when the vessel is navigating rough seas. This configuration permits the waves to pass under the deck while experiencing very little resistance in the open support structure. Truss members 42 may be enclosed in stream-lined housings to further reduce resistance.

The downturned end lengths 50 and 52 of the spars 58 and 59 may be formed of telescopic construction with interior hydraulic cylinders and appropriate control circuitry to position the stabiliser hull at a desired distance below the level of the deck 14 as required to maintain the deck in a level orientation for the various loading conditions of motor vehicles and passengers. Additionally the lengths of the spars 58 and 59 outboards of the platform and between the latter and the downturned end lengths 52 and 50 may be similarly formed of telescopic construction to permit retraction of the stabiliser hull 12 towards the main hull 10 thereby permitting the vessel to enter a narrow harbour.

As best shown in Figure 4, propulsion for the vessel is provided by conventional propeller units each having an engine housing 60 enclosing therein a marine diesel engine or the like. Extending downwardly from each engine housing 60 is a drive shaft housing 62 in which a conventional drive shaft driven by the engine is rotated. At the lower end of each drive shaft, bevel gears transmit power to a conventional propeller 64 extending rearwardly

from a propeller housing 66 mounted at the lower end of the drive shaft housing 62.

As can be seen from Figure 4, there are three drive units 20 and the centre drive unit is positioned at the location which causes the vessel to travel in a straight line on a calm sea. This configuration permits propulsion of the boat by the single centre propeller drive unit with operation of the outside drive units providing any desired additional thrust. By controlling the speed of the outer drive units, the boat vessel be turned to port or starboard, depending on which unit is being operated. In case of failure of one drive unit, the remaining two could satisfactorily perform all necessary functions. Conventional controls can be provided for operation of the propulsion units in a conventional manner. Additionally, conventional rudders can be incorporated in the main hull 10 and/or the stabiliser hull 12, if desired.

A vessel as hereinbefore described provides a large capacity ferryboat or the like which is capable of navigating extremely rough seas since the hulls 10 and 12 are of elongate configuration and may be sized to bridge between the crests of adjacent waves while maintaining adequate structural strength and rigidity to withstand the loads imposed in such situations. The open configuration of the truss support structure 16 and connecting structure 18 permits waves to pass under the deck 14 while imposing minimum loads on the vessel.

From the foregoing detailed description, it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those skilled in the art, and it is intended that the invention should be comprised as embracing all such variations as fall within the scope of the appended claims.

105 CLAIMS

1. A surface vessel, particularly adapted for operation in rough seas, comprising an elongate and closed main hull, a deck mounted directly above said main hull on an open support structure extending upwardly from said main hull and with sufficient clearance from the latter to permit most waves to wash over the main hull and under the deck, an elongate and closed stabiliser hull which is small relative to said main hull, an outrigger structure integral with the said deck and downturned remote therefrom and there connected with said stabiliser hull, and multiple drive means operatively connected to the deck and the outrigger structure for contacting the water and providing thrust to the vessel with the drive means differentially controllable to permit various modes of operation, including forward, reverse, steering, and turning in place, thereby permitting operation of the vessel with or without a rudder.

2. A vessel according to Claim 1, wherein said support structure includes triangular open trusses fixed at a lower end thereof to said main hull and at an upper end thereof to said deck with said trusses extending outwardly and upwardly from said



their outboard ends. The downturned end lengths 50 and 52 of the three spars 58 and 59 are similar and parallel to one another and the lower ends 54 and 56 thereof are attached to the stabiliser hull 12. Due to this spar arrangement, upward thrust caused by the buoyancy of the stabiliser hull 12 is transmitted through the deck 14 and the support structure 16 to the main hull 10.

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2. A vessel according to Claim 1, wherein said support structure includes triangular open trusses fixed at a lower end thereof to said main hull and at an upper end thereof to said deck with said trusses extending outwardly and upwardly from said

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support hull.

3. A vessel according to Claim 1 or 2, wherein said deck is generally flat with an area for storage of motor vehicles positioned over said closed support
- 5 hull and a passenger compartment mounted adjacent said storage area to provide protection from the weather for passengers.
4. A vessel according to Claim 1, 2, or 3 wherein each of said drive means comprises an engine, a
- 10 drive shaft operatively connected to said engine, and a propeller operatively connected to said drive shaft.
5. A vessel particularly adapted for operation in rough seas, substantially as hereinbefore described with reference to the accompanying drawings.

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