Oct. 20, 1953 J. V. MARTIN 2,656,136

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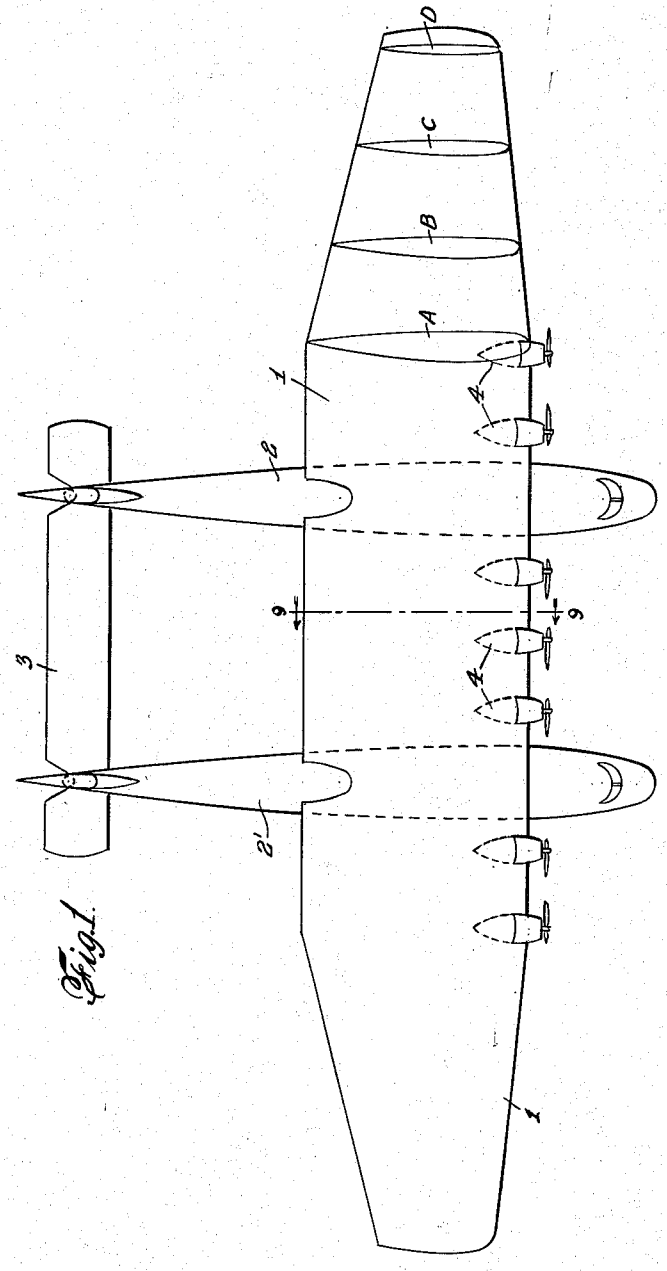


Fig. 1.

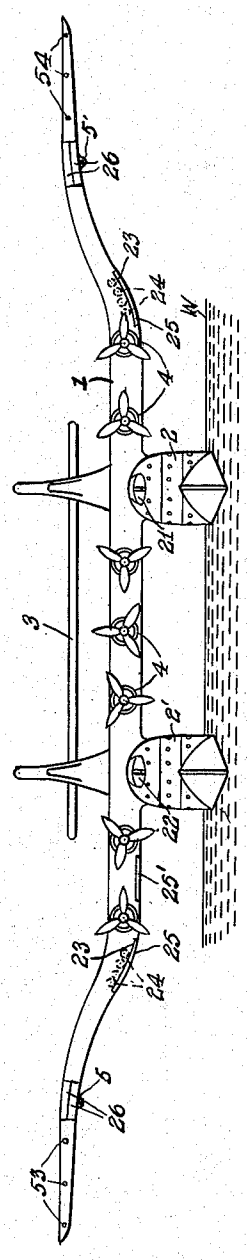


Fig. 2.

INVENTOR.

James V. Martin

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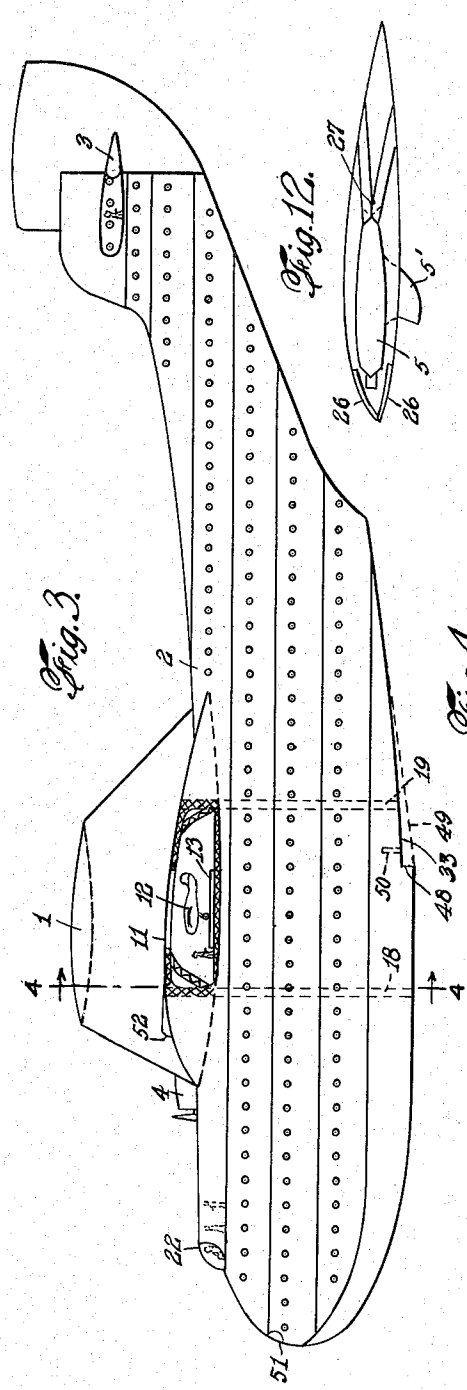


Fig. 3.

Fig. 12.

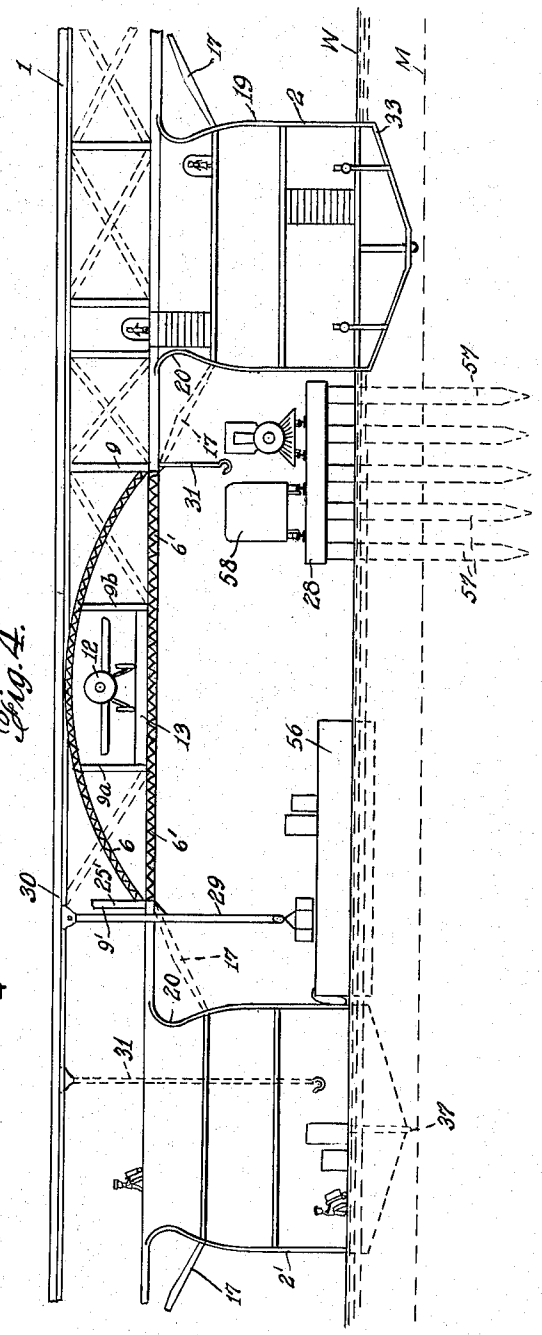


Fig. 4.

INVENTOR.

James V. Martin

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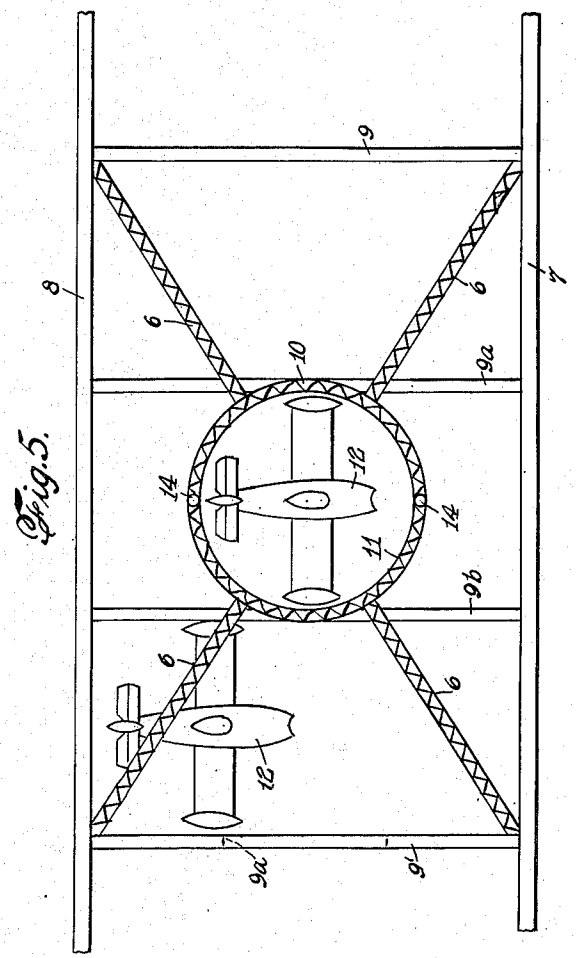


Fig. 5.

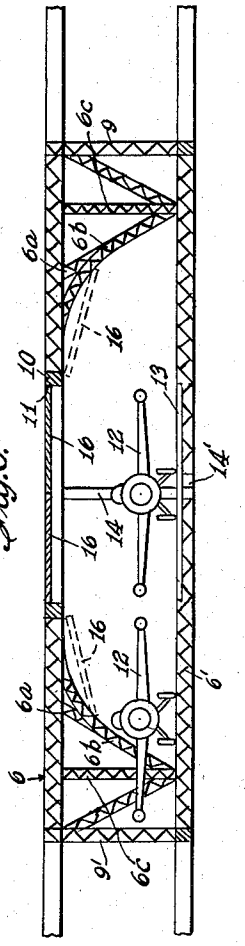


Fig. 6.

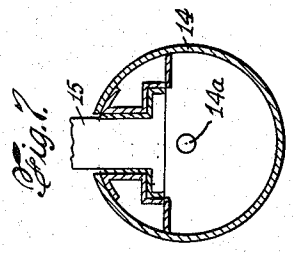


Fig. 7.

INVENTOR.

James V. Martin

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Fig. 8.

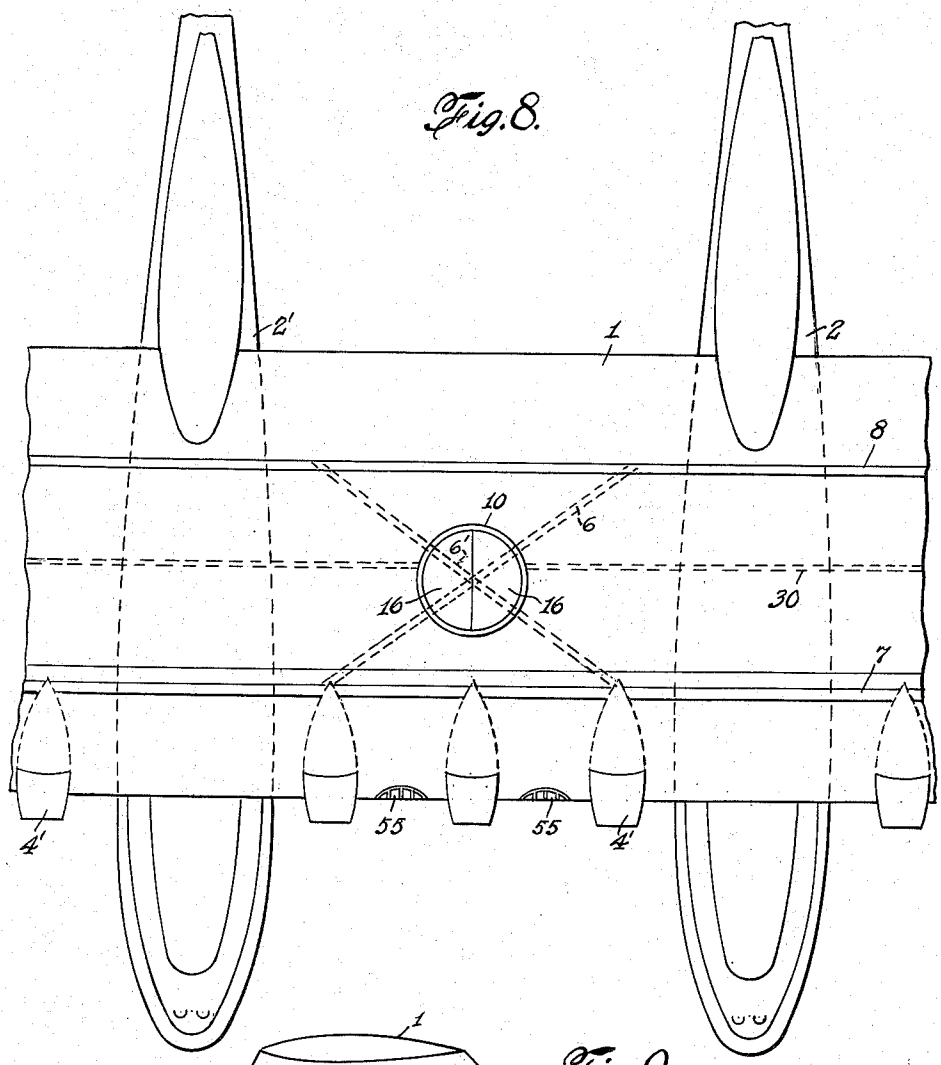
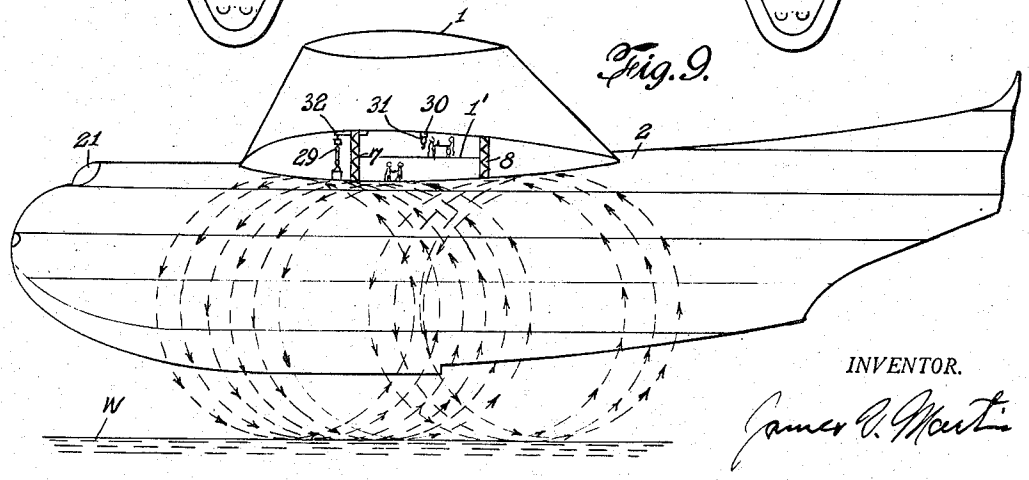


Fig. 9.



INVENTOR.

James V. Martin

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Fig. 10.

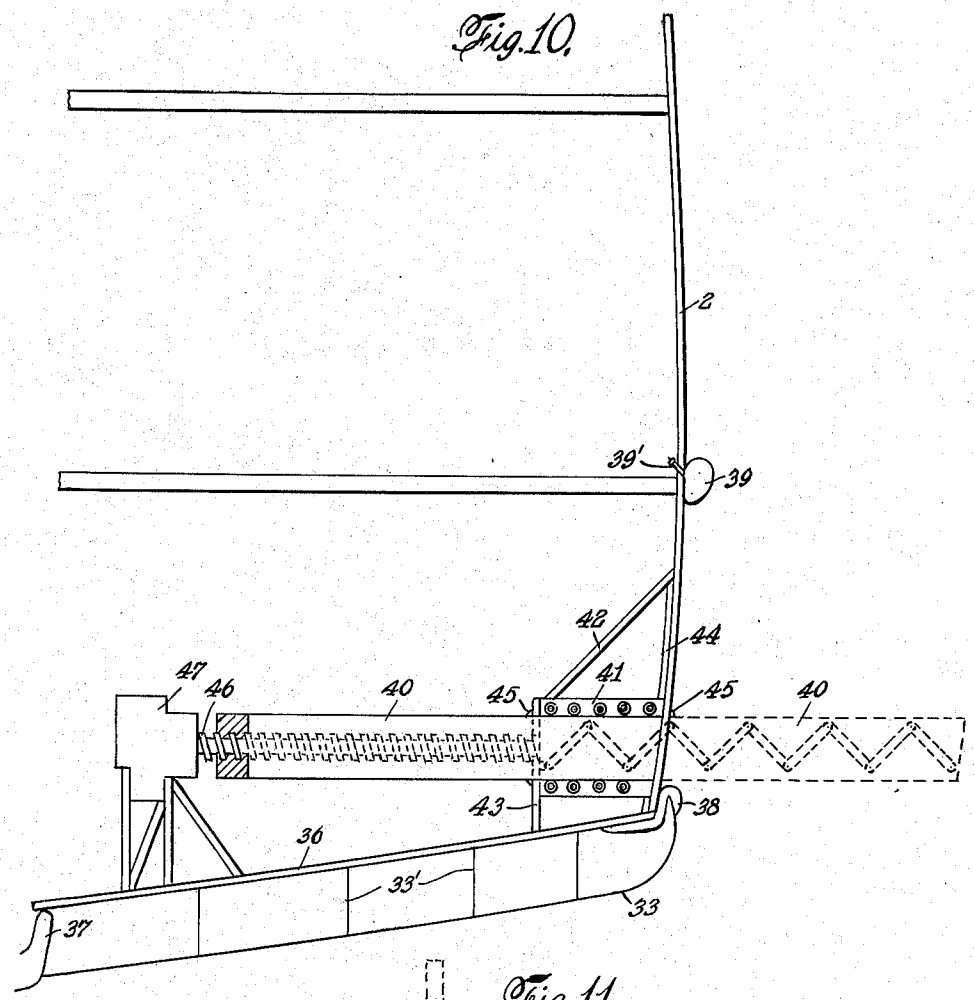
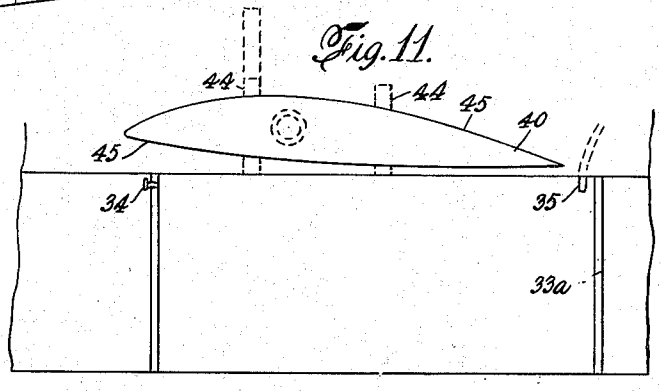


Fig. 11.



INVENTOR.

James V. Martin

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2,656,136

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2,656,136

FLYING SHIP

James V. Martin, Paramus, N. J.

Application January 3, 1951, Serial No. 204,162

13 Claims. (Cl. 244—106)

1

This invention relates to the union of two great sciences, hydrodynamics and aerodynamics in a single instrumentality to dominate air, sea and land in both war and commercial peacetime operations of transportation.

The primary object of the invention is to provide a seaworthy ocean vessel utilizing the old sailing principle of aerodynamics for lift instead of propulsion so that the power required for increased velocity will be reduced by the wing's influence upon the hulls. In other words a catamaran for ocean wave stability and a wing to hold the twin hulls in parallelism, provide inclosed space for passengers and cargo and, most important of all, to progressively lift the hulls out of their depth of water draft and roll the entire craft forward upon a superlifting vortex billow of air just above the mean height of the waves.

A further object of the invention is to provide a diagonal anti-torque truss located within the central wing portion to retain the twin hulls in parallelism against the wrenching action of the ocean waves and to adapt the said wing section to receive and discharge jet airplanes.

A still further object of the invention is to improve the aerodynamic characteristics of the wing outboard portions by avoiding dihedral angles while elevating the end portions above the impacts of ocean waves and making their top surfaces horizontal.

Another object of the invention is to mitigate the impact of waves at velocity upon the hulls of the flying ship.

Still another object of my invention is to lower the time required for loading and discharging cargo.

Other objects of my invention will become apparent by the following descriptions of the drawings and by the appended claims.

Fig. 1 is a plan view of my invention, showing the right angle profiles of the wing ends at stations A, B, C and D.

Fig. 2 is a view in front elevation.

Fig. 3 is a view in side elevation looking at the port side of the starboard hull, the center portion of the main wing being exposed to indicate location of internal wing trussing and placement of jet airplane.

Fig. 4 is a view taken along the line 4—4 of Fig. 3.

Fig. 5 is a view looking down upon the central wing portion with the upper surface of the wing removed so as to reveal location of diagonal trusses and jet aircraft.

Fig. 6 is a view in elevation looking from front

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to rear into the interior of the portion of the wing shown in Fig. 5.

Fig. 7 is a plan view, partly in section, looking at one of the posts 14, shown in Figs. 5 and 6.

Fig. 8 is a larger view looking down on the central portion of my invention as shown in Fig. 1.

Fig. 9 is a diagrammatic view indicating the region of "water interference" as located between the hulls 2 and 2' and indicating the relative size of the wing interior at stations outside of the central wing portions already shown.

Fig. 10 is an enlarged front elevational view of the typical aspect of a lower port side of either hull.

Fig. 11 is a side elevation of the lowest portion of the said hull looking toward the outside of said hull as shown in Fig. 10, and

Fig. 12 is a side elevational view indicating the position of a set of twin jet engines located outboard in each elevated section of my wing for the flying ship.

Proceeding now to the more detailed description of my invention, similar parts will be designated by the same numerals throughout the several views: 1 indicates the main wing of my catamaran craft, 2 is the port hull and 2' the starboard hull. 3 indicates the horizontal stabilizer of the ship's empennage and 4 the turboprop power units, while 5 indicates the twin jet engines located well outboard on the elevated portions of my main wing.

The principal part of my flying ship is the wing 1 in its relationships to the twin hulls 2 and 2'. In general the wing structure is of the stressed skin type and most of the said skin is in two sheets separated by bent aluminum or extruded metal forms, such as disclosed in my former patents, Nos. 2,231,524 and 2,365,205; however, in the present invention, I show diagonal anti-torque trusses 6 extending between the front wing spar 7 and the rear wing spar 8 and also between the union of the said spars with fore and aft rib structures 9 on the port side of wing center and 9' on the starboard side of wing center. The bottom diagonal member 6' of the trusses continues uninterrupted from the said unions on one side of wing center through the wing center to the opposite union, i. e. each end of each truss terminates at either the front or rear wing spar. The upper member 6*a* of each diagonal truss, reinforced by members 6*b* and 6*c* connects structurally with a strong circular truss member 10 designed to carry the torque stresses, originating through uneven flotation of hulls 2 and 2', around an opening 11 in the upper wing skin through which I propose to receive and dis-

charge jet type airplanes 12 or any other type aircraft of proper size. It will be understood that the union between the stressed skin of the wing 1 and the wing ribs and truss members to the wing skin is to follow the most approved practice.

In Figs. 3, 4 and 6 an elevator platform 13 which has an upper surface contour conforming to the upper central wing surface which normally closes the hole 11. This platform 13 is raised and lowered by means of electric motors 14' located at the base and inside of posts 14. Each post contains a guided hoist 15, see Fig. 7, and the electric motors are synchronized so as to raise the platform evenly on each post with the object of replacing the doors 16 which normally close the opening 11, but which are arranged to be moved into dotted positions shown in Fig. 6 when it is desired to exit an aircraft. The said doors separate at their centers as indicated at Fig. 6 moved by servomotors, see my Patent No. 1,627,191, and No. 1,672, 985, to make way for the platform 13 with the plane 12 secured to it by a releasing hook not shown. 14a, the small circle in the center of post 14, see Fig. 7, represents a spiral screw like 46 of Fig. 10, driven by electric motor 14' similar to 47 of Fig. 10. An extension from guided hoist 15 acts like a nut, similar to part 40 of Fig. 10 and will travel up and down on 14a.

The diagonal internal wing trusses 6 make a structural connection with each hull by means of retractable braces 17 see Fig. 4 and for details of means to retract and house such braces see my Patent 2,365,205, particularly Figs. 4, 5, 6, 6a, 7, 8 of the said patent. This connection is at the hull side where the 'tween deck makes a strength carry-through to a similar brace on the outboard side of both hulls. The inboard braces 17 in Fig. 4 are dotted to illustrate that these four braces should be retracted and housed for the super-lift condition illustrated in Fig. 9, but for rough wave conditions it is advised the braces all be in extended position to provide major strength between wing and hulls. In full flight all such braces should be retracted and neatly housed as, in the air; there are no stresses sufficiently large which call for the anti-torque type of trussing.

At one side of wing center I show in Figs. 5 and 6 an additional parked plane just to indicate storage space available near the exit 11 and the platform 13. At 9a I indicate an opening in the rib 9', see Fig. 5, through which planes can be moved laterally and in Fig. 2 I indicate lower wing panels 25 and 25' through which planes can be received by hoists such as 31 of like sort to 29, see Figs. 9 and 4. Hoist 29 travels on track 32 and similar hoist 31 travels on track 30. Both tracks run through the wing and all the way laterally up to the twin jet motor positions. Track 30 is not continuous through the circle 10 and it is assumed that as many hoists such as it will be employed on both tracks 30 and 32 as are needed to load and unload the flying ship rapidly. I have not shown as many piers 28 nor lighters 56 as may properly be employed to load and discharge the ship at one time employing all the practicable hatches 25' and sliding doors 25 for which provision can be made. At 25' in Fig. 4, a hinged hatch cover is shown. For similar structure see Fig. 5 of Patent No. 2,365,205. However, larger openings such as 25' of Fig. 2 which permit entrance for planes like 12 should be of the sliding panel type.

Typical frames for each hull are indicated at 18 and 19, see also type of structure in Patent No. 2,365,205, Fig. 5. For added efficiency of air flow I provide fillets 20 where the bodies 2 and 2' merge structurally into the wing 1. Pilot control houses 21 and 22 are shown in the forward upper portion of each hull and it is contemplated that well known means for operating the controls for the vessel, such as the usual longitudinal flaps, ailerons and rudders will permit operation should one wheel house and navigating room be shot away or otherwise incapacitated.

The wing 1, superposed over the two hulls, not only holds the two hulls in parallel catamaran alignment making the craft seaworthy, but it also provides great loading and storage space for passengers and cargo thus saving the parasite drag otherwise required for comparable body area and provides in addition the type of wing end having its upper surface top profile ordinates horizontal and in a straight line in frontal elevation thus giving aerodynamic efficiency of a high order, but the wing central portion in combination with the inner sides of the two hulls provides a scientific phenomenon not enjoyed by either a single hull ocean vessel or an airplane per se, i. e., the ability to increase velocity at only a small fraction of the power and fuel required without the combination. This is accomplished by the wing's capacity to multiply lifting force to the hulls many times greater than the thrust required to drive the wing through the air. In aeronautical nomenclature this ability of the wing is expressed as L/D (lift over drag; drag being the resistance which the wing offers to propulsion through the air).

In the flying ship this lifting ability of the wing raises the hulls gradually out of their depth resistance to propulsion in a much denser medium, the liquid ocean. Thus the flying ship operates in two different fluid oceans at one and the same time, in the surface region of the liquid ocean and at the bottom stratum of the atmospheric ocean. At the stage of transition from the hulls touching the liquid ocean to the condition where the hulls are clear of the water, but still in close juxtaposition to the mean height of the waves a peculiar and unexpected phenomenon develops which I indicate diagrammatically in Fig. 9 by dotted or broken lines and arrows. These lines and arrows indicate the location between the two hulls and between the water indicated at W and the under portion of wing 1 what may be described as a vortex billow or cushion of air rolling over the water and not only aiding the lift of the wing central portion but also lowering the drag of the combination, hulls and wing. To obtain the full benefit of this increased efficiency I advise that the four inboard retractable hull-wing braces 17 be retracted and housed smoothly within the lower wing surface, see Fig. 4, and that the pilot fly as close as practicable to the mean height of the waves. Experience indicates that the beneficial phenomenon is greatest between half to 75% of the wing chord distance of the wing's lower surface above the water and the entire cushion is lost above one chord distance.

That an interference exists between the ground and the under side of a wing in adjacent flight has long been contemplated by aeronautical experts, but tests indicate the presence of the hulls and the absence of a central airplane body greatly augment the effect. From tests made it appears that the vortex does not generate

readily when a flying ship descends to an adjacent water position, but it is best to leave the water gradually toward the position of greatest lift and least drag. This phenomenon is known as water interference and provides a cushion of air rolling forward with the hulls and central wing, resting on the ocean, making the flying ship water-borne even when not touching the water.

The form of wing 1 shown in front elevation in Fig. 2 is superior in efficiency to that shown in my former Patent No. 2,365,205 not only in L/D but also in its effect upon the control of the flying ship. From the wing end, a considerable distance inward, I keep the upper ordinates of the wing sections B, C and D in an approximately straight line horizontal in normal flight and the tapering is accomplished by diminishing the other wing dimensions, see Figs. 1 and 2. Abrupt curves in the wing proved detrimental to both efficiency and to control and the dihedral angles of the wing tips shown in Patent No. 2,365,205 were not beneficial nor are they needed for clearing waves with the larger scale and additional decks disclosed in this application. On the other hand the type of wing tip shown in this application creates no yawing moments and improves the gliding angle of the flying ship. Especially in the larger sizes of the flying ship, such as the scale indicated by dotted figures of people and the size of port holes; the wing tips should prove adequate to raise the wing ends by means of the superbuoyancy of the adjacent hull on the slope of an ocean wave so that green water will never contact the wing itself. Also the leverage of the elevated wing tips exceeds the separation of the two hulls and combines with the shallow draft of the hulls to afford a jet engine position out on the wing tip for extreme turning maneuverability on the ocean surface.

The large space available at **23** where the wing curves upwardly in frontal elevation provides an ideal loading and discharging place for depth bombs **24** and arrangement shown as a rack inclining toward a sliding door opening **25** through which bombs, life rafts or other cargo can be dropped and successive bombs will roll by gravity into place for release. The opening **25** in the wing as well as larger openings **25'** will permit loading heavy cargo on a long lever arm completely impractical in any other than a catamaran flying craft. The twin jet engines **5** located within the outer wing sections see Figs. 2 and 12, and far from the vertical axis make for a degree of turning maneuverability never heretofore contemplated for ocean surface craft and I have arranged these engines within the wing so they do not create much drag when not in use. Sliding panel doors **26** close the openings needed when jets are in use and the jets are surrounded by a special housing **5** and a deflector **27** is provided to direct the exhaust either upward over the wing or downward under it.

The regular engines can be either the turboprop sort **4** shown in Figs. 1, 2 and 3 or can be modern jets indicated at **4'** in Fig. 8. In Fig. 4, I show a pier **28** with heavy type cargo, a locomotive and a freight car **58** indicating how the new vessel can be discharged in comparatively shallow water W from piers supported by piling **57** driven into the mud M, the central track **30**, hoist **31** can be thus employed as well as the forward hoist **29** on track **32**.

With high velocities over rough waves the flying ships may suffer early deterioration unless damping is interposed to ease the impact of the waves on the hull plates wherefore I provide an inflated rubber bottom **33** for the hulls, seen best in larger scale Figs. 10 and 11. The auxiliary inflated bottom **33** is made up of laminated fabric and rubber much like the casing of a pneumatic tire and fore and aft partitions or bulk heads **33'** intersect thwartship partitions **33a** to provide airtight compartments with oneway valves **34** between such compartments and a feed line **35** from within the hull plates **36**. A reinforced keel portion **37** is part of the subbottom protruding through or between some of the inflated cells and a metal guard **38** protects the false bottom **33** from wear against lighters or other objects. Also I provide another wearing guard strip higher up on the hull at **39** made of tough gum dipped fabric and cured rubber with high inflation from a valve indicated at **39'**. Those skilled in the art will understand the need for the very strong and externally protruding keel **37**, see Figs. 4 and 10, to take the first impact of the water; experience will dictate how far the keel should protrude. Also the vertical stanchion seen in Fig. 4 serves as a keelson to strengthen the said keel. The laminated rubber and fabric bulkheads also contribute to the reinforcements for the auxiliary rubber bottom, while providing a shock absorbing reinforcement such as that for the keel **37**.

Also in Figs. 10 and 11 I show a means of raising the hulls of any vessel before the velocity has become great enough to produce atmospheric lift. The means consists of a hydrovane **40** extendable from within the lower hull on any side of a vessel. The vane **40** moves through antifriction means in a watertight box **41** strongly braced inside the hull at **42**, **43** and **44**. Rubber seals **45** are employed at the exit in the hull side of the vessel for the vane and also at points in the box where water might leak through. Should water collect in the box a suction pump can be employed to keep it dry. A spiral screw **46** can be used, driven by an electric motor **47** to retract and extend the hydrovane **40**.

As the hydrovane operates in a much denser medium than air it can aid a flying ship in getting onto the step **48**, Fig. 3, and in single hull vessels without wings the vanes should raise the hulls enough to reduce the power required for increased velocities. Naturally the vanes should be fully retracted when the ship, if equipped with wings, gets onto the step **48**.

In Fig. 12 I show an enlarged view of the wing 1 where it becomes thinner and substantially horizontal in upper surface but nevertheless large enough to accommodate crew members or passengers, see front elevation in Fig. 2, and inclosed I locate a pair of jet engines designated **5** with sliding doors **26** forward of their said location and means **27** to route the exhaust either upward or downward. Those familiar with jet engines will realize that the outline I show in Fig. 12 and marked **5** is an internal housing for the pair of jet engines rather than the engines themselves and serves to confine the heat and gases within such housing thus permitting regulation of the airflow into and out of the said housing or engine casing **5** without contaminating the atmosphere within the wing itself. The airscoop **5'** feeds air into the casing **5** and it is understood that in case jet engines **4'** are substituted for propeller type engines **4** then they should follow the internal casing **5** teaching, permitting forwardly placed jet engines inside the

wing naturally remote controls can be provided for pilot operation of the casing doors.

Returning to Fig. 3 it will be noticed that I have located the hydrostep 48 in the rubber false or inflated bottom 33, see Figs. 10 and 11, and also I streamline the step 48 by a comparatively thin and elastic rubber covering 49 shown as dotted because it is used only when the ship is entirely in the air to avoid the drag which the step 48 will otherwise produce. By passing compressed air through airline 50 I force the elastic cover 49 into the dotted line position shown in Fig. 3 and by reversing the process, i. e. by sucking air through 50 I can collapse 49 so as to produce the normal hydroplane step 48 which has the usual vents, not shown.

Bringing together the successive steps which comprise the best method of generating and magnifying the vortex-billow phenomenon the pilot taking off in rough waves should have all his braces 17 extended and a low angle of attack until an airstream velocity of 25 miles per hour is attained, then an attack angle of ten or twelve degrees should be assumed until approximately half of the flying ship's weight is airborne, at this stage the pilot should retract the inboard braces and ease the angle of attack to 6 or 8 degrees. Immediately the hulls clear the water, the pilot should level off into horizontal flight and keep the lower surface of the wing approximately 75% of the chord distant above the mean height of the waves. At this level the outboard braces can be retracted.

Thus it will be seen that a number of surprise results flow from the improvements in flying ships. The vortex phenomenon of super-efficiency becomes practicable for ships of the form and size shown and the improved wing end, also the greater utilization of the wing for laterally extended loading and for double deck, see 1' Fig. 9, accommodation of passengers, takes on improved usefulness with greater distribution of loads for both flight and water support. In view of the lateral extension of such a vessel, possibly 600 feet wing span, it will probably be desirable to use two headlights, 51, one in fore part of each hull, with corresponding range lights 52 and multiplied red port lights 54 and starboard green lights 53. The forward portion of the wing can serve for a promenade for passengers and I provide special vision 55 therefore, see Fig. 8. From the foregoing explanation of my invention it will be seen that new problems have been solved by new combinations of old elements, for example, when an ocean wave lifts the bow of the starboard hull and at the same time lifts the stern of the port hull a severe condition of stress arises in the comparatively small central wing portion midway between the two hulls and the direction of the greatest stress runs in a diagonal direction through the box trussing made up of the wing spars, ribs and stressed wing skin, also the reverse stress created when the waves lift the port hull bow and the stern of the starboard hull call for a diagonal running in the opposite direction to the first diagonal. These diagonal trusses are shown, see Figs. 5 and 6, as lattice girder type trusses with upper and lower members which unite with the spars at the box-like truss corners and along their contact with the stressed skin of the wing surface. Diagonals as such are thousands of years old, but in the flying ship they must conform to the inner dimensions of the wing and unite with other trussing to produce a new result never before contemplated in the art, i. e. maintain the parallelism of the two hulls while providing spaces for the movement and storage of smaller aircraft through the wing. And in addition the diagonals cannot extend above or below the wing surface so as to prevent the phenomenal "water interference" indicated by Fig. 9 nor can the weight of the diagonal truss itself be excessive.

Another problem related to the comparative size of an ocean flying vessel as contrasted to the natural size of ocean waves is how to prevent destruction of the wing ends by contact with ocean waves. The shape of wing ends shown in U. S. Patent No. 2,365,205 may be good for preventing wave contact, but it is bad for aeroplane stability and efficiency in full flight, consequently there is room for inventive improvement of wing tips.

What I claim is:

1. A catamaran hull flying craft provided with a biconvex, internally trussed main wing spacing the said hulls apart, the said wing in frontal elevation having its upper wing surface forming two substantially parallel horizontal lines, with a recurving portion intervening between the said lines, the lower of said lines located over the central wing portion and the upper of said lines defining the tops above the plane of the first said line and substantially coincident with the ordinates of the outboard sections of the said wing, whereby in flight, all of the said wing central portion and most of its outer portions can present the wing's upper surfaces in a substantially horizontal position to the atmosphere and nevertheless the wing tips can be held by the buoyancy of the adjacent hull above wave impact.

2. An airplane wing having upwardly recurving portions in front elevation providing passenger and freight accommodations therewithin, the uppermost ordinates of said wing's central portion forming a substantially horizontal line transverse to its normal line of flight and wing ends extending outwardly from the said recurved portion and located above the plane of the said central portion, the highest ordinates of the said wing ends defining a line substantially parallel to said first line and the lower surface tapering to meet the said upper surface of the wing end tips.

3. A biconvex twin hull supported wing devoid of external bracing having a lower central portion and two upper wing end portions, the top surface ordinates of all said portions forming two substantially parallel lines in front elevational aspect and a recurving wing portion merging each said end portion to said central portion and a three deck hull adjacent each said recurve wing portion, whereby the said end portions are kept above wave impact.

4. In a flying ship, the combination of two hulls each having a transverse deck each three deck spaces high held in parallelism by the central portion of a superposed passenger inclosing wing, external braces connecting the said wing to the said hulls in the region of the said tween-decks, the said wing provided with elevated wing ends comprising substantial portions of the total wing span and passenger space, the surfaces of said wing ends having, as the termini of their highest ordinates, a substantially straight line horizontal in the normal flying attitude of the said ship.

5. In combination with a twin hull flying ship, a central wing portion having stressed wing skin and holding the said hulls in parallelism; the

said portion provided with two diagonal girder type trusses having upper and lower members which unite with the said wing skin and provide space in their neutral axes for the movement of smaller aircraft transversely through the wing, a power driven elevator platform supported in its lowest position above the lower of the said truss members, an opening in the said wing skin and in the said upper truss members, where the same surround the said opening, said opening located directly above the said elevator platform and the upper surface of the said platform adapted to open and close the said opening and to receive and discharge small aircraft therethrough.

6. A combination as recited in claim 5 and an opening in the lower wing surface outward of the said two hulls, a traveling hoist over the last said opening adapted to load a small aircraft through said opening into the said outward wing portion and to transfer the said aircraft through the wing transversely through the said neutral axes of the said truss members into the said central wing portion adjacent the said elevator platform.

7. In combination with a flying ship, twin hulls, each provided with two principal frames, a central wing portion holding the said hulls in parallelism and an internal wing truss for said portion including spars, ribs and stressed wing skin forming a box-like connection from one hull to the other, two diagonal girder type trusses having upper and lower members, one of said members of each truss united with the upper wing skin and the other set of members united with the lower wing skin and both said trusses connected at the corners of the said box-like structure with the said ribs and spars and retractable means of connecting the termini of each said diagonal truss to one of the said hull frames.

8. A combination as recited in claim 7 and openings in the neutral axes of the said trusses for the movement of small aircraft through the wing.

9. In combination with a wave riding twin hull flying ship, a biconvex central wing section structurally attached to the upper portions of the said hulls, said wing section provided within its external surfaces with two girder type diagonals and a rear and front spar, each said diagonal having an upper and a lower member joined along their major axes to the stressed wing covering of the said wing section and uniting at their ends with the major axes of the said wing spars, the neutral axes of the said diagonals being open between their upper and lower members for the accommodation of passengers and freight and means at the ends of the said diagonals to connect them with the said hulls at points distant from their aforesaid attachments to the said wing, whereby the said hulls will be kept in parallelism with each other.

10. A combination according to claim 1 and means including front and rear wing spars extending transversely through the wing interior, united along their major axes with two diagonal girder type trusses located in the central wing portion between the said hulls and each said truss structurally interconnecting the forward part of each said hull with a rearward part of the companion hull.

11. In combination with a twin hull flying ship having a central stressed skin wing attached to the tops of the said hulls, front and rear spars within said wing attached by retractable braces to positions distant from the said top attachments, one such brace connecting each said spar to each hull, a diagonal girder type truss, structurally united with said wing skin, interconnecting the major axes of each forward spar where it joins with one of the said forward braces with the major axes of the said rearward spar where it joins with one of the said rearward braces to the companion hull.

12. A wave riding flying ship including twin hulls of comparatively shallow draft, but having more than two decks above water level, a biconvex wing enclosing trussing and load carrying compartments within its upper and lower wing surfaces, said wing holding the said hulls in spaced apart relationship and having upwardly recurving portions outwardly of each said hull blending into substantially horizontal outboard wing sections capable of housing crew members and jet engines, each said outboard section including a jet engine casing and engine, whereby the said engines will be kept well above wave impact and nevertheless afford the ship rapid turning ability when on the water.

13. The method of operating a twin hull flying ship which comprises putting on power and retaining low angle of attack until approximately 30 knots air velocity is attained, then taking angle of attack of ten degrees until approximately 45 knots airflow is attained, then retracting all inboard braces and lowering the angle of attack to six degrees then, when the hulls clear the water, leveling off into horizontal flight at 75% chord length distance of the lower surface of the central wing above the mean height of the waves and retracting the outboard braces, whereby a forwardly rolling vortex-billow of air will increase the lift drag ratio of the said flying ship.

JAMES V. MARTIN.

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