Feb. 19, 1963 W. C. BEUBY 3,077,850

SAILBOAT OF THE CATAMARAN TYPE

Filed June 19, 1961 4 Sheets-Sheet 1

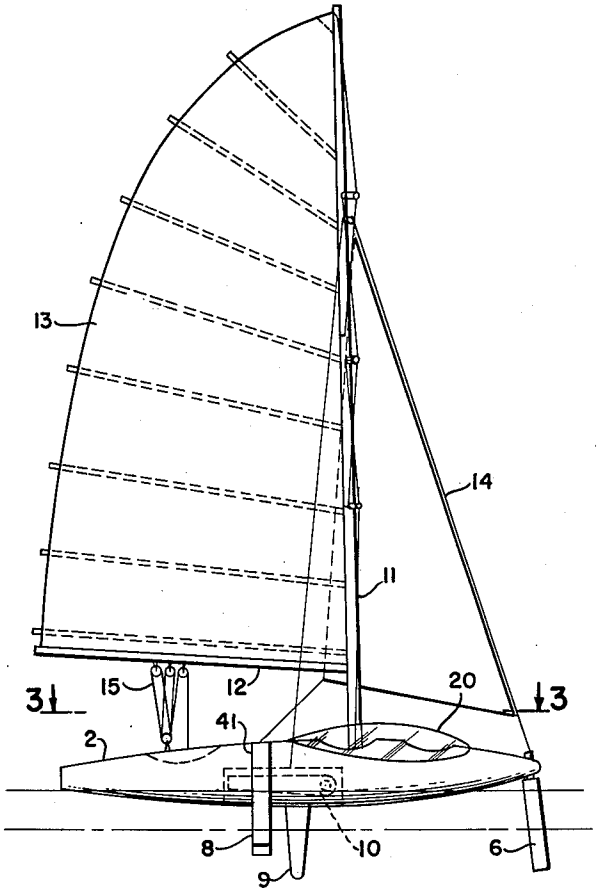

FIG. 1.

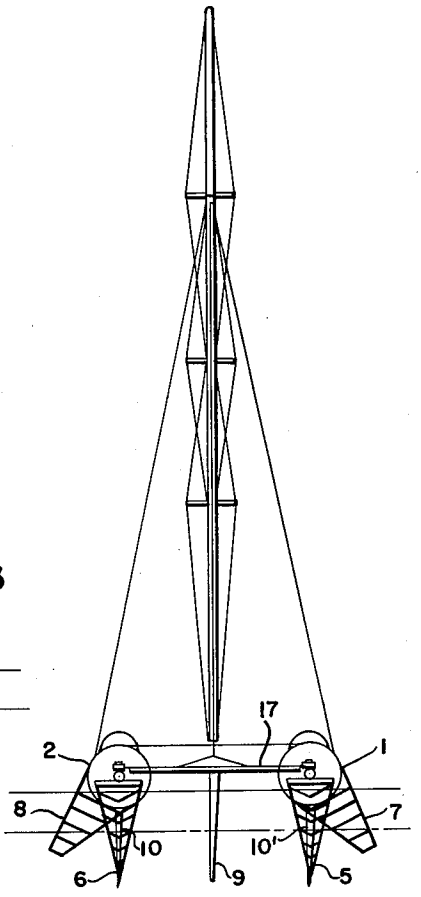

FIG. 2.

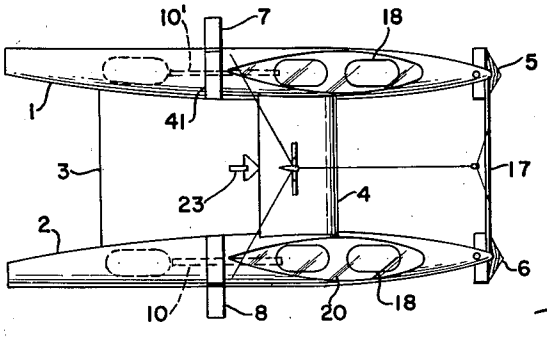

FIG. 3.

INVENTOR
William Charles Beuby

BY Raymond Jones

ATTORNEY

Feb. 19, 1963 W. C. BEUBY 3,077,850

SAILBOAT OF THE CATAMARAN TYPE

Filed June 19, 1961 4 Sheets-Sheet 2

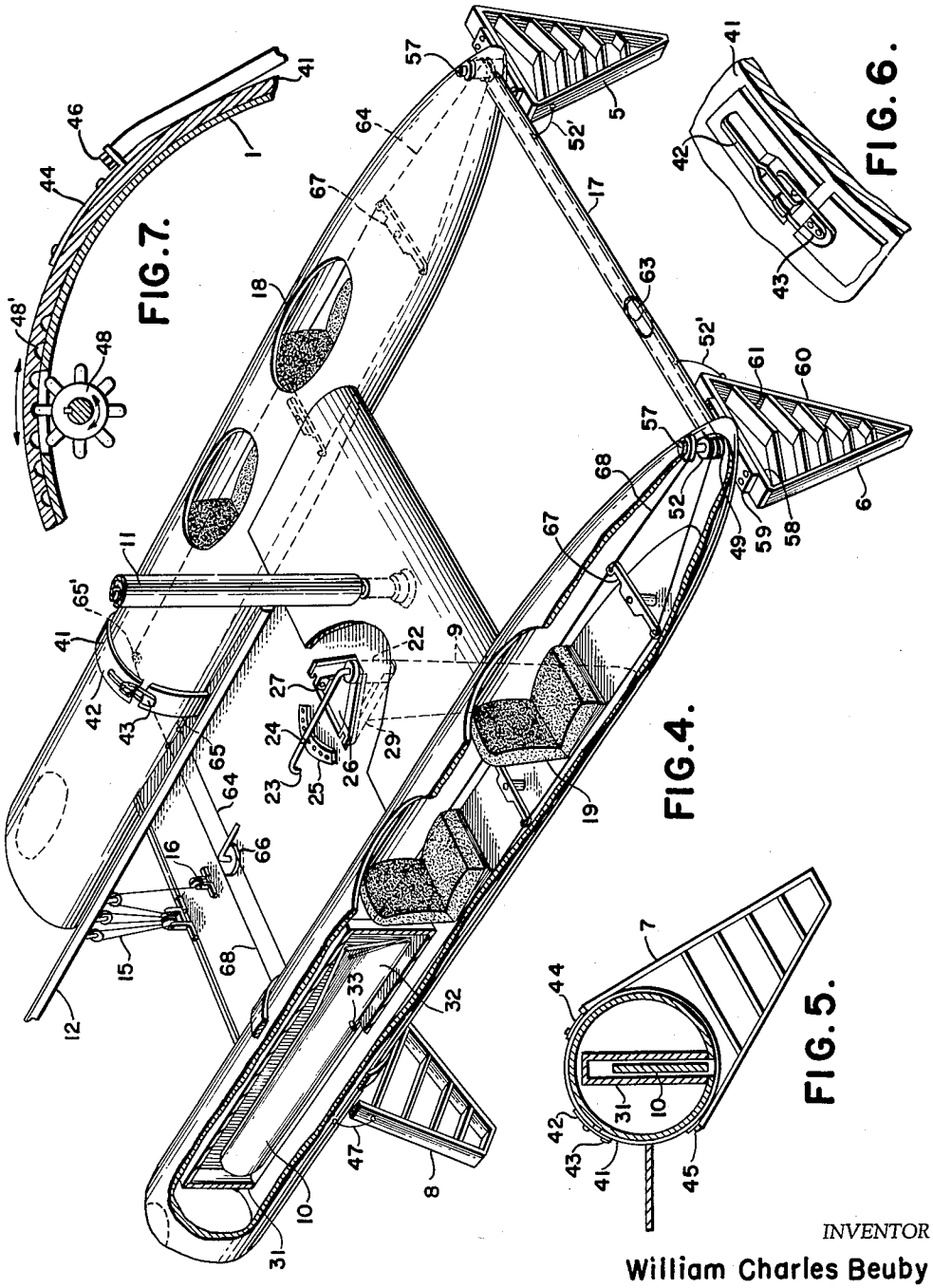

FIG. 4.

FIG. 6.

FIG. 7.

FIG. 5.

INVENTOR

William Charles Beuby

BY Raymond Jones

ATTORNEY

Feb. 19, 1963 W. C. BEUBY 3,077,850

SAILBOAT OF THE CATAMARAN TYPE

Filed June 19, 1961 4 Sheets-Sheet 3

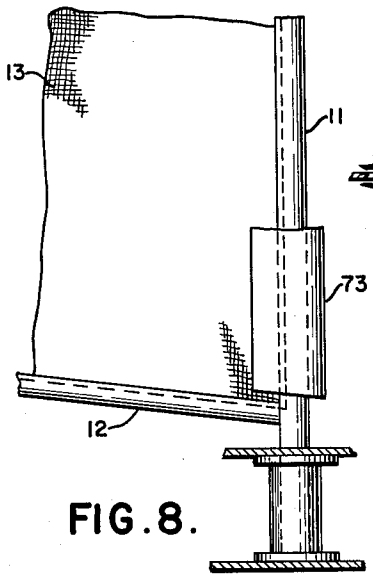

FIG. 8.

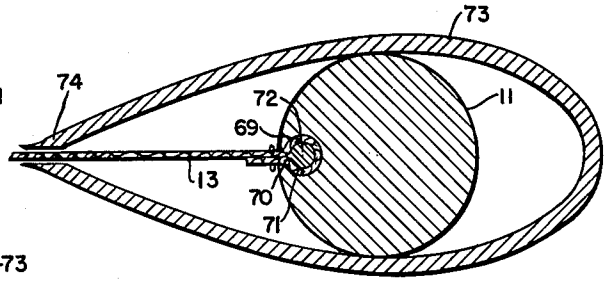

FIG. 9.

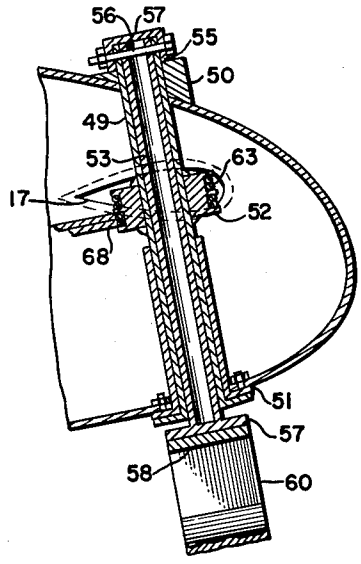

FIG. 10.

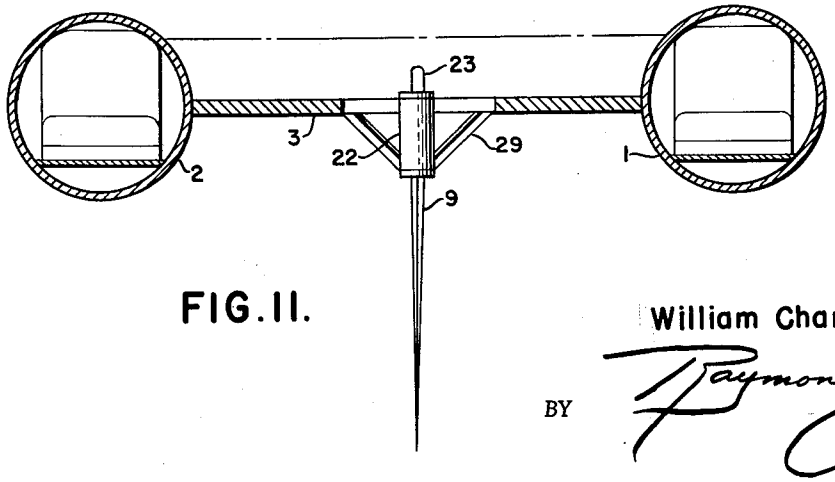

FIG. 11.

INVENTOR

William Charles Beuby

BY Raymond Jones

ATTORNEY

Feb. 19, 1963 W. C. BEUBY 3,077,850

SAILBOAT OF THE CATAMARAN TYPE

Filed June 19, 1961 4 Sheets-Sheet 4

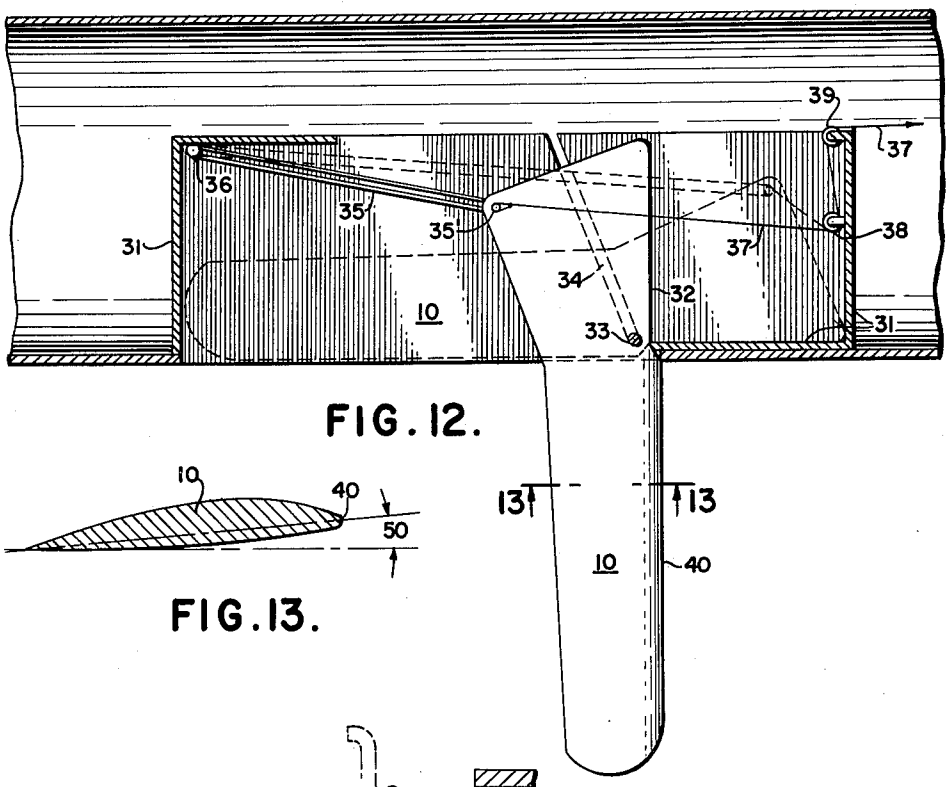

FIG. 12.

FIG. 13.

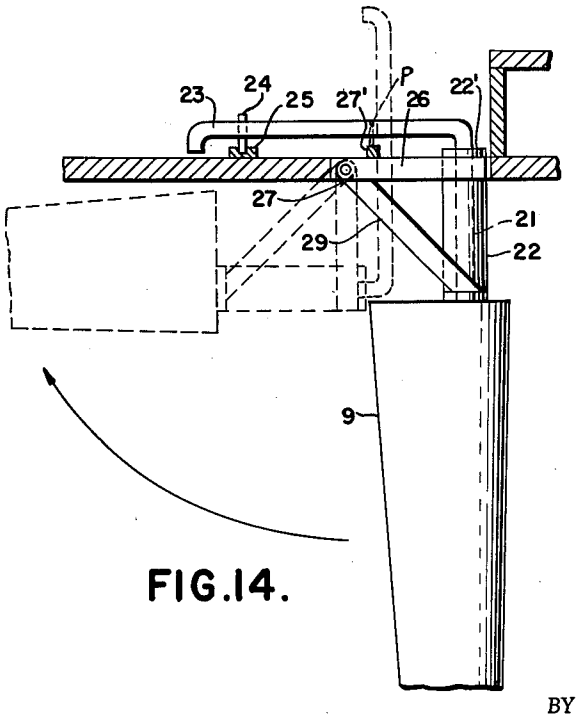

FIG. 14.

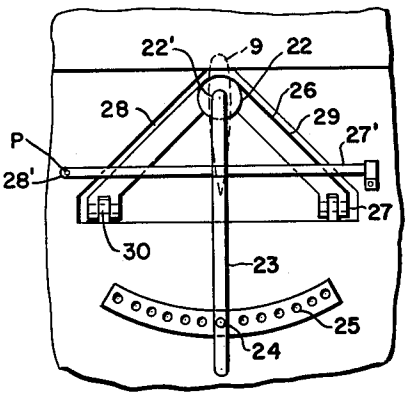

FIG. 15.

INVENTOR
William Charles Beuby

BY Raymond Jones

ATTORNEY

United States Patent Office

3,077,850

Patented Feb. 19, 1963

3,077,850

SAILBOAT OF THE CATAMARAN TYPE

William C. Beuby, 2411 E. 25th Place, Tulsa, Okla.

Filed June 19, 1961, Ser. No. 117,914
14 Claims. (Cl. 114—39)

This invention relates to a sailboat of the catamaran type wherein a pair of pontoons or hulls which resemble, more or less, the hull of an airplane are secured fore and aft to the lateral edges of a deck and are supported in flight by a longitudinal arrangement of surface-piercing hydrofoils. These hydrofoils are positioned slightly aft of the center of gravity, on or slightly ahead of the aerodynamic center of pressure of the sail system and the boat is directed, trimmed and stabilized longitudinally by means of a pair of guidance and stabilizing hydrofoils located at the bow of the hulls. This sailboat can be operated either as a conventional sailboat or as a hydroplane in the event that ample wind velocity is available.

As will appear from the detailed description which follows, the more important objects of the invention are comprised as follows:

First—to provide a sailboat that is capable of attaining exceptionally high speeds yet being useful and enjoyable in light weather.

Second—to provide a sailboat that can maintain its own trim without complicated mechanism or adjustment by the pilot or crew.

Third—to provide a sailboat that has superior pointing capability and is easily controlled as to direction.

Fourth—to provide a sailboat that can be easily docked, safely flown at high speeds, handled and transported more easily and which is low in cost.

With these and other objects in view, my invention consists in the novel features and advantages of construction and arrangement of parts which will be more fully understood from the following specifications, reference being had to the accompanying drawings wherein:

FIG. 1 is a conventional view, in side elevation, showing the relative positions of the various hydrofoil and other elements;

FIG. 2 is a view, in side elevation, of the sailboat shown in FIG. 1;

FIG. 3 is a top plan view looking downwardly on line 3—3 of FIG. 1;

FIG. 4 is a view in perspective showing, conventionally, the relative positions of the hull and deck centerboards or keels, the spaced fuselage shaped pontoons or hulls, the guidance and stabilizing hydrofoils, control means therefore, main lifting hydrofoils and other details;

FIG. 5 is a sectional end view showing, in detail, a main lifting hydrofoil and a detachable band adapted to secure it to a respective hull;

FIG. 6 is a detailed view showing a quick release for the band;

FIG. 7 is a detailed view showing means to attach a lifting hydrofoil to a respective band by inserting therebetween a frangible fail safe element;

FIG. 8 is a broken away view of a mainsail showing means to attach it to a mast and associated streamlined shell or fairing;

FIG. 9 is an enlarged view, in detail, of a sail track formed in the mast and an associated sail and mast fairing.

FIG. 10 is an enlarged view, partly in section, showing a quick detachable rotary support for a stabilizing hydrofoil;

FIG. 11 is a front elevational view of the deck mounted centerboard;

FIG. 12 shows, in detail, a hull mounted centerboard or keel which is retractible and shockproof;

FIG. 13 is a sectional view on line 13—13 of FIG. 12;

FIG. 14 is a detailed side view, partly in section, of the centerboard mountd on the rear deck in a manner to be either retracted or adjusted about its vertical axis, and

FIG. 15 is a top plan view, in detail, showing a triangular shaped plate or deck section hingedly mounted adjacent to the forward edge of the rear deck and which supports a vertical bearing for the centerboard shaft.

Referring to the drawings in detail, the hydrofoil sailboard according to the present invention and with particular reference to FIGS. 1 to 3, comprises, as the main elements thereof, similar fuselage shaped pontoons or hulls 1 and 2, a rear deck 3, a forward deck 4, a pair of similar guidance and stabilizing hydrofoils 5 and 6, a pair of main similar lifting hydrofoil units 7 and 8, a deck mounted centerboard 9 and hull mounted centerboards 10 and 10'.

A mast 11 and a boom 12 serve to support a mainsail 13. A common form of rigging 14 is operatively connected to the mainsail while the boom is controlled by a sheetline 15 the free end of which is releasably secured to a head 16 shown in FIG. 4. A hollow strut 17 of streamline cross-section is connected to and between the forward ends of the hulls. Each hull is provided with a plurality of openings 18 forming cockpits to afford access to seats 19 and a canopy 20 covers, preferably, the forward pairs of cockpits.

Deck Mounted Centerboard

The deck mounted centerboard 9, shown in FIG. 14, is affixed to a rotatable shaft 21 mounted in a suitable bearing 22 and this centerboard, preferably, is streamlined in cross-section. This centerboard and shaft unit is adjustable to various positions by means of a control lever 23 and this lever can be locked in various positions of adjustment thereof by means of a detent 24 mounted on the lever in a manner to engage a series of detents 25, deck mounted. The centerboard, as shown in FIG. 14, may be swung to assume a retracted position parallel to the deck. A triangular shaped plate 26 serving as a bearing support is pivoted at 27 to the deck and the bearing 22 is held rigidly by said plate. The plate 26 is positioned within an opening 28 formed in the rear deck. When the lever 23 is raised, and swung forwardly, the plate 26 will swing clockwise on the pivots 27 to permit the centerboard to be elevated to a position parallel to the deck. A suitable detent 27' is pivoted at 28' and on a lock pin P. Before raising lever 23, pin P is removed to permit 27' to swing a little counterclockwise. When lever 23 is vertical, the detent 27' is returned to its locking position and it will hold the lever 23 locked up. A pair of brace members 29 is secured as by welding to pivot lugs 30 and to the lower end of the bearing 22. The lever 23 may ride over the upper end of the bearing 22 or a collar 22' on this lever may rest on this bearing.

The centerboard hydrofoil, which is to be used when the boat is sailed in light weather as a conventional boat, extends some four feet into the water vertically and has the unique feature of directional control. It can be directionally set in such a manner as to provide drift stabilization without the necessity of pointing the boat as in the case in conventional sailboats and is to be retracted when the boat is to be flown on the hydrofoil system. The hydrofoil centerboard rotates with the shaft 21 which is located in the hydro-dynamic center of the vertical hydrofoil system so that the various positions may be selected with minimum effort on the part of the crew operator.

Hull Mounted Centerboard

In order to assure a proper drift stabilization for the

type of hulls used on the sailboat disclosed when sailed as a conventional boat, an additional centerboard hydrofoiil of special design is mounted in each hull at substantially the same location fore and aft as for the deck mounted centerboard hydrofoil **9**. These hull mounted centerboa as 10 and 10' are adapted to be retracted into housings or boxes **31** and the left hand centerboard is shown in detail in FIGS. 12 and 13. Each box **31** is open at its upper end. The upper portion or end plate **32** of each centerboard normally remains completely housed within in its respective box **31** and is formed to taper to provide a relatively wide upper edge. This end plate, if desired, may be thick enough to fit a little loosely within its respective box. A stud **33** projects from each side of the plate **32** at a point shown close to the hull bottom and each stud is arranged to slide upwardly within a slot or groove **34** formed in each side of the box **31**. An elastic shock cord **35** connects the upper aft corner of the plate at **35'** to a point **36** on the box. In order to retract the centerboard **10** shown, a cable **37** is connected at point **35'** on the plate end **32** and is passed over pulleys **38** and **39** as shown. The lower and slightly tapered end **40** of each hull centerboard is formed as shown in FIG. 13 more or less aeroform in cross-section from its lower end up to the bottom of the hull.

The left hand hull centerboard is shown in FIG. 13 as set at about a 5 degree angle of attack or angle of incidence with respect to a line parallel to the centerline of the boat or respective hull. The right hand centerboard is set, as to its 5 degree angle of attack, opposite to that of the left hand centerboard. The use of these hull centerboards will provide proper drift stabilization on the boat disclosed. By setting these two centerboards at the angle of attack described, additional effectiveness is obtained without significantly increasing the drag so that one centerboard will perform the work of two with no angle of attack. The boat is sailed with only the leeward hull centerboard foil extended in addition to the deck mounted centerboard **9**. The centerboard box is designed to just accept the centerboard plate **32** and loose enough to maintain it steady and is built strong enough to withstand the required side loads. After the centerboard is slid downwardly through the upper open box top with the studs **33** within the slots **34**, the shock cord and the retracting cable are fastened in place. By merely pulling this retracting cable, the centerboard will pivot around the studs **33** clockwise to its horizontal position. Reversely, by merely paying out this cable the centerboard will be rotated in a counter clockwise direction by the elastic shock cord **35** and the weight of the lower centerboard end.

This unique feature of yieldably mounting a hull centerboard is an important part of my invention. If the centerboard strikes an object while in forward motion, it will be deflected aft and up out of the way or, if struck an upward blow or is forced upwardly, it will be displaced upwardly since it is not restrained as to position. A combination of these undesired forces acting on the centerboard might very well occur and the easiest and simplest deflection possible will be had.

Lifting Hydrofoils

The main lifting hydrofoils **7** and **8** are located slightly aft of the center of gravity and on or slightly ahead of the aerodynamic center of pressure of the sail system. This hydrofoil system provides the main lifting force, supporting the boat in such a manner as to provide optimum maneuverability. Each lifting hydrofoil is removably mounted upon its respective pontoon by means of a band **41**. To permit quick detachment, the free ends of the band are secured in a tight manner by means of an old form of lever clasp or loop **42** pivotally mounted on one band end in a manner to engage a detent **43** affixed to the other cooperating band end. Each hydrofoil is secured to a respective band by means of two angular members **44** and **45** by means of bolts **46**. In order to provide a fail safe feature, each member **44** and **45** is formed from Bakelite or similar frangible material. In the event that a hydrofoil unit engages an obstruction, the frangible supporting members will fracture in a manner to drop the unit to prevent damage thereto. A restraining cable **47** is used to prevent loss of the released hydrofoil unit. The hydrofoil is adjustably held on its respective hull by means of a spur gear **48** the teeth of which pass through an opening in the hull and engage holes **48'** formed in the cooperating band. The shaft of the gear can be rotated by an electric motor or by a hand crank placed within the hull.

This novel form of band support permits the desired retraction of each hydrofoil while docking by merely releasing a clasp **42** to permit the unit to drop by its own weight. A main feature of the lifting hydrofoil is that it can be quickly detached and stowed away on the forward deck. When it is desired to sail as a conventional sailboat, these hydrofoils will be removed and all three centerboards will be used. However, when these hydrofoils are in use, the hull centerboards will remain retracted and need not be used.

Guidance and Stabilization System

The guidance and stabilization system comprises a similar pair of hydrofoil units **5** and **6** supported rotatably one unit at each forward end of a respective pontoon. Referring to FIG. 10, a tubular shaft **49** is supported in a manner to be rotated within a pair of upper and lower fittings or bearings **50** and **51**. A cable drum **52** is shown as affixed to said shaft to be rotated therewith and in a manner to be described. A second tubular shaft **53** is arranged within the shaft **49**. In order to provide a means to cause the shafts to rotate in unison or to permit the inner shaft **53** to be readily detached from the outer shaft **49**, a cap **57** is mounted on the upper shaft ends with the circular cap flange **55** arranged to contact and rotate on the fitting **50**. A bolt **56** is adapted to be passed through registering openings in both shafts and this cap. A metallic plate **57** is affixed to the lower end of the shaft **53**.

To provide for a fail safe feature for each guidance hydrofoil unit, the upper end of each unit comprises a plate member **58** formed from Bakelite or similar frangible material which is secured as by bolts **59** to a plate member **57**. Each unit comprises side members **60** forming a V-shaped and a plurality of dihedral shaped vanes **61**. In the event that either hydrofoil unit might meet with an obstruction, the respective frangible member will become shattered at some point close to a corresponding end of a plate member **57**. A restraining cable **52** is provided to prevent loss of the detached hydrofoil.

An important feature of the invention is the provision of a guidance control whereby both guidance hydrofoils **5** and **6** can be rotated in unison from any one of the series of cockpits or by a crew member stationed on the deck. As shown in FIG. 4, an endless cable **63** is passed through the strut **17** and is engaged around both drums **52** in the front hull ends that serve to rotate the shafts **49** and **53**. A second cable **64** also engages, in the bight thereof, around a respective drum and the two cable ends are extended rearwardly to pass each cockpit in one hull thence around pulleys **65** and **65'** to permit each cable to be accessible at a deck crewman position **66**. At each cockpit, a foot operated lever **67** functions to control the cable **64**. A third and similar cable **68** is provided to cooperate with each cockpit in the other hull and the free cable ends extend, also, to said crewman position **66**.

Mast Track and Streamlined Casing

The mast is formed with a track or channel **69** which is substantially closed except for a narrow opening **70**

through which the leading edge of the sail projects. A bead 71 is formed on said leading edge by sewing or otherwise securing a rope 72 into this edge. This rope is solid enough to retain its shape as it is introduced into the track and slid upwardly into position along the full length of the mast.

As a means to reduce head resistance to the mast as well as to reduce the formation of eddy currents around the mast which might impair the efficiency of the sail and affect air currents on the leading face of the mast, I provide a fairing or casing 73 stream-lined in cross-section in position to surround the mast. The trailing edge of this casing is provided with a narrow opening 74 that receives the sail. If desired, the sail may be reinforced along the zone thereof that engages the casing ends that contact the sail. The casing is arranged to rotate freely around the mast so as to follow all lateral movements of the sail thereby to reduce the effects of the objectionable eddy currents upon the sail. This mast casing will form a continuation of the sail up to and somewhat in advance of the mast.

In view of the foregoing detailed description, it should be obvious that, in the boat disclosed, a reduction of wind resistance and consequent increase in efficiency is obtained due to such factors as housing the crew within canopy covered cockpits, use of streamlined mast shell and hulls as well as the use of a deck section and forward cable housing strut that are of airfoil shape.

Longitudinal stability is obtained by locating the stabilization hydrofoil system at the bow of catamaran hulls. Each hydrofoil assembly is made up of foil elements of a well known hydrofoil cross section, and of small cord for efficient high speed operation. These elements shaped with a decided dihedral are spaced vertically. Each whole assembly thus forms a V shape and is mounted on an axis tilted about 5° to keep the resultant hydrodynamic forces on the foil system within the plane of the axis while the boat is foil borne.

Each foil element, having the proper angle of incidence, exerts a separate lifting force. The total lifting force exerted at any time increases very rapidly with the degree of submergence of the hydrofoil assembly. An increase in the wind velocity momentarily increases the sail thrust forward which tends to depress the bow of the boat. The stabilization hydrofoil assemblies being submerged to a greater depth will instantly exert a greater lift, immediately counteracting this increased sail thrust and thus re-establish the trim of the boat automatically. Since the boat is supported primarily by the main lifting hydrofoil system just aft of the center of gravity, the trim changes required by movement of the crew and variation in wind velocity will require little force to correct. With this arrangement of these hydrofoil systems, especially effective trim control is realized.

Lateral trim or stability is attained, first by reason of the wide "tread" or distance between the main lifting hydrofoils made possible by the use of the catamaran type boat and, second, because of the design of the main hydrofoil system.

This system is made up of two assemblies, one for each hull, which have elements of a well known hydrofoil section of small cord for efficiency at high speeds. These lifting elements, or foils, are spaced vertically to eliminate hydrodynamic interference between lifting surfaces, and extend from the inner in the outer struts to which they are welded. The elements are perpendicular to the outer strut and therefore exert a total lifting force parallel to the outer strut which increases with the degree of submergence of the assembly as a whole.

As the boat is subjected to a side load due to an increase in wind velocity or a change in wind direction, the leeward hydrofoil assembly will be depressed or submerged to a greater depth. This increase in submergence immediately increases the lifting force exerted by this foil assembly which tends to right the boat. The sail force is thus instantaneously counteracted with the result that the boat is immediately stabilized in a natural manner without any action on the part of the pilot or screw.

Variations in the direction of the sustaining force can be attained by rotating the hydrofoil assembly about the hull to different settings. This makes it possible, for instance, to increase the efficiency of the system while going before the wind, which requires no drift stabilization, by rotating both the right and left hand assemblies so that the lifting force is vertical to the surface of the water. Each submerged element would be thus lifting to its maximum efficiency.

When the boat is foil borne, drift stabilization is attained by setting the windward main foil assembly so that the lifting force is vertical while the leeward main foil assembly is still working to oppose the sail force. With this arrangement, the boat would actually "crab" to the windward momentarily as the wind velocity would intermittently diminish in intensity. This would also achieve the most desirable objective of maintaining the "apparent" wind direction constant without loss of heading.

This same result is achieved when the boat is sailed as a conventional catamaran by reason of the unique hydrofoil centerboard arrangement on this boat. The leeward hull centerboard foil is lowered and the deck centerboard foil is set at a 5° heading in the same direction as that of the lee hull centerboard foil. With both of these exerting a force counteracting the effect of the wind against this sail, when this wind momentarily diminishes this side force is correspondingly reduced and the boat thus unopposed would "crab" to the windward, thus gaining in position closer to the wind. Again the secondary effect of this action would make it possible to maintain a constant "apparent" wind direction and continue to realize the advantages of this efficient attitude of sail with respect to wind direction.

The boat is supported substantially at its center of gravity and therefore can be directionally controlled with great efficiency. Since the guidance system is at the bow of the boat, its turning moment is great and directional changes are easily made. In addition, the fact that the guidance system is hydrodynamically balanced further reduces the pilot effort required to turn the boat, it responds instantaneously to the touch of the rudder pedals.

Docking is made easy by means of the adjustable feature of the main lifting hydrofoil assembly attaching band. This band, which normally holds the hydrofoil assembly securely in position, can be easily loosened and the assembly can be repositioned vertically below the hull to clear the side of the catamaran to come along side the dock. This adjustment can be made quickly by simply bringing the boat into the wind, permitting the boat to lose speed and settle into the water, at which time there being no load on the assembly, it can be released and placed in the desired position.

The breakaway or fail-safe feature is important because it is necessary to entirely remove the hydrofoil assembly from the boat rather than permit it to be distorted or displaced which might result in some adverse loads of considerable magnitude. There is also a secondary advantage gained by this breakaway feature which concerns the reduction of the probable damage to the basic hull structure when encountering obstructions As a result, the boat can be more safely flown at high speeds.

This boat is constructed of lightweight low cost material as fiber glass which assures an economy which is reflected in low production costs and therefore a reasonable purchase price. Also, the boat is simple in design and has no complicated mechanism. A preferred width of eight feet will permit safe road trailering.

While a preferred form of the invention is disclosed and various details thereof, it is to be understood that various

modifications are contemplated such as would be included within the scope of the appended claims as follows:

I claim:

1. A sailboat of the catamaran type comprising a pair of spaced fuselage shaped hulls, a deck secured rigidly to and between said hulls, each hull being provided with a main lifting hydrofoil unit positioned slightly aft of the center of gravity of the respective hull, a quickly detachable means for supporting each of said units, said means comprising a band encircling each of said hulls, each band including a quick release device for opening either band to permit removel of the respective unit.

2. In a sailboat as set forth in claim 1 wherein the deck is provided with openings through which the bands are adapted to pass freely whereby, during docking of the boat, the units are permitted to drop by gravity upon operation of the quick release devices and extend vertically.

3. In a sailboat as set forth in claim 1 wherein each hydrofoil unit is supported by a respective band by means of an interposed frangible element whereby, if the unit meets with an obstruction, said unit will be released quickly from the band.

4. In a sailboat as set forth in claim 1 wherein a forward portion of the deck is formed aerofoil in shape in fore and aft section.

5. In a sailboat as set forth in claim 1 wherein the forward ends of the hulls are rigidly interconnected by a transverse strut, said strut being of aerofoil shape in a manner to provide lift during forward motion.

6. A sailboat of the catamaran type comprising a pair of spaced hulls interconnected by a deck, a guidance and stabilizing unit rotatably mounted on and at the forward portion of each hull, each unit having a cylindrical bearing member extending upwardly and rearwardly through a respective hull and terminating above the hull, a control sleeve support surrounding said bearing member, means to detachably interlock the bearing member to the control, sleeve, a control element affixed to each sleeve and a cable engaged with both elements whereby rotation of either element will cause rotation of the other element.

7. In a combination as set forth in claim 6 wherein the upper ends of the bearing member and the control sleeve are provided with means for releasably locking the member and sleeve whereby removal of the locking member will permit quick detachment of a respective unit.

8. In a combination as set forth in claim 6 wherein each hull is provided with cockpits, a foot operable lever positioned at each cockpit, main control cables in engagement with each control element, an end of each control cable being connected to the foot levers in each hull whereby the control cables may be operated by any member of the crew.

9. In the combination set forth in claim 6, a streamlined strut rigidly connected to and between the forward ends of the hulls, the control elements being positioned adjacent respective ends of the strut and said cable being located within the strut.

10. In the combination set forth in claim 6 wherein a frangible element is positioned between the upper end of each unit and a respective cylindrical bearing, said element being adapted to break in a manner to release the unit in the event that a respective unit encounters an obstruction.

11. A sailboat of the catamaran type comprising a pair of spaced hulls interconnected by a deck, said deck being provided with an opening, a deck section pivotally mounted in said opening in a manner to swing downwardly and rearwardly, a centerboard having a vertically extending shaft, a bearing mounted on said section, said shaft being rotatably supported within the bearing, a rearwardly extending handle on said shaft for swinging the centerboard laterally, said handle being operative, when moved upwardly and forwardly, to swing the centerboard rearwardly to a retracted position close to the lower side of the deck.

12. A sailboat of the catamaran type comprising a pair of spaced fuselage shaped hulls, a deck secured rigidly to and between said hulls, each hull being provided with a main lifting hydrofoil unit positioned substantially intermediate of the ends of the hull and on or slightly ahead of the aerodynamic center of pressure of the sail system but slightly aft of the center of gravity of the boat, each main hydrofoil having a pair of lateral supports connected to opposite sides of a respective hull and converging downwardly, a guidance and stabilizing unit of the hydrofoil type positioned on and below the forward end portion of each hull each guidance unit comprising transverse vanes decreasing in area downwardly whereby depression of the bow due to an increase in wind velocity and sail thrust will be counteracted by an increased lift on the bow and due to increased submersion of said stabilizing units, each last named unit being rotatably mounted on a respective hull and control means for rotating said last named units in unison.

13. A sailboat of the catamaran type as set forth in claim 12 wherein a shaft is rotatably mounted on each of the forward hull ends and being extended downwardly to a point below the respective hull end, each stabilizing unit being supported on the lower end of a respective shaft, the control means being associated with said shafts and including an operating element therefor which is extended to an operating position on the boat.

14. A sailboat as set forth in claim 12, a band encircling each hull and being adjustably mounted thereon, the main lifting hydrofoil units being supported on said bands and means for adjusting the position of each band and the hydrofoil supported thereon while the sailboat is in flight.

References Cited in the file of this patent

UNITED STATES PATENTS

1,410,875	Baldwin	Mar. 28, 1922
2,561,253	Wells-Coates	July 17, 1951
2,703,063	Gilruth	Mar. 1, 1955
2,856,878	Baker	Oct. 21, 1958
2,991,749	Patterson	July 11, 1961

OTHER REFERENCES

Catamarans 1958, A. Y. R. S. publication No. 22, pages 20 and 34, published by John Morwood.