April 20, 1965 WAI PO LOO 3,179,077

HYDRO WING SHIP

Filed Jan. 21, 1963 5 Sheets-Sheet 1

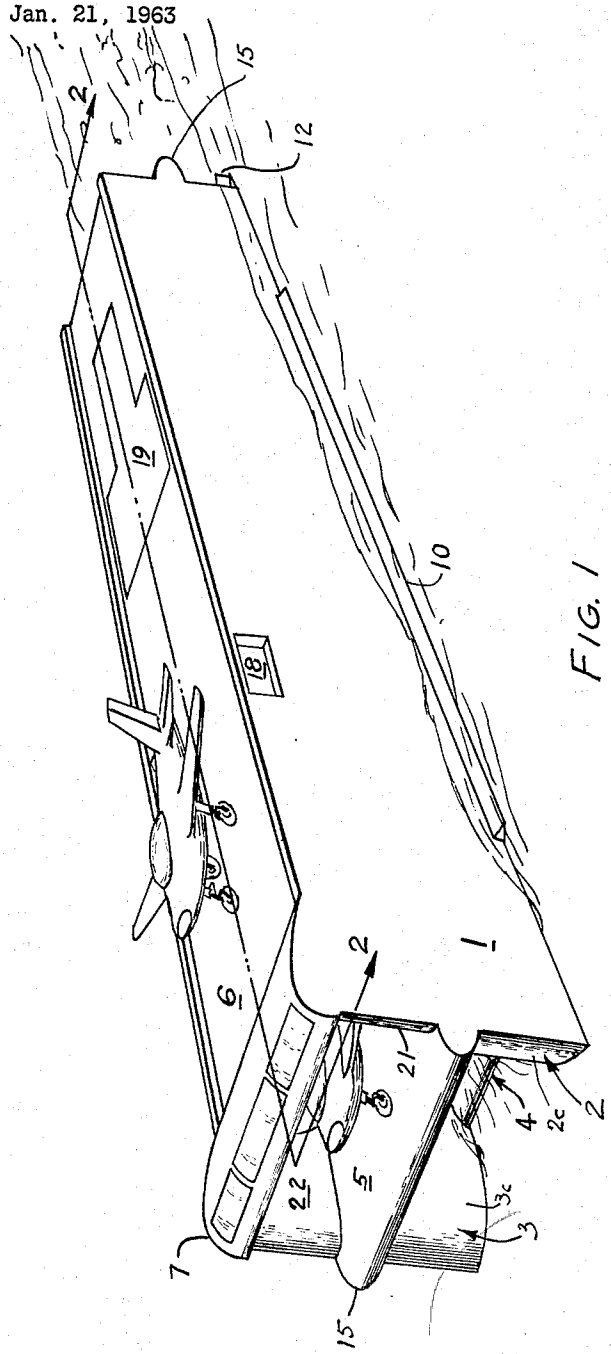


FIG. 1

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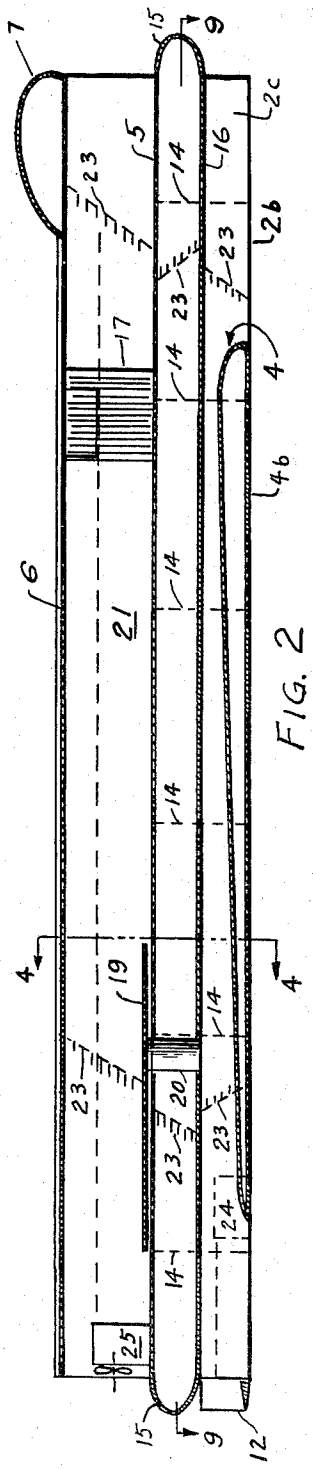


FIG. 2

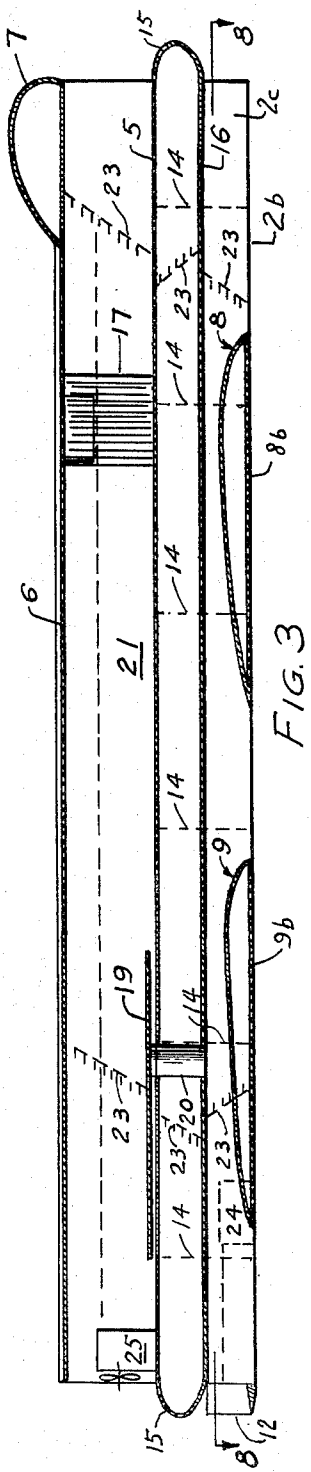


FIG. 3

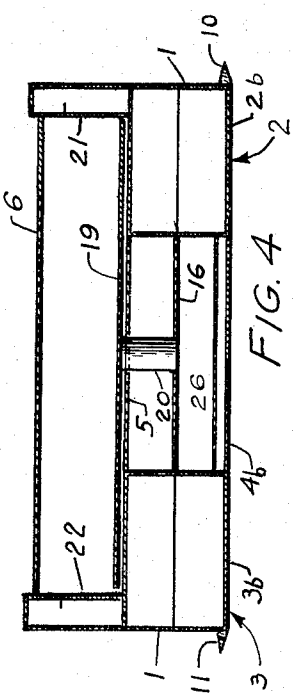


FIG. 4

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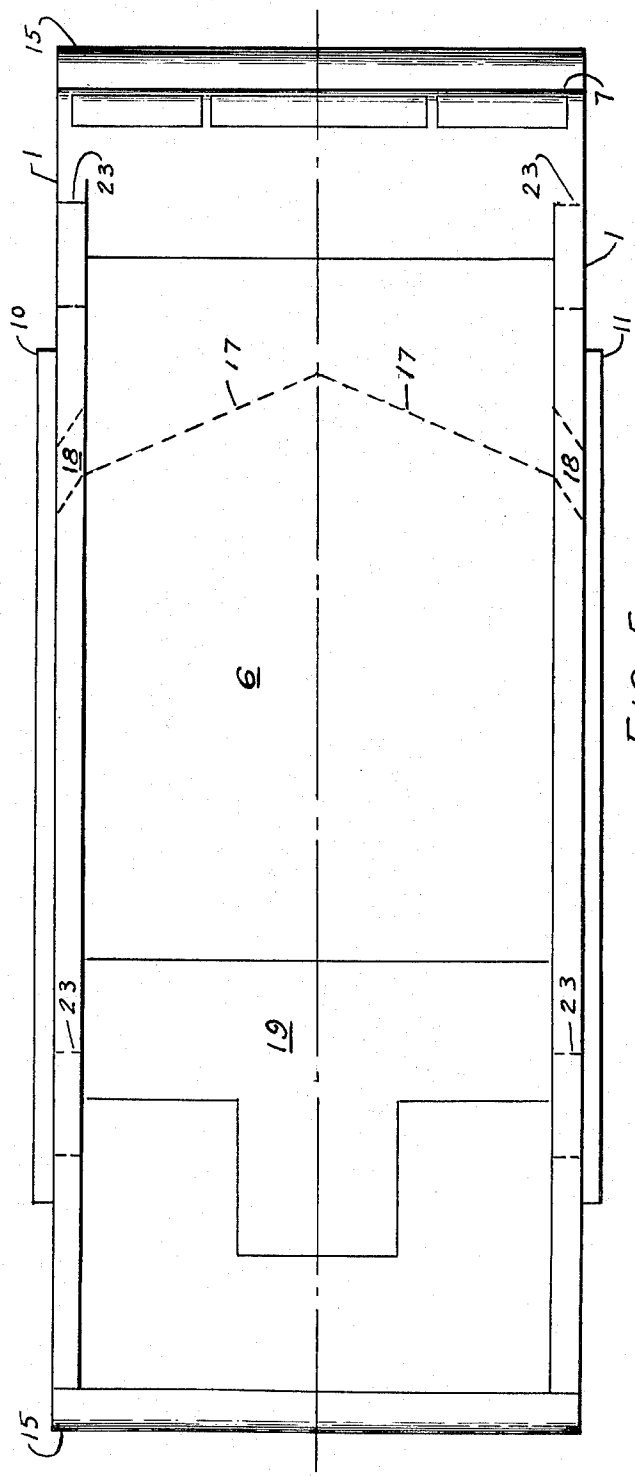


FIG. 5

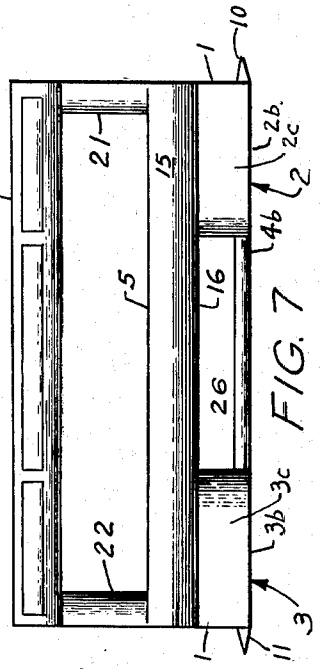


FIG. 7

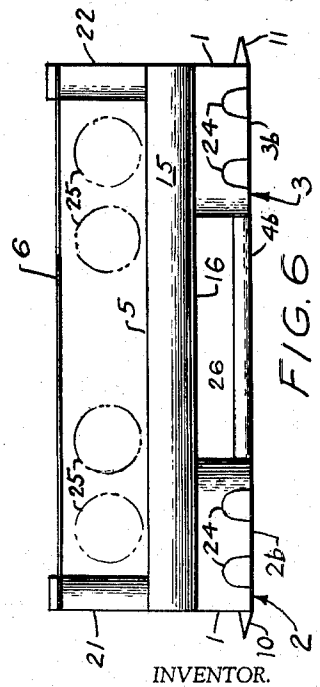


FIG. 6

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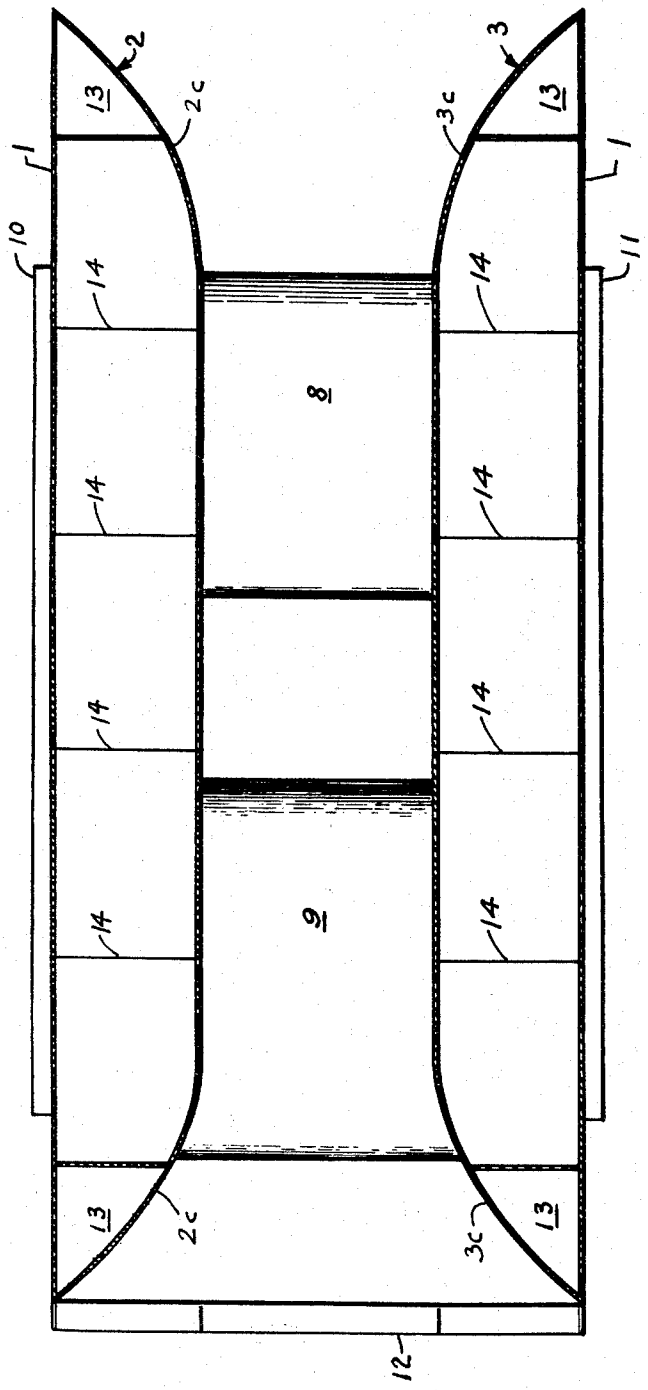


FIG. 8

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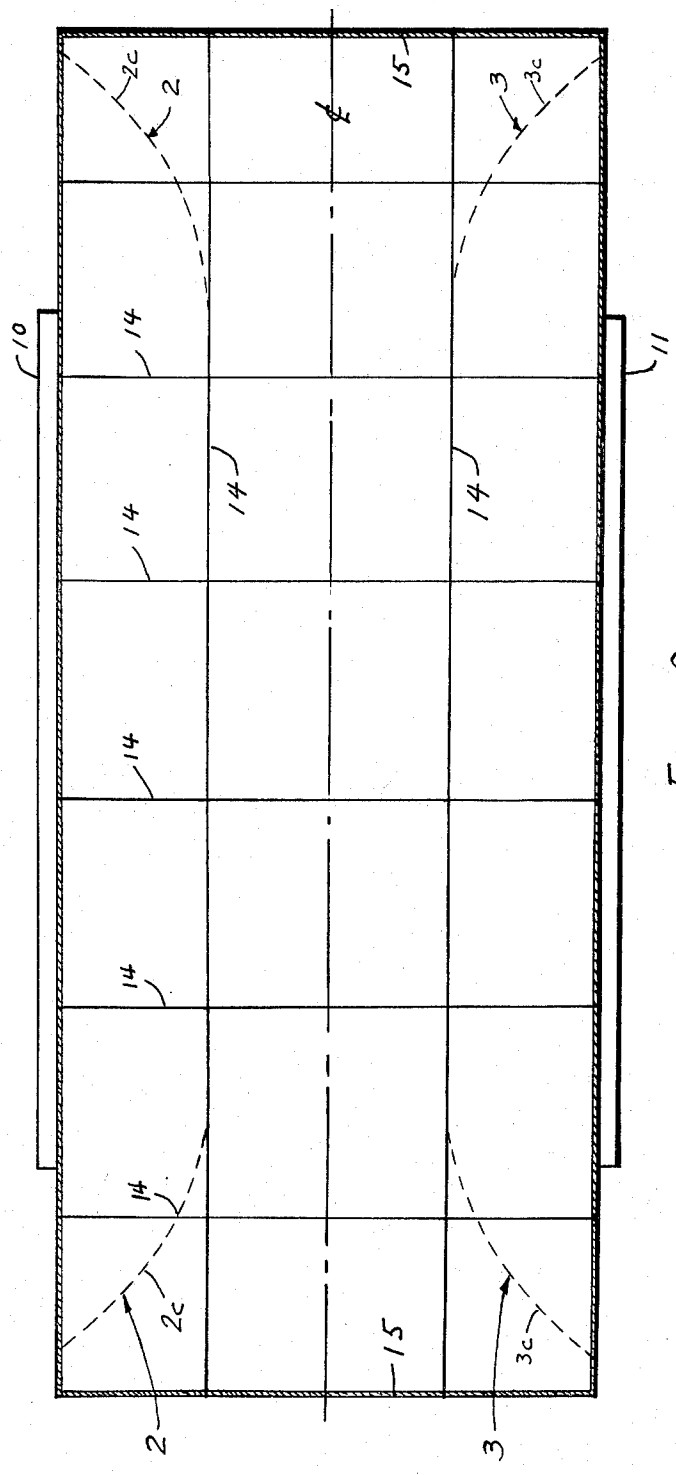


FIG. 9

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United States Patent Office 3,179,077 Patented Apr. 20, 1965

3,179,077

HYDRO WING SHIP

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Filed Jan. 21, 1963, Ser. No. 252,762
5 Claims. (Cl. 114—66.5)

This invention relates to a novel but useful form of ship designated by me as a "Hydro-Wing" ship which possesses the following outstanding functional, operational and tactical capabilities:

(1) My main object is to design this hydro-wing ship as a high speed aircraft carrier of a very much smaller size than a conventional aircraft carrier and having a tentative capacity of a few planes only. By virtue of its relatively small size and high speed, the tactical advantage of an ocean-striking force comprising a number of these ships are maximum mobility, maneuverability, dispersal but minimum exposure as objects for enemy attack. The cost of construction, as suggested by the structural features which are within the capability of present-day ship-building industries, can reasonably be expected to be comparable to that of a conventional merchant ship of equal displacement capacity.

(2) Because of its relatively small size, high speed and maneuverability, it can also be modified and used (with the proper equipment and weapons) as a destroyer, a submarine chaser, or as an assault-troop landing craft.

(3) Because my design of this "Hydro-Wing" ship retains the full floating capacity of a conventional merchant ship of equal tonnage, it has the further potential of being converted for non-military applications such as cargo ship, whaler, or passenger ship.

For the purpose of clarifying the nature of the present invention, several exemplary embodiments of the invention are illustrated in the hereinbelow-described figures of the accompanying five sheets of drawings and are described in detail hereinafter.

FIG. 1 is a reduced-size perspective view of one exemplary embodiment of the hydro-wing ship of the present invention.

FIG. 2 is a longitudinal sectional view taken along the center line of the exemplary embodiment of the invention shown in FIG. 1 in the direction of the arrows 2—2 thereof.

FIG. 3 is a view similar to FIG. 2 but illustrates a slightly modified form of the invention with respect to the hydro-wing means at the bottom of the ship, which in this modification comprises a tandem arrangement including two longitudinally spaced hydro-wing portions of shorter chordwise extent than the single hydro-wing portion of the first form of the invention as best shown in FIG. 2.

FIG. 4 is a cross-sectional view, looking aft, taken in the direction of the arrows 4—4 of FIG. 2.

FIG. 5 is a top plan view of the exemplary first form of the hydro-wing ship of the present invention as shown in FIG. 1 and, in particular, shows the top plan view of the aircraft landing deck at the top thereof.

FIG. 6 is a rear elevational view of the rear end or stern of the novel hydro-wing ship of the present invention.

FIG. 7 is a front elevational view of the front end, bow or stern end of the novel hydro-wing ship of the present invention.

FIG. 8 is a sectional view looking downwardly toward the lower portion of the ship and taken in the direction of the arrows 8—8 of FIG. 3.

FIG. 9 is a sectional view looking downwardly toward the lower portion of the ship and taken in the direction of the arrows 9—9 of FIG. 2.

A conventional hull is to be divided and parted along the longitudinal center line, from stem to stern; the planes of separation 1 on both halves (now being open) are to be completely covered and closed up with new plates 1 to form two floating hulls 2 and 3 (see FIG. 8); these two parted-hulls 2 and 3 are then interchanged in position, left to right and right to left, but placed further apart and parallel, at a lateral clearance distance equal to the span of an air-plane plus a sidewise clearance; the two parted-hulls 2 and 3 are then permanently and rigidly connected by three major bridge-like structures at different levels (see FIG. 6 and FIG. 7); (*a*) the hydro-wing 4 at the lowest level, (*b*) the hangar and take-off deck at mid-level, and (*c*) the landing deck 6 and navigation bridge 7 at the top level. This arrangement forms the basic configuration.

The hydro-wing 4 (see FIG. 2) which is normally sub-merged under water, is shaped like an airfoil or wing section with the left and right ends attached to the parted hulls 2 and 3, and with the leading edge reaching the stem and the trailing edge extending to the stern. (Alternatively, two hydro-wings of shorter chord lengths may be attached in tandem instead of a long one, depending on the speed range desired. These two shorter hydro-wings 8 and 9 are shown in FIG. 3 and FIG. 8.) When the ship moves forward at cruising speed or faster, the water flowing past the hydro-wing 4 (or 8 and 9) creates a hydrodynamic lift in exactly the same manner as the aerodynamic lift created by an airplane wing in an air stream. As a result, the front portion of the parted-hulls 2 and 3 will be raised above water (see FIG. 1); drag and resistance are greatly reduced; and high speed is thus possible.

Referring to FIGURES 4, 5, 6, 7 and 8, it can be seen that there are two auxiliary hydro-wings 10 and 11, one on each side of the hulls 2 and 3 respectively, and at the same level under water, of shorter but equal spans. These auxiliary hydro-wings also contribute a certain amount of lift, and in addition, serves to reduce pitching and rolling of the ship and thus improves stability.

At the stern and across the full width of the ship (see FIGS. 2, 3, and 8) are a row of vertical and horizontal segmental rudders 12. The horizontal rudders can be controlled and actuated individually or simultaneously for trimming action. In addition, there are fore and aft peak tanks 13 (see FIG. 8) used to regulate the trim of the ship and the angle of incidence of the hydro-wing.

The watertight bulkheads 14 are of conventional construction and need no elaboration.

Referring to FIGURES 2, 3, 5 and 7 again, it can be seen that the bridge house 7 spans the full width of the ship, and the cross-section of the bridge house is streamlined and shaped exactly like that of an airplane wing-section but much enlarged. By virtue of this wing-shaped airfoil, the bridge house 7 has exactly the same action as that of an enlarged airplane wing, i.e., it creates an aerodynamic lift when traveling forward in air. And because of its foremost location, it contributes a substantial amount of additional uplift with a maximum moment arm or leverage about the center of gravity of the ship, thereby further lifting the front portion of the hulls 2 and 3 out of water while moving through water rapidly.

The above paragraphs explain the fundamental dynamics of my hydro-wing ship; how the lift for the hulls 2 and 3 is created; how the drag and resistance in water are substantially reduced; and as a result, how high speed equal to or surpassing the airplane take-off or landing speed can be realized.

The following paragraphs further explain the secondary but otherwise important features of construction.

Referring to FIGURES 1, 2, 3, 4, 5, 6, 7 and 8, it can

be seen that the major structure of the ship is essentially constructed by separating a conventional hull along the longitudinal vertical central plane; covering up the planes of separation **1** on each half to form two floating hulls **2** and **3**; interchanging positions of the two; separating further apart and then connecting by three major bridge-like structures across at three levels, (*a*) the hydro-wing **4**, (*b*) the flight deck **5**, and (*c*) the landing deck **6** with the bridge house **7** in front.

The hydro-wing **4** is located at the lowest level. Its underneath surface and the flat bottoms of the two parted hulls **2** and **3** are coplanar and, together, form a continuous near-flat surface. When the stem is lifted up above water, this continuous surface acts if it were a water ski, greatly enhanced, of course, as compared to the size of a conventional water ski.

The flight deck **5** is located directly above the hydro-wing **4**. The width of the flight deck **5** extends sidewise at the same level, over and including the two parted hulls **2** and **3**. The flight deck **5** itself is a double-deck structure, with both the stem and stern ends covered up with curved-over plates **15** as shown. The top deck **5** is the flight deck; while the space inbetween the top and the bottom decks serves as crews quarters, storage and cargo space. The underneath surface of the lower deck **16** (see FIG. 2 or 6) is covered with smooth plates so that it also contribute part of the hydrodynamic lift. It also serves as the double bottoms of a conventional ship and, together with the hulls **2** and **3** on both sides and the hydro-wing **4** below, forms a rectangular water tunnel **26**.

At the front portion of the flight deck **5** (FIGS. 2, 3 and 5) and at a distance considered adequate to provide parking area for an airplane, is a louvre-type rolling partition **17**. This partition serves to deflect the jet or propeller blast sidewards through exit ports **18** (see FIGS. 1 and 5) to the atmosphere, thus protecting the other airplanes and personnel at the rear. After the first has taken off, this partition will be rolled aside to allow the next airplane in the rear to advance to the take-off position. The partition **17** will then be closed again.

Immediately behind the rolling partition **17** (see FIGS. 2 and 3) is the get-ready area where the subsequent airplanes are parked in line. Behind this area and near the stern is a platform-elevator **19** for transferring airplanes from the landing deck **6** to flight deck **5**, or vice versa. This platform is contoured like the letter T approximating the plan-view profile of the airplane and, when raised, fits exactly into and flush with a correspondingly profiled opening directly above in the landing deck **6**. The operation of this elevator, up and down, is by means of a hydraulic telescopic shaft **20** (see FIGS. 2 and 4) sunken vertically in the flight deck at the position indicated.

The landing deck **6** is essentially a flat platform supported on both sides by the alleyway casings **21** and **22**, shown in FIGS. 4, 6 and 7. This alleyway is provided for interdeck foot traffic by means of ladders **23**, and also passages from stem to stern and vice versa. It also serves the purpose of observation stations by the crew members of the landing deck **6**. Openings are provided for the crew members to crawl out to the landing deck **6** when necessary.

For the airplane to land, the speed of the ship is to be adjusted, through radio and radar coordination with the incoming airplane pilot, to match the landing speed of the airplane. (In other words, the relative speed disparity of the two, the airplane and the ship, will be reduced to near-zero.) Thus after touchdown, the rolling distance of the landed airplane is at a minimum and is limited to dozens of feet. Under such a condition, the airplane can be arrested readily by conventional arresting devices, not shown.

The arrangement of the landing deck **6** above the flight deck **5**, flanked at both sides by the alleyway casings **21** and **22** (see FIGS. 1 and 4) forms in effect a wind tunnel of rectangular cross section. This wind-tunnel effect has the outstanding advantage of directing the airstream in the line of flight and greatly assist airborne stability at the instant of taking off.

For propulsion of the ship, two types of power plants are used; the high speed diesel engines **24** for normal cruising (see FIGS. 2 and 3) and the aero engines, piston type or turbo-jets **25**, for boosting the cruising speed to take-off speed.

For purposes of clarification with respect to the language employed in the appended claims, please note the following:

The previously mentioned two floating hulls **2** and **3** may be said to comprise similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts **2***b* and **3***b*, as best shown in FIGS. 4, 6 and 7. In the exemplary forms of the invention illustrated, said ship hull portions **2** and **3** have similar inwardly convex side wall parts **2***c* and **3***c* as best shown in FIGS. 6, 7 and 9 and also have similar oppositely outwardly directed, substantially flat, outer side wall parts comprising the previously mentioned outer plates or walls **1** which lie in similar laterally spaced substantially vertical planes.

The two hulls portions **2** and **3** are effectively laterally interconnected in laterally spaced substantially parallel relationship by what might be generally termed interconnection means which, in its broadest form, merely comprises the bottom hydro-wing means designated by the reference numeral **4** in the first form of the invention shown in FIGS. 1, 2, 4, 7 and 9 (and having a flat bottom planing surface **4***b*) and designated by the reference numerals **8** and **9** in the tandem hydro-wing modification of the invention shown in FIGS. 2 and 8. However, in the exemplary forms of the invention illustrated, said interconnection means also is shown as including a vertically intermediate aircraft flight take-off deck means which comprises the previously mentioned flight deck **5**, and is also shown as including a vertically uppermost aircraft landing deck means which, in the exemplary form of the invention illustrated, comprises the previously mentioned landing deck **6** which is carried by the previously mentioned alleyway casings **21** and **22**, which may be said to comprise the upper extensions referred to in the appended claims. The previously referred to navigation bridge **7** may be said to comprise the laterally directed bridge-house referred to in the appended claims.

I claim:

1. A hydro-wing ship comprising: substantially similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts and being provided with laterally directed interconnection means rigidly joining and connecting said hull portions together in laterally spaced, substantially parallel relationship with said bottom planing surface parts lying in a common bottom plane, said interconnection means comprising hydro-wing means extending in a lateral span-wise direction between said laterally separated hull portions adjacent to the bottoms thereof and being of susbtantial longitudinal extent in a chord-wise fore-and-aft direction and having a substantially flat bottom planing surface part lying in said common bottom plane and contiguous with and connected to said bottom surface parts of said ship hull portions and, together therewith, comprising an integral water ski, said hydro-wing means having an upper surface part effectively upwardly convexly curved along a longitudinal fore-and-aft direction to define a hydrofoil adapted to produce hydrodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through a body of water; said ship hull portions being provided with similar upper extensions projecting upwardly therefrom adjacent to outer sides of said ship hull portions and rigidly integrally connected thereto, said interconnection means also comprising a substantially horizontal intermediate aircraft

flight take-off deck means rigidly connected laterally between said separated ship hull portions at a level vertically spaced above said hydro-wing means and a substantially horizontal uppermost aircraft landing deck means rigidly connected laterally between said separated ship hull portions adjacent to the tops of said upper extensions thereof at a level vertically spaced above said intermediate aircraft flight take-off deck means.

2. A hydro-wing ship comprising: substantially similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts and being provided with laterally directed interconnection means rigidly joining and connecting said hull portions together in laterally spaced, substantially parallel relationship with said bottom planing surface parts lying in a common bottom plane, said interconnection means comprising hydro-wing means extending in a lateral span-wise direction between said laterally separated hull portions adjacent to the bottoms thereof and being of substantial longitudinal extent in a chord-wise fore-and-aft direction and having a substantially flat bottom planing surface part lying in said common bottom plane and contiguous with and connected to said bottom surface parts of said ship hull portions and, together therewith, comprising an integral water ski, said hydro-wing means having an upper surface part effectively upwardly convexly curved along a longitudinal fore-and-aft direction to define a hydrofoil adapted to produce hydrodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through a body of water; said ship hull portions being provided with similar upper extensions projecting upwardly therefrom adjacent to outer sides of said ship hull portions and rigidly integrally connected thereto, said interconnection means also comprising a substantially horizontal intermediate aircraft flight take-off deck means rigidly connected laterally between said separated ship hull portions at a level vertically spaced above said hydro-wing means and a substantially horizontal uppermost aircraft landing deck means rigidly connected laterally between said separated ship hull portions adjacent to the tops of said upper extensions thereof at a level vertically spaced above said intermediate aircraft flight take-off deck means, and, together therewith, defining and comprising longitudinal wind tunnel means operable to effectively longitudinally collimate air flow therethrough whereby to greatly increase the air-borne stability of an aircraft during take-off.

3. A hydro-wing ship comprising: substantially similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts and being provided with laterally directed interconnection means rigidly joining and connecting said hull portions together in laterally spaced, substantially parallel relationship with said bottom planing surface parts lying in a common bottom plane, said interconnection means comprising hydro-wing means extending in a lateral span-wise direction between said laterally separated hull portions adjacent to the bottoms thereof and being of substantial longitudinal extent in a chord-wise fore-and-aft direction and having a substantially flat bottom planing surface part lying in said common bottom plane and contiguous with and connected to said bottom surface parts of said ship hull portions and, together therewith, comprising an integral water ski, said hydro-wing means having an upper surface part effectively upwardly convexly curved along a longitudinal fore-and-aft direction to define a hydrofoil adapted to produce hydrodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through a body of water; said ship hull portions being provided with similar upper extensions projecting upwardly therefrom adjacent to outer sides of said ship hull portions and rigidly integrally connected thereto, said interconnection means also comprising a substantially horizontal intermediate aircraft flight take-off deck means rigidly connected laterally between said separated ship hull portions at a level vertically spaced above said hydro-wing means and a substantially horizontal uppermost aircraft landing deck means rigidly connected laterally between said separated ship hull portions adjacent to the tops of said upper extensions thereof at a level vertically spaced above said intermediate aircraft flight take-off deck means, the front of said uppermost aircraft landing deck means and corresponding front parts of said upper extensions being provided with a laterally directed bridge-house extending the width thereof and having the cross-sectional shape of an airfoil in a longitudinal direction to effectively define and comprise an aerodynamic wing section adapted to produce aerodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through ambient atmosphere.

4. A hydro-wing ship comprising: substantially similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts and being provided with laterally directed interconnection means rigidly joining and connecting said hull portions together in laterally spaced, substantially parallel relationship with said bottom planing surface parts lying in a common bottom plane, said interconnection means comprising hydro-wing means extending in a lateral span-wise direction between said laterally separated hull portions adjacent to the bottoms thereof and being of substantial longitudinal extent in a chord-wise fore-and-aft direction and having a substantially flat bottom planing surface part lying in said common bottom plane and contiguous with and connected to said bottom surface parts of said ship hull portions and, together therewith, comprising an integral water ski, said hydro-wing means having an upper surface part effectively upwardly convexly curved along a longitudinal fore-and-aft direction to define a hydrofoil adapted to produce hydrodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through a body of water; said ship hull portions being provided with similar upper extensions projecting upwardly therefrom adjacent to outer sides of said ship hull portions and rigidly integrally connected thereto, said interconnection means also comprising a substantially horizontal intermediate aircraft flight take-off deck means rigidly connected laterally between said separated ship hull portions at a level vertically spaced above said hydro-wing means and a substantially horizontal uppermost aircraft landing deck means rigidly connected laterally between said separated ship hull portions adjacent to the tops of said upper extensions thereof at a level vertically spaced above said intermediate aircraft flight take-off deck means, said upper extensions comprising hollow enclosed passageway means for facilitating travel between various portions of the ship.

5. A hydro-wing ship comprising: substantially similar longitudinal left and right hollow buoyant ship hull portions having similar substantially flat bottom planing surface parts and being provided with laterally directed interconnection means rigidly joining and connecting said hull portions together in laterally spaced, substantially parallel relationship with said bottom planing surface parts lying in a common bottom plane, said interconnection means comprising hydro-wing means extending in a lateral span-wise direction between said laterally separated hull portions adjacent to the bottoms thereof and being of substantial longitudinal extent in a chord-wise fore-and-aft direction and having a substantially flat bottom planing surface part lying in said common bottom plane and contiguous with and connected to said bottom surface parts of said ship hull portions and, together therewith, comprising an integral water ski, said hydro-wing means having an upper surface part effectively upwardly convexly curved along a longitudinal fore-and-aft direction to define a hydrofoil adapted to produce hydrodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through a body of water; said ship hull

portions being provided with similar upper extensions projecting upwardly therefrom adjacent to outer sides of said ship hull portions and rigidly integrally connected thereto, said interconnection means also comprising a substantially horizontal intermediate aircraft flight take-off deck means rigidly connected laterally between said separated ship hull portions at a level vertically spaced above said hydro-wing means and a substantially horizontal uppermost aircraft landing deck means rigidly connected laterally between said separated ship hull portions adjacent to the tops of said upper extensions thereof at a level vertically spaced above said intermediate aircraft flight take-off deck means, and, together therewith, defining and comprising longitudinal wind tunnel means operable to effectively longitudinally collimate air flow therethrough whereby to greatly increase the air-borne stability of an aircraft during take-off, the front of said uppermost aircraft landing deck means and corresponding front parts of said upper extensions being provided with a laterally directed bridge-house extending the width thereof and having the cross-sectional shape of an airfoil in a longitudinal direction to effectively define and comprise an aerodynamic wing section adapted to produce aerodynamic lift in response to movement thereof in a longitudinal fore-and-aft direction through ambient atmosphere.

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