United States Patent [19]

Wassell

[11] **3,839,979**

[45] **Oct. 8, 1974**

[54] **COLLAPSIBLE MULTICARRIER WIND PROPELLED VEHICLE**

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[21] Appl. No.: **266,618**

[52] **U.S. Cl.** ..... **114/61,** 9/2 R, 114/39

[51] **Int. Cl.** **B63b 1/14**

[58] **Field of Search** ..... 9/2 C, 2 R, 2 F; 114/39, 114/43, 61, 123; 115/70

[56] **References Cited**

UNITED STATES PATENTS

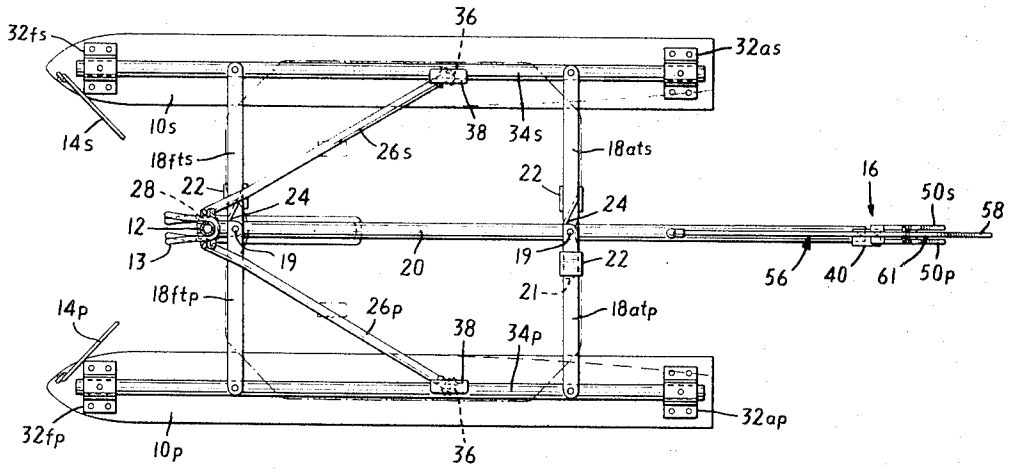
55,675	6/1866	Knudsen et al.	9/2 C
744,590	11/1903	Moore	114/39
2,351,542	6/1944	Paull	114/39
3,150,632	9/1964	Evans	115/70

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Assistant Examiner—Stuart M. Goldstein
Attorney, Agent, or Firm—Brumbaugh, Graves, Donohue & Raymond

[57] **ABSTRACT**

A collapsible multicarrier wind propelled vehicle includes a pair of spaced carriers connected by centrally hinged struts. A center control spar is connected to the struts at the hinged midpoint and a mast is stepped on the spar by a hinged connector. One or more mast brace spars are pivotally connected at one end to the mast and at the other end are connected to a respective one of each of the carriers. The vehicle is collapsed in a convenient package for transportation by folding the mast down parallel to the control spar thereby shifting the control spar axially forward relative to the carriers and folding the center struts at the hinged midpoint to bring the carriers together. The mast may be telescoped to that in collapsed condition it does not extend beyond the ends of the package.

23 Claims, 19 Drawing Figures



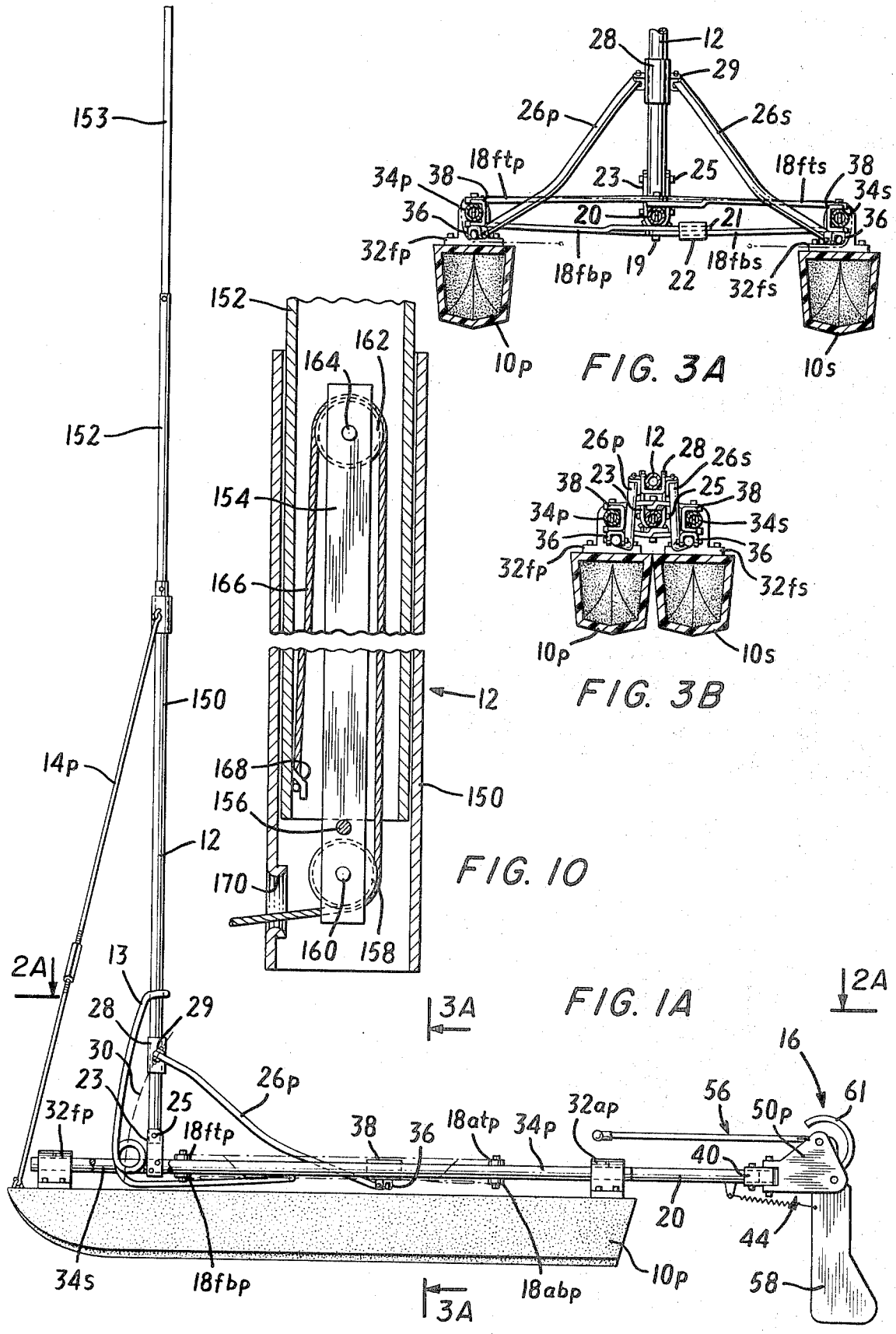


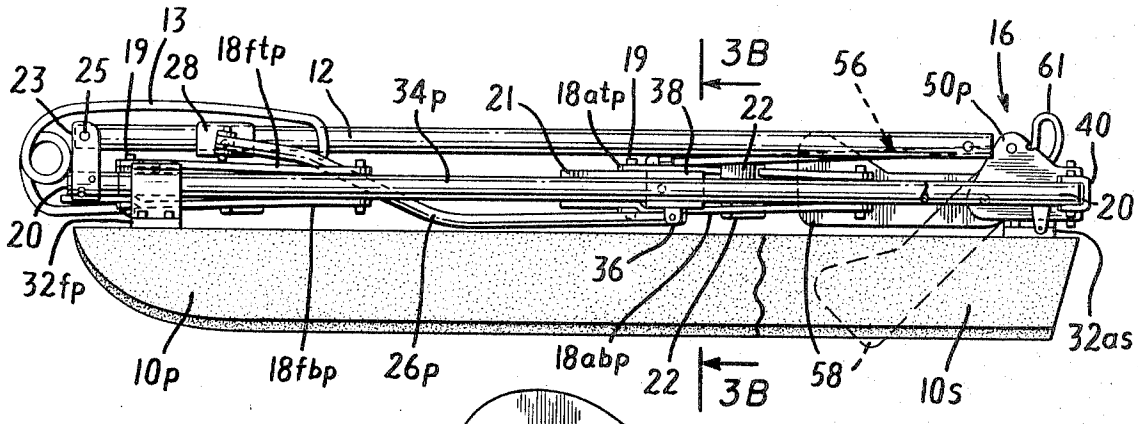
FIG. 10

FIG. 3A

FIG. 3B

FIG. 1A

FIG. 1B


13
19
28
18ftp
12
34p
21
18atp
19
38
3B
22
56
16
50p
61
40
20
23
25
32fp
36
32as
10p
18fbp
26p
18abp
22
3B
58
10s

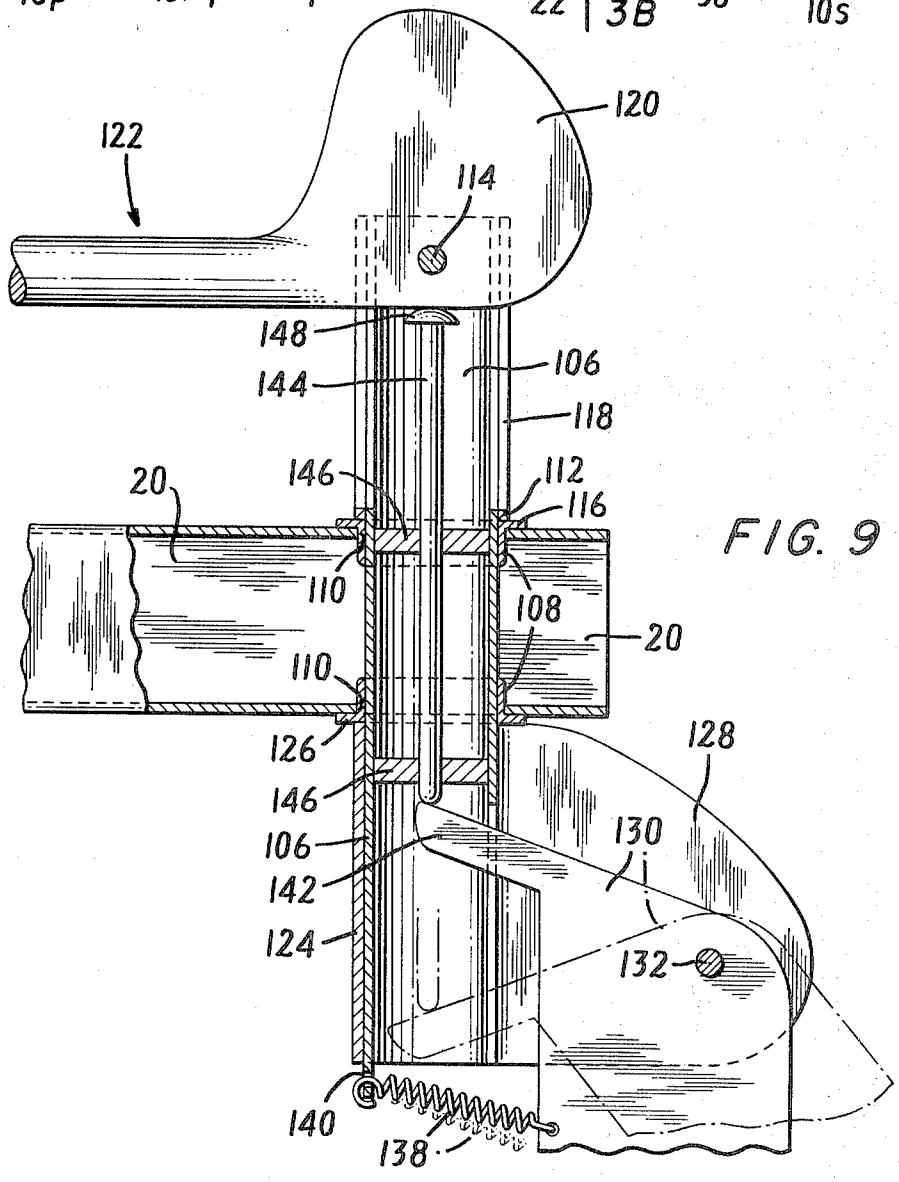

120
122
114
148
106
144
118
146
112
116
20
110
108
20
110
126
128
146
106
130
142
124
132
140
138

FIG. 9

FIG. 2A

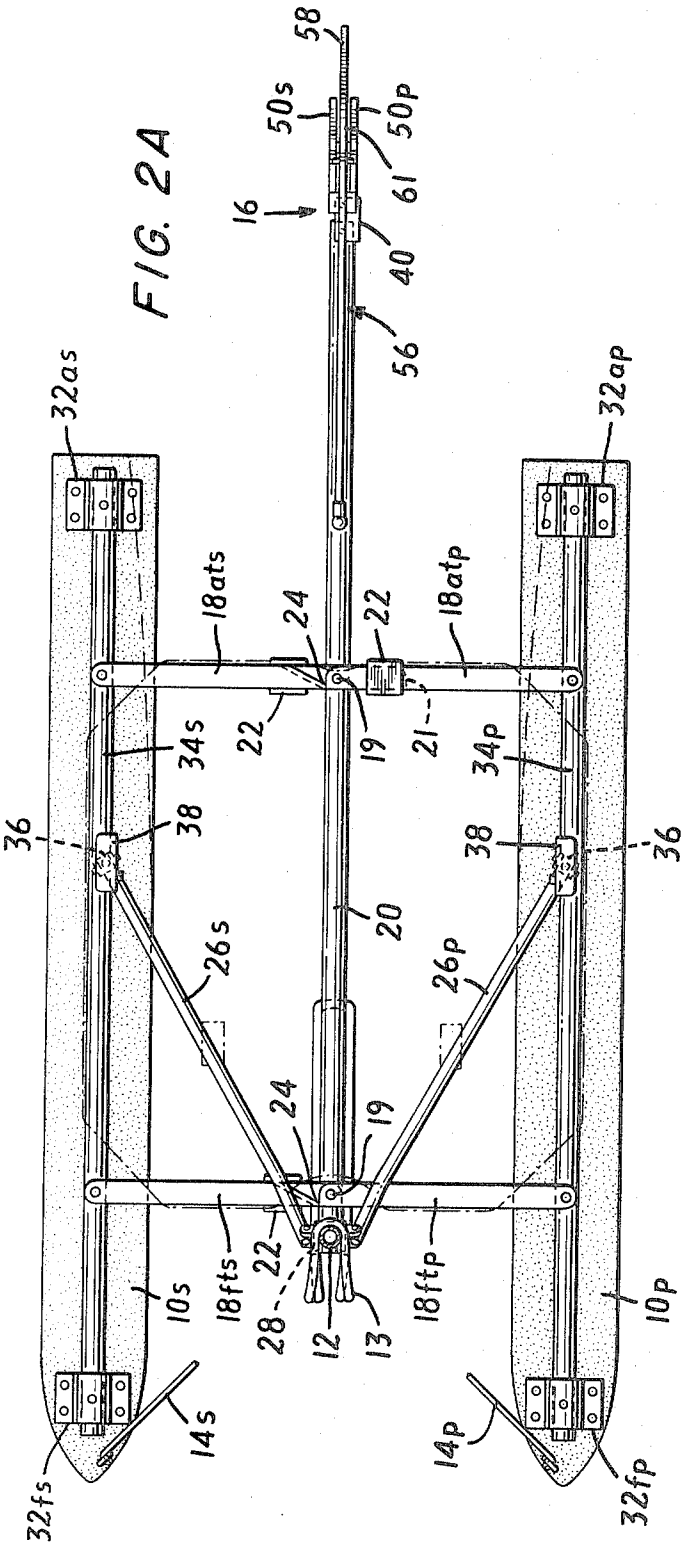

58
50s
50p
16
61
40
56
32as
32ap
18ats
24
22
18atp
22
19
21
34s
34p
36
38
38
36
26s
20
26p
24
19
22
18fts
18ftp
10s
10p
28
12
13
14s
14p
32fs
32fp

FIG. 2B

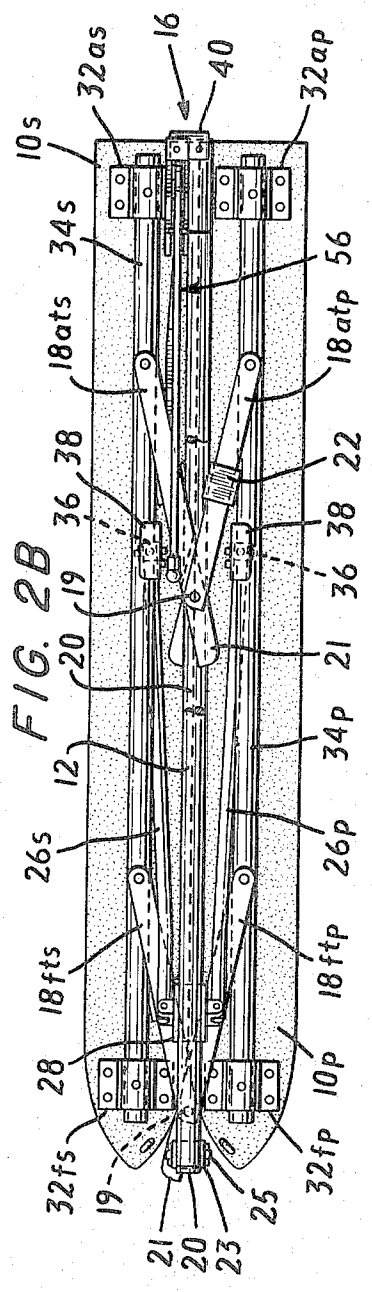

10s
32as
16
40
32ap
34s
56
18ats
18atp
38
22
36
38
19
36
20
21
12
34p
26s
26p
18fts
18ftp
28
10p
32fs
19
32fp
25
21
20
23

FIG. 4

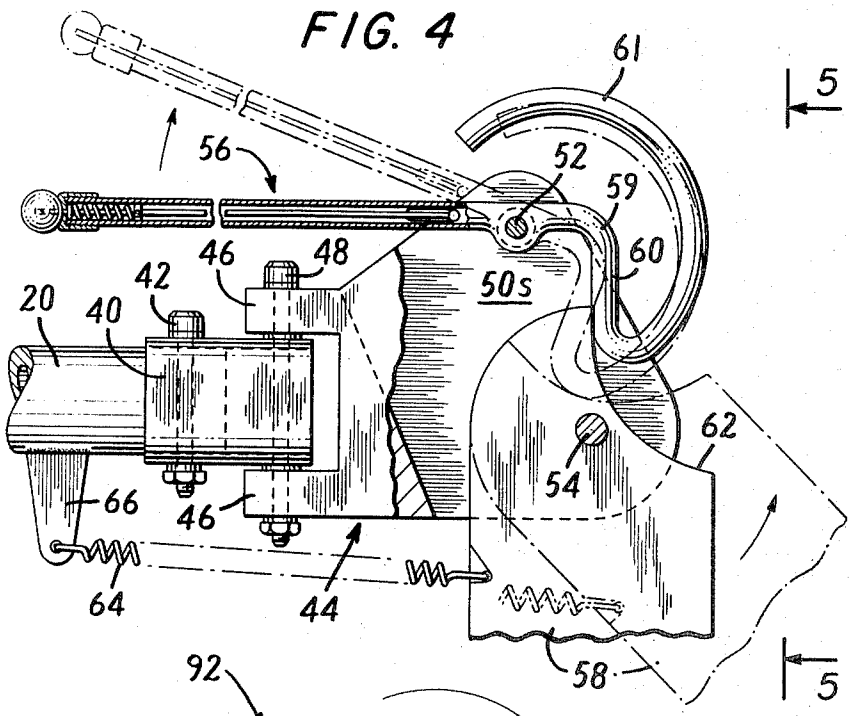
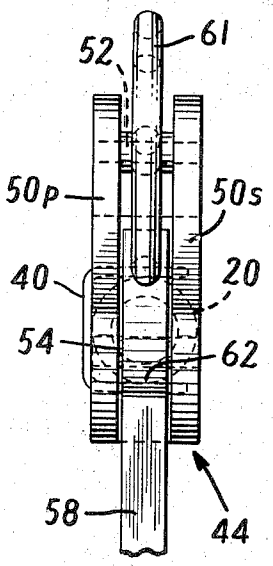


FIG. 5



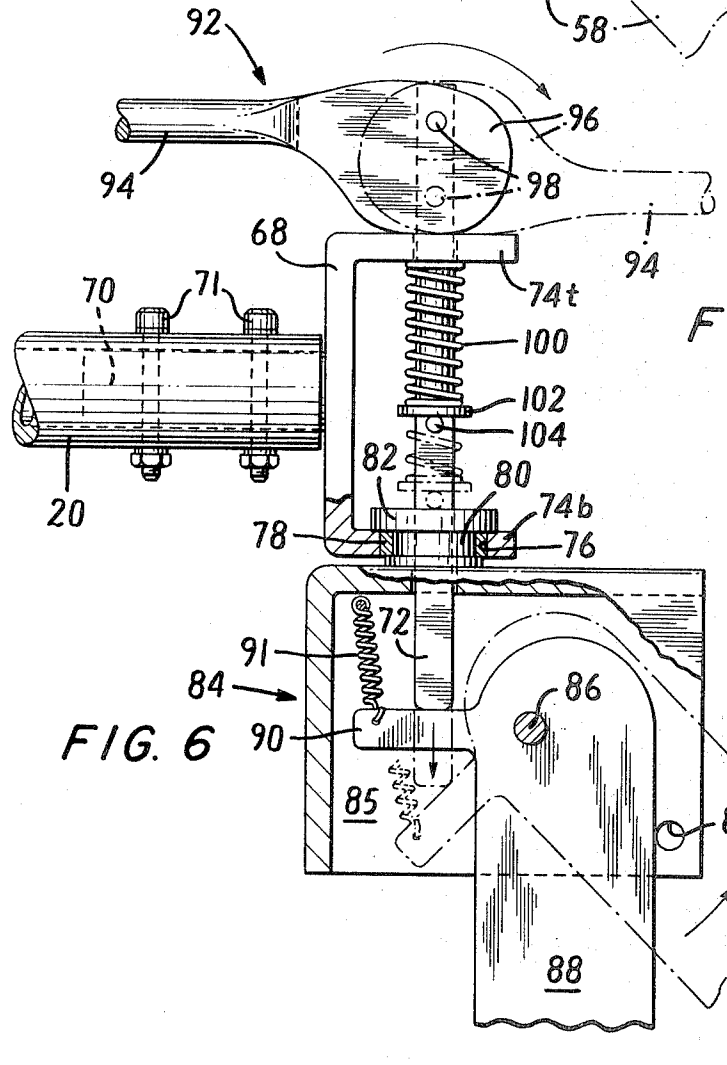
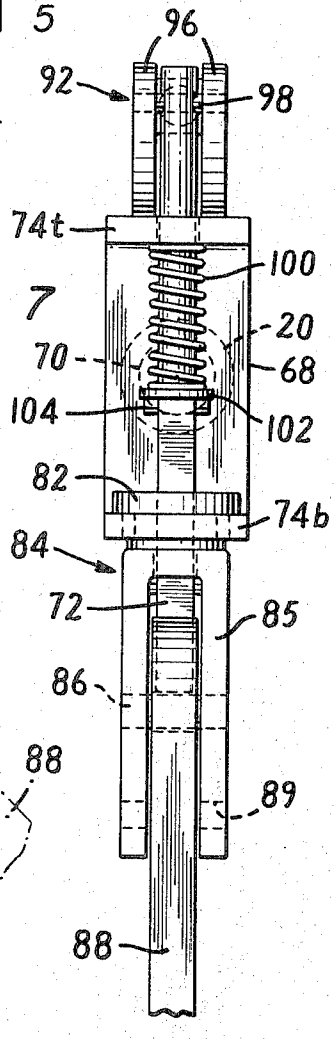


FIG. 6

FIG. 7



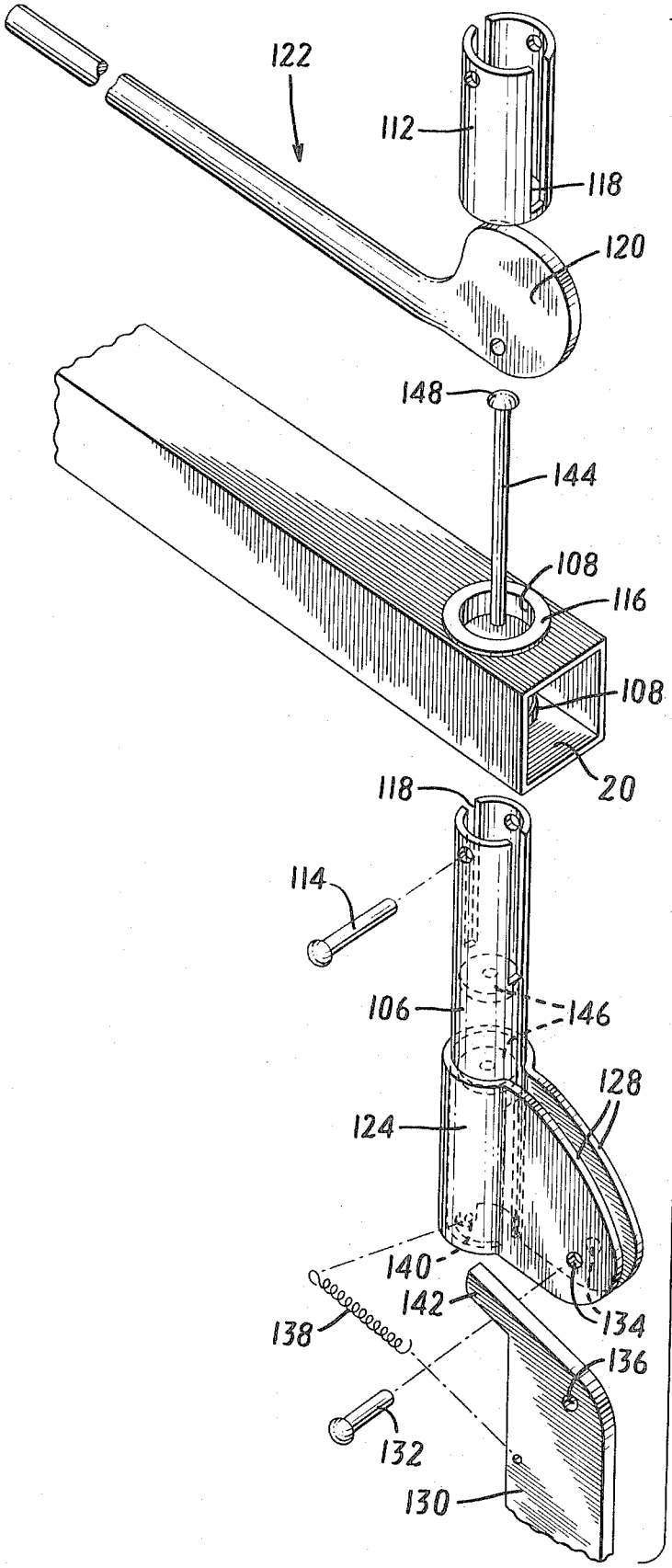

122
112
118
120
148
144
108
116
108
20
118
114
106
146
128
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136
132
130

FIG. 8

FIG. 11

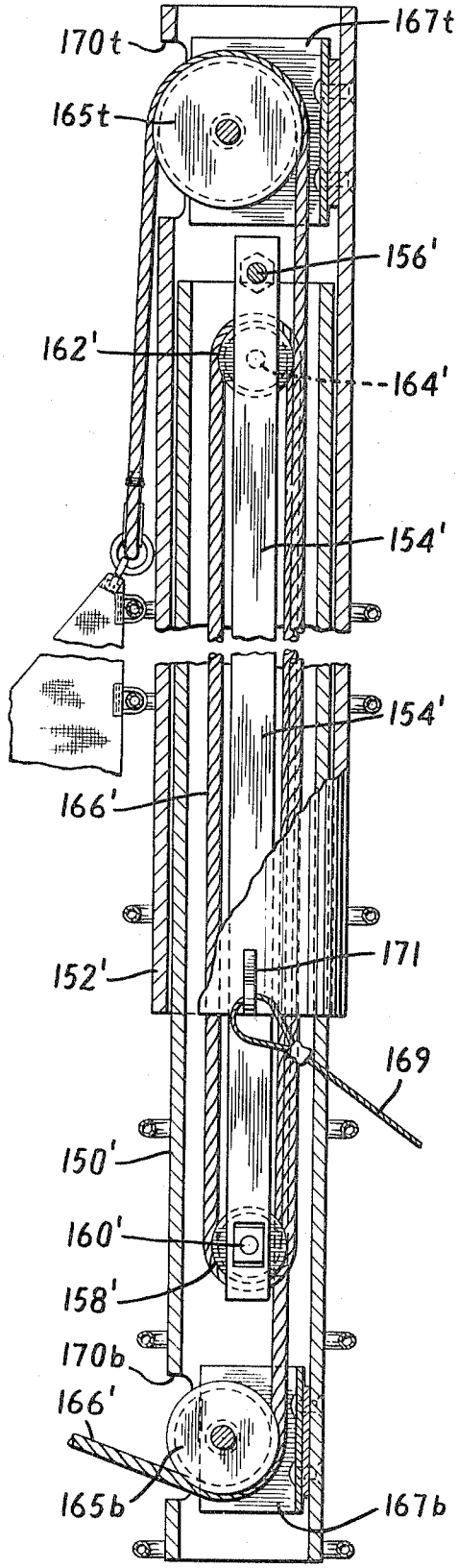

170t
167t
165t
156'
162'
164'
154'
154'
166'
152'
171
169
150'
160'
158'
170b
166'
165b
167b

FIG. 12

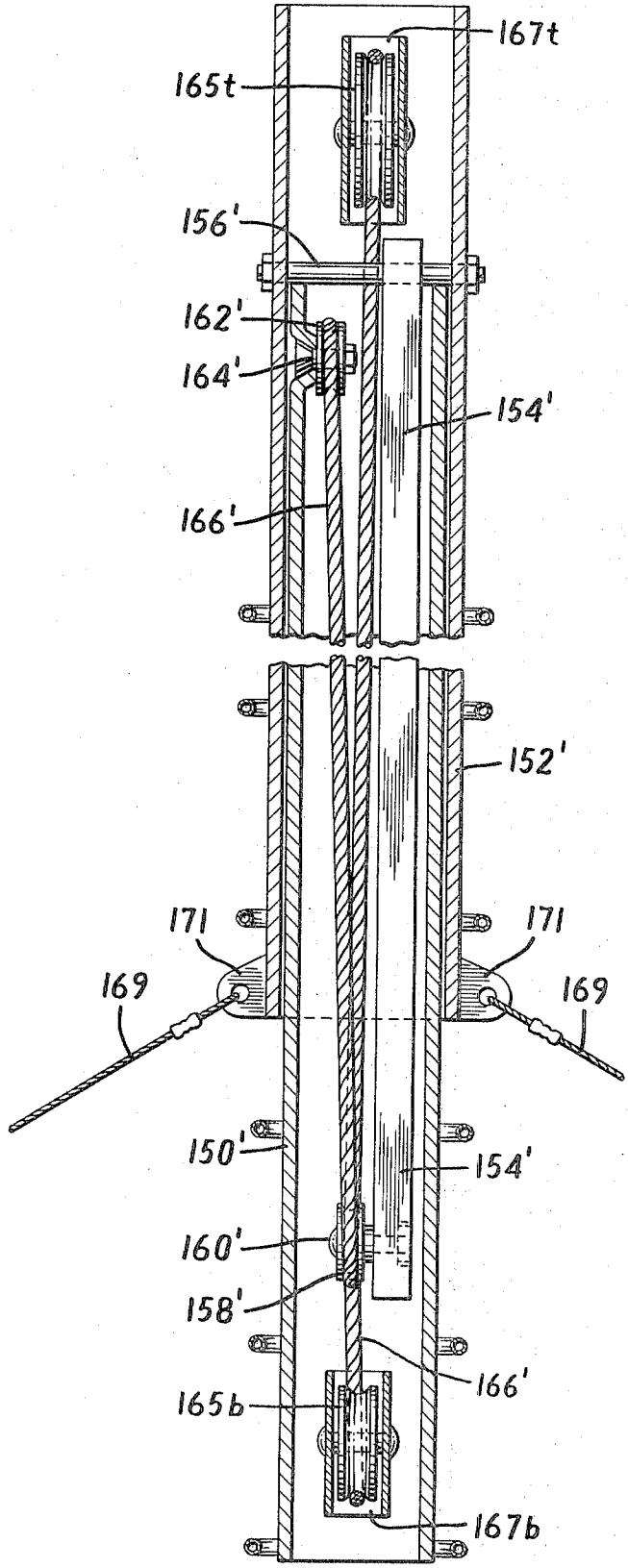

167t
165t
156'
162'
164'
154'
166'
152'
171
171
169
169
150'
154'
160'
158'
166'
165b
167b

FIG. 13

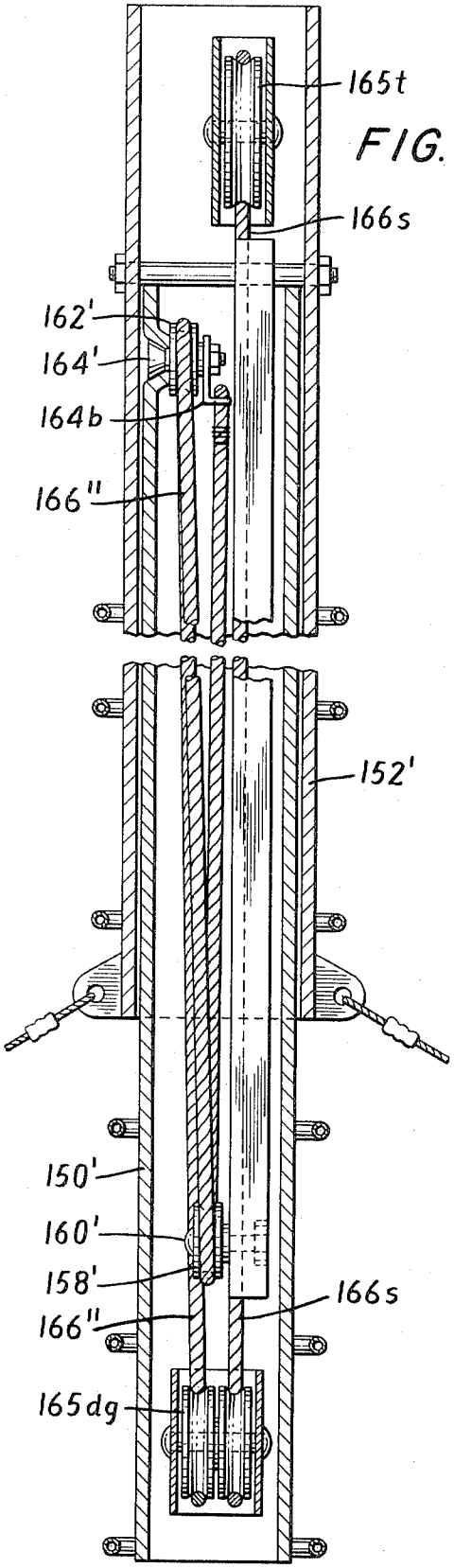

165t
166s
162'
164'
164b
166''
152'
150'
160'
158'
166''
166s
165dg

FIG. 16

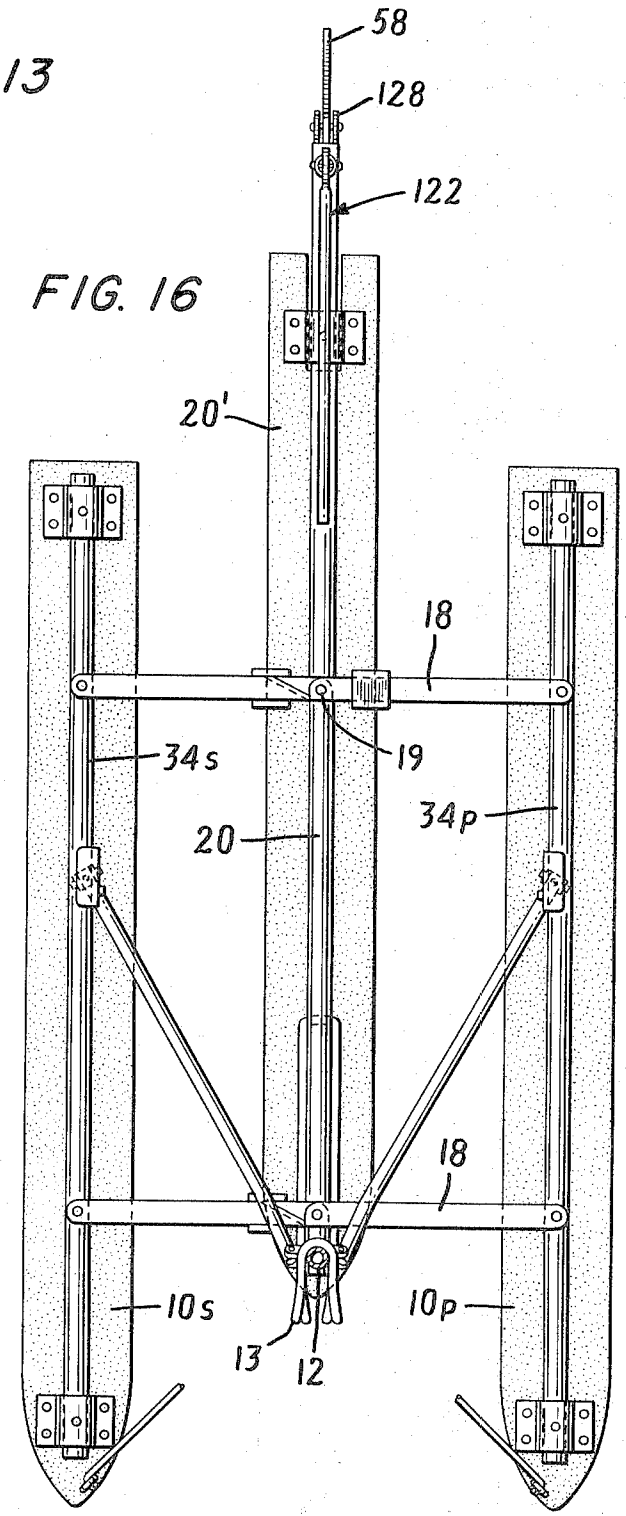

58
128
122
20'
18
34s
19
34p
20
18
10s
10p
13
12

FIG. 14

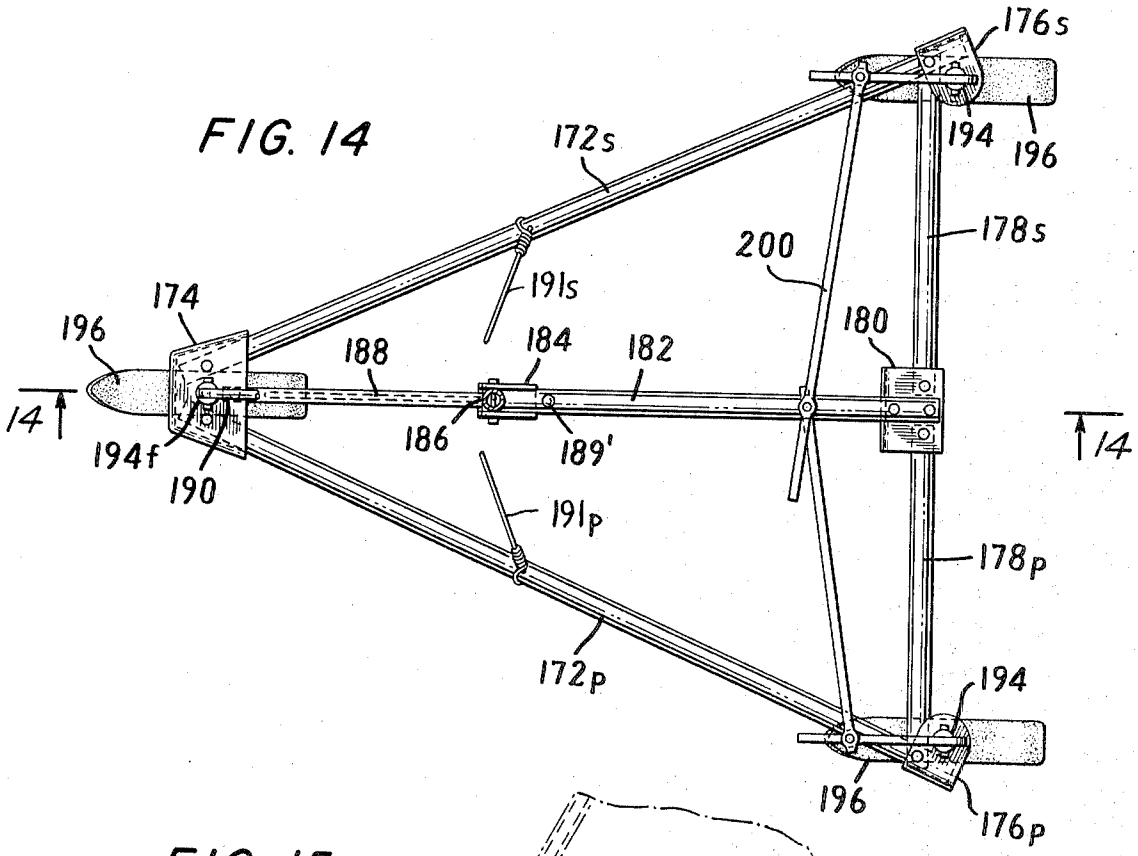
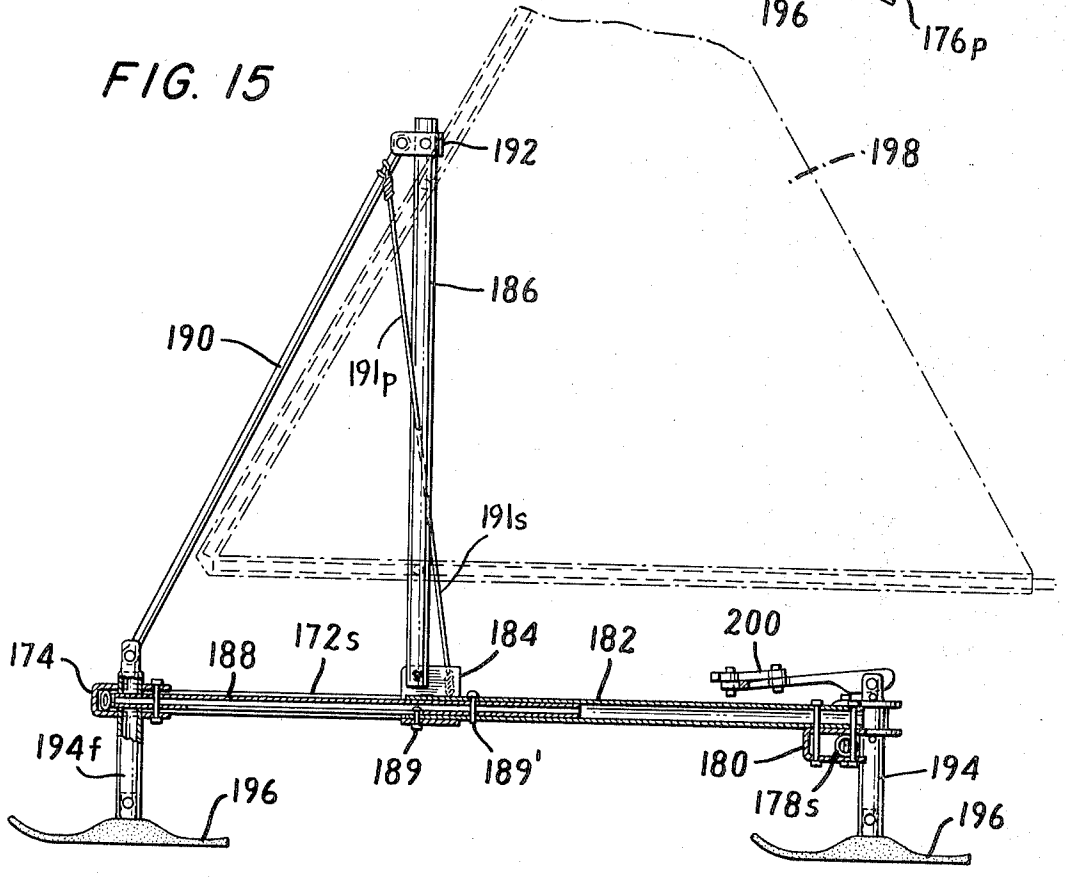

176s
194
196
172s
178s
200
191s
174
196
188
184
182
180
14
14
186
189'
194f
190
191p
178p
172p
194
196
176p

FIG. 15


192
198
186
190
191p
191s
174
188
172s
184
182
200
194f
189
189'
180
194
178s
196
196

COLLAPSIBLE MULTICARRIER WIND PROPELLED VEHICLE

BACKGROUND OF THE INVENTION

This invention relates to multicarrier craft, and more particularly to collapsible wind propelled multicarrier vehicles such as catamaran and trimaran sailboats and iceboats.

The superior nautical qualities of the catamaran type water craft have been known for many years. Because of their high beam-to-length ratio and their shallow draft, catamaran type water craft exhibit desirable seaworthy qualities of stability and resistance to capsizing equivalent to those of much larger single hull water craft. In addition, multihulled water craft are much faster than single hulled water craft.

Despite these obvious and well known advantages, catamaran water craft have not enjoyed the degree of popular acceptance that one would expect of a water craft of this nature. A principle reason for this lack of acceptance is the awkward bulk of the double hull design which makes handling, transportation and storage difficult and inconvenient. Many boat owners prefer to remove their boats from the water in the winter months to forestall fouling of the bottom and thereby greatly reduce the maintenance that would otherwise be necessary if the boat were left in the water all year. Single hull boats are easily removed from the water by means of the conventional ramp and trailer arrangement, but because of the catamaran's wide beam, they require much wider trailers or other special equipment to be removed from the water and transported. Alternatively, conventional catamarans must be disassembled in the water and removed one hull at a time. The storage of conventional catamarans is expensive and inconvenient because of the wide beam which occupies a great deal more space than an equivalent sized single hull boat. Because of the increased difficulty, expense, inconvenience and time loss involved in the handling, transportation and storage of conventional catamarans, many prospective catamaran owners decide against buying a catamaran and instead buy a single hull boat.

To overcome these problems, there have been attempts in the past to design a catamaran type water craft which collapses into a transportable package, but these designs have been either excessively complicated and expensive to manufacture and maintain, or flimsy and unseaworthy. In addition, the procedure for collapsing the catamaran into a transportable package is frequently so complicated and time consuming that the prospective owner is unwilling to undertake the chore and instead buys a single hull water craft.

Accordingly, there has existed in the art a longstanding need for a collapsible catamaran which may be folded quickly and easily into a convenient package for transportation and storage and which, when afloat, provides a strong and reliable watercraft which the owner may sail with confidence.

SUMMARY OF THE INVENTION

Accordingly, there is provided herewith a collapsible multicarrier vehicle which is strong and light, inexpensive to manufacture and maintain, is easily erected for operation and easily collapsed for transportation and storage.

A multicarrier vehicle according to this invention has a plurality of laterally spaced carriers, such as hulls, skis or skates held in space relationship by a pair of struts pivotally connected at either end to a respective hull. The struts are centrally hinged and connected to a center control spar which may be moved axially relative to the carriers to fold the struts and bring the carriers together. A mast is stepped on the center control spar and one or more mast braces are connected at one end to the mast and at the other end to a respective carrier. When the mast is folded down to lie horizontally, it pivots about the connection at the mast braces and levers the center control spar forward which folds the struts forwardly and brings the hulls together. The mast is made of axially telescoping sections and may be raised by a mechanism located completely within the interior of the mast.

DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and its many attendent advantages will develop as the same becomes better understood by consideration of the following detailed description of the preferred embodiment in conjunction with the appended drawings, wherein:

FIG. **1A** is an elevation of a catamaran sailboat according to this invention in erect configuration;

FIG. **1B** is a similar elevation of the sailboat shown in FIG. **1A** in collapsed configuration;

FIG. **2A** is a plan view along lines **2A—2A** in FIG. **1A**;

FIG. **2B** is a plan view of the sailboat shown in FIG. **1B** in collapsed configuration;

FIG. **3A** is a cross-sectional elevation along lines **3A—3A** in FIG. **1A**;

FIG. **3B** is a cross-sectional elevation along lines **3B—3B** in FIG. **1B**;

FIG. **4** is an elevation, partly in section, of a tiller and rudder assembly for use on a wind propelled vehicle according to the present invention;

FIG. **5** is an elevational end view along lines **5—5** in FIG. **4**;

FIG. **6** is an elevation, partly in section, of a second embodiment of a rudder and tiller assembly;

FIG. **7** is an elevational end view along lines **7—7** in FIG. **6**;

FIG. **8** is an exploded isometric view of a third embodiment of a rudder and tiller assembly;

FIG. **9** is an elevation, partly in section, of the rudder and tiller assembly of FIG. **8**;

FIG. **10** is a broken cross-sectional elevation of the bottom section of a mast for use with the invention;

FIGS. **11–13** are broken cross-sectional elevations of a second and third embodiment of a mast;

FIG. **14** is a plan view of a trimaran skiboat according to this invention; and

FIG. **15** is an elevation of the skiboat along lines **15—15** in FIG. **14**;

FIG. **16** is a plan view of a trimaran sailboat.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference characters designate identical or corresponding parts, and more particularly to FIGS. **1A** and **1B** thereof, a sailboat according to the present invention is shown having a pair of supporting carriers, which in the case

of a waterborne vehicle, take the form of hulls **10***p* and **10***s*, of which only the hull **10***p* appears in FIG. **1**A. Connected centrally between hulls **10***p* and **10***s* is a vertical mast **12** foldable to the horizontal position illustrated in FIG. **1**B but biased to the erect vertical position illustrated in FIG. **1**A by a spring **13.** A pair of mast stays **14***p* and **14***s*, of which only stay **14***p* appears in FIG. **1**A may be connected between the mast and the hulls to hold the mast erect and lock the catamaran in erect configuration. A rudder and tiller assembly **16** is connected aft of the hulls **10** for steering the sailboat, and along with the mast **12,** may be folded compactly with the hulls **10** as shown in FIG. **1**B for easy transportation for example, on top of a car, to and from the launching site and for convenient storage.

Looking now at FIGS. **2**A and **2**B, the structure which holds the catamaran sailboat in the erect configuration shown in FIG. **2**A and provides for its collapse into the folded configuration shown in FIG. **2**B includes a forward strut **18***f* and an aft strut **18***a* connected athwartships at their respective opposite ends to hulls **10***p* and **10***s*. Each strut **18** includes a separate port and starboard section **18***p* and **18***s* and each port and starboard section is in turn formed of a pair of spaced top and bottom sections **18***t* and **18***b*. The outboard end of each top and bottom strut member is pivotally pinned to the top and bottom, respectively, of a longitudinal member, shown here as a rail **34** connected to each hull **10.** The strut could be connected directly to the hulls **10,** in which case the hulls themselves would function as the longitudinal members.

The inboard end of each top and bottom strut member is pinned by hinge pin **19** to the top and bottom, respectively, of an axially extending center control spar **20.** By shifting the center control spar **20** forward with respect to the hulls **10,** the struts **18** will fold forwardly at their hinge pins **19** thereby bringing the hulls **10** together as shown in FIG. **2**B.

A mechanism for supplementing the function of the stays **14** in locking the struts **18** in erect configuration is provided, including an extension **21** formed on the aft top starboard strut **18***ats* and the aft bottom port strut **18***abp* and also on the fore bottom starboard strut **18***fbs*. (No extension is formed on the fore top strut because it would interfere with the mast.) A sleeve **22** on the struts formed without extensions slides over the extensions **21** to hold them for swinging relative to the strut which they underlie thereby locking the catamaran in open configuration. Of course, the extensions **21** could be provided on other or additional struts, as will be appreciated by one skilled in the art.

To provide additional rigidity to the struts in the locked erect configuration, and to provide a means for automatically positioning the extensions **21** in exact alignment over their mating struts, a stop **24** is formed on the strut member having the extension. The stop **24** abuts against a corner of the inboard end of the strut member on which the sleeve **22** slides to prevent the struts from opening beyond the 180° configuration illustrated in FIG. **2**A.

The stop **24** is formed by stamping an indentation in the strut member on which the extension **21** is formed, to receive the overlapping portion of the opposite strut member when the strut is folded as illustrated in FIG. **2**B. Alternatively, the strut bearing the extension **21** could be made out of flat stock, and a separate piece of stock, beveled and truncated as illustrated in FIG. **2**A could be secured to the top of that strut to provide the stop **24.** Other forms of stop are possible as well. For example, the end of strut **18***atp* could be provided with an extension like the extension **21** on the strut **18***ats* and both extensions could be notched on their aft edges. A vertical pin could be provided on the struts to receive and engage the notches when the struts are straightened to 180° and then a seleve could fit over each extension. Other forms of lock and stop structure are possible and will occur to those skilled in the art in view of this teaching.

As best seen in FIGS. **1**A and **3**A the mast **12** is hingably stepped on the forward end of the center control spar **20** by means of a elongated upstanding U-shaped bracket **23** whose arms embrace the control spar **20** and the port and starboard sides of the heel of mast **12,** to which they are pinned by a pivot pin **25** extending through the heel of mast **12** and both arms of the bracket **23.** Two mast brace spars **26***p* and **26***s* are connected to a U-shaped bracket **28** fixedly disposed on the mast **12.** The connection is by means of universal joint formed of a U-shaped bracket **29** pinned through its arms to the inboard end of each spar **26,** and fastened to the bracket **28** by a pin which extends horizontally through the cross-piece of both brackets **29,** through both arms of bracket **28,** and through the mast **12.** The other end of each mast brace spar **26** is pivotally connected to a hull **10** by a similar universal joint, described below. When the mast is pivoted about pivot pin **25** and folded down parallel to the hulls **10,** the mast acts as a lever fulcrumed at the bracket **28** which, as the mast **12** pivots downwardly, describes a short arc **30** shown in FIG. **1**A. The center control spar **20** moves directly forward from its position illustrated in FIG. **2**A to its position illustrated in FIG. **2**B wherein the fore and aft ends of the center control spar **20** are even with the bow and stern respectively, of the hulls **10.**

The technique for fastening of the struts **18** and the mast brace spars **26** to the hulls **10** will now be described in conjunction with FIGS. **1** through **3.** While this method of fastening is effective, it will be recognized by those skilled in the art that other techniques may be used which offer other or additional advantages.

A support block **32** having a bore formed therethrough is fastened at each end of each hull **10***p* and **10***s*, and each bore receives one end of a rail **34.** The top and bottom members of the struts **18** bracket the rails **34** and are secured thereto by a pin extending through the rail **34** and the outboard ends of the top and bottom members of the struts **18.** The mast brace spars **26** are attached to the rails **34** by U-shaped brackets **36** pinned to the outboard ends of the mast brace spars **26** and also pinned to the underside of a second U-shaped bracket **38** which is fixed to rails **34** by a pin which extends through the cross-piece of bracket **36,** both arms of bracket **38,** and the rail **34.** This universal joint permits the mast brace spars to pivot vertically and also fore and aft as the mast is erected and collapsed and the hulls **10** are spread apart and folded together.

Turning now to FIG. **4,** a rudder-tiller assembly is illustrated for use with a catamaran sailboat of the present invention and is attached to the aft end of the center control spar **20** by means of an elongated U-shaped bracket **40** pivotally secured to the end of the center control spar **20** by means of a bolt **42.** The rudder is

pivotally connected to the bracket **40** by means of a double bifurcated yoke **44** having a pair of vertically spaced horizontally extending tongues **46** which extend above and below the bracket **40** and are pivotally connected thereto by a pintle pin **48** which allows the yoke **44** to swivel in a horizontal direction. A pair of vertically extending horizontally spaced leaves **50***p* and **50***s* extend aft from the yoke **44** and support the opposite ends of a pair of horizontal pivot pins **52** and **54.** The pivot pin **52** pivotally supports a tiller assembly **56,** and the pivot pin **54** pivotally supports a rudder **58.** Both the tiller **56** and the rudder **58** are supported for pivotal movement in the vertical plane of the yoke **44** and the vertical plane in which they pivot is itself horizontally swingable about the bolt **42** and the pintle pin **48** by virtue of the pivotal attachment of the bracket **40** to the control spar **20** and the yoke **44** to the bracket **40.**

The end of the tiller **56** aft of the pivot pin **52** is bent downwardly in a right angle **59** to give a short vertical length **60,** and then is formed in a semi-circle **61** having a radius of curvature equal to that of a quarter-circle cut **62** in the top aft corner of the rudder **58.** A rudder spring **64** is connected between the forward edge of the rudder **58** and a vertically projecting lug **66** welded to the underside of the center control spar **20** to bias the rudder to pivot forwardly about its pivot pin **54.** The spacing and dimensions of the tiller and rudder are such that when the assembly is in operative position, that is, with the tiller extending toward the bow and the rudder extending vertically into the water, the short vertical length **60** of the tiller engages the top vertical edge of the quarter-circle cut **62** in the rudder to prevent the rudder from pivoting forwardly about pivot pin **54** under the influence of the rudder spring **64.** To prevent the rudder spring **64** from rotating the rudder **58** clockwise and levering the tiller **56** counterclockwise, a spring loaded detent rod **65** is provided which engages a slot **67** cut into each leaf **50** of the yoke **44.**

The rudder is cocked upwardly by pulling forward on the end of detent rod **65** to withdraw the aft end thereof from the slots in the leaves **50.** The handle of the tiller **56** is then raised which pivots the aft end of the tiller about pivot pin **52,** and swings it down against the quarter-circle cut **62** in the rudder **58** to pivot rearwardly about its pivot pin **54** against the force of the rudder spring **64.** Further raising of the handle of the tiller **56** causes further rearward pivoting of the rudder **58** until the semi-circular portion **61** of the aft end of tiller **56** swings into full engagement with the quarter-circle cut **62** in the rudder **58.** At this point the handle of the tiller **56** will be vertical and the rudder **58** will extend horizontally aft. Tiller **56** may be further rotated backward and the rudder will remain extending aft.

In operation, the rudder and tiller assembly functions in the conventional manner while the catamaran sailboat is underway. When the sailboat is to be collapsed and removed from the water for transportation and/or storage, the handle of the tiller is swung in a horizontal 180° arc. This caues the bracket **40** to describe a 90° arc about the pivot pin **42** relative to the center control spar, and causes the yoke **44** to describe a 90° arc about pintle pin **48** relative to the bracket **44.** The yoke **44** therefore describes a 180° arc relative to the center control spar to a final position lying alongside the starboard aft end of control spar **20.** At this point, the handle of tiller **56** extends aft and the rudder **58** remains extending vertically into the water. The handle of tiller **56** is then swung in a vertical 180° arc about pivot pin **54** so that it extends horizontally toward the bow and the rudder is cocked up horizontally toward the bow. The rudder and tiller assembly thus folds neatly so as not to project beyond the dimensions off the folded hulls.

Referring now to FIGS. **6** and **7,** the second embodiment of the rudder and tiller assembly for use with the present invention, like the first embodiment, is connected to the aft end of the central control spar **20.** A U-shaped channel member **68** is attached to the aft end of the center control spar **20** by means of a short cylindrical stud **70** connected to the channel member **68** as by welding and extending into the interior of the center control spar **20.** The diameter of stud **70** is substantially identical to the internal diameter of the control spar **20.** A pair of bolts **71** extends through a pair of holes drilled completely through the end of the center control spar **20** and the stud **70** to secure the stud to the center control spar **20.**

A vertical shaft **72** extends through a pair of aligned openings in the vertically spaced arms **74***t* and **74***b* of the channel member **68.** The top half of the shaft **72** is circular in horizontal cross-section and the bottom half is square in horizontal cross-section.

The opening **76** in the lower arm **74***b* of the channel member **68** carries a bearing bushing **78** through which is inserted a collar **80** having an enlarged flange **82** on the upper end thereof with an external diameter larger than the diameter of the opening **76** to prevent the collar **80** from pulling the bushing **78** downwardly through the opening **76.** A yoke **84** having two horizontally spaced vertically extending plates **85** is fixed, as by welding, to the lower end of the collar **80** and rotates therewith.

A pivot pin **86** is fixed in the opposite plates **85** of the yoke **84** extending thereacross and supporting a rudder **88** for pivotal movement in a vertical plane between the plates **85.** A stud **90** is attached to and projects forwardly from the rudder **88** beneath the lower end of the shaft **72.** A spring **91** is attached between the end of the stud **90** and the top inside forward corner of the yoke **84** to bias the stud **90** upwardly against the lower end of the shaft **72** against the drag of the water which would otherwise tend to cock the rudder **88** aft. The rudder may be fixed in vertical position by inserting a pin through a pair of aligned holes **89** formed through the plates **85** to prevent rearward swinging of the rudder **88** about pivot pin **86.** The rudder **88** may be cocked counterclockwise about pivot pin **86** by removing the pin from the holes **89** and lowering the shaft **72,** by a technique which will be explained below, against the stud **90,** pushing it downwardly and thereby rotating the rudder.

The opening through collar **80** which receives the square end of the shaft **72** is likewise square in horizontal cross-section so that when shaft **72** is rotated about its axis it will rotate collar **80** and also the yoke **84,** which causes rudder **88** to rotate about the axis of shaft **72** for the purpose of steering the sailboat.

The shaft **72** is rotated about its axis by means of a tiller **92** having handle **94** and a bifurcated end portion formed in a pair of vertically extending horizontally spaced leaves **96** which bracket the upper end of the shaft **72.** A pivot pin **98** extends horizontally through both leaves **96** and through a hole formed in the upper end of the shaft **72** to fix the tiller, the axis of shaft **72,**

the yoke 84, and the rudder 88 in a common vertical plane while permitting angular movement of the tiller 92 about pivot pin 98 in that common plane. The angular orientation of that common plane relative to the longitudinal axis of the boat may be adjusted by swinging the handle 94 of the tiller 92 in a horizontal arc which transmit the torque through the shaft 72 to the yoke 84 and the rudder 88.

The vertical position of the shaft 72 is adjusted by swinging the tiller 92 in a vertical arc about the pivot pin 98. This changes the point of contact of the peripheral edge of the leaves 96 on the upper surface of the top arm 74*t* of the channel member 68. As clearly illustrated in FIG. 6, the radial dimension between the pivot pin 98 and the point on the peripheral edge of the leaves 96 in contact with the upper surface of the arms 74*t* varies from a maximum in the position illustrated in the solid lines to a minimum in the position illustrated in phantom. By rotating the tiller 92 upward in a vertical plane, the vertical radial distance between the pin 98 and the peripheral edge of the leaves 96 in contact with the upper surface of the top arm 74*t* gradually decreases to permit the shaft 72 to descend vertically.

To assure that shaft 72 will assume its lower position when the tiller 92 is rotated up and over in a vertical plane about the pivot pin 98, a spring 100 is disposed concentrically about the shaft 72, bearing, at its top end, against the under surface of the top arm 74*t* and bearing, at its lower end, against a washer 102 also disposed concentrically about the shaft 72 and supported by a pin 104 extending therethrough. The spring 100 biases the shaft 72 downwardly so that when the tiller 94 is swung upwardly to shorten the vertical radial distance between the pivot pin 98 and the point of contact of the peripheral edge of the leaves 96 against the upper surface of the top arm 74*t*, the spring 100 will force the shaft 72 downwardly against the stud 90 thereby rotating the rudder 88 in a vertical plane about the pivot pin 86.

In use, while the catamaran sailboat is underway, the rudder and tiller assembly is in the configuration as illustrated in solid lines in FIG. 6. When the catamaran is to be collapsed and removed from the water for transportation and/or storage the tiller is first swung horizontally in a 180° arc to position the handle 94 of the tiller 92 aft. The plane of the rudder 88 has rotated 180° but the rudder remains extending vertically down into the water. The handle 94 is then rotated up in a vertical plane in a 180° arc to position the shortest radial distance between the pivot pin 98 and the peripheral edge of the leaves 96 against the top surface of the bracket arm 74*t* and allow the spring 100 to push the shaft 72 downwardly to its extreme lowest position to cock the rudder 88 forward and upward. The hulls are then folded together, as previously described, which shifts the control spar forward to compactly position the rudder between the hulls and provide a compactly folded package for easy transportation or storage.

Looking now at FIGS. 8 and 9, the third embodiment of the rudder tiller assembly illustrated therein includes a tube 106 extending through a pair of flanged bushings 108 in a pair of aligned openings 110 through the aft end of center control spar 20 which, in this embodiment, is square in vertical cross-section. A ferrule 112 fits concentrically over the top portion of tube 106 and is fixed thereto by a pin 114 extending through a pair of aligned holes in the top portion of the ferrule 112 and the tube 106. The bottom edge of the ferrule 112 rests against the flange 116 formed on the top bushing 108 to prevent the tube 106 from dropping vertically through the holes 110 in the control spar 20. A pair of longitudinally extending diametrically aligned slots 118 in the ferrule 112 and the tube 106 receive the aft end of a tiller 122 which is flattened and enlarged to form a leaf 120. By means of the engagement of the leaf 120 in the slots 118, horizontal rotation of the tiller causes rotation of the tube 106 about its axis.

A yoke 124 is connected, as by welding, to the bottom end of tube 106 in abutting relationship to the flange 126 on the lower bushing 108. A pair of vertically extending horizontally spaced vanes 128 extend from the yoke 124 along both sides of a rudder 130. A pin 132 extends through a pair of aligned holes 134 in the vanes 128 and through a hole 136 in the rudder to support the rudder 130 for pivotal movement in a vertical plane between the vanes 128. A spring 138 connected between the forward edge of the rudder 130 and a vertically projecting tang 140 on the bottom end of the tube 106 biases the rudder 130 forwardly.

A stud 142 is formed on the upper forward corner of the rudder 130 and engages the bottom end of a pin 144 supported axially in the tube 106 by means of a pair of vertically spaced centrally apertured guide discs 146 fixed in the tube 106. The pin 144 has a large rounded upper end 148 which engages the peripheral edge of the leaf 120 of the tiller 122. As best illustrated in FIG. 9, the radial distance between the pivot pin 114 and the peripheral edge of the leaf 120 is shortest in the operational position illustrated in FIG. 9. To cause the rudder 130 to rotate in a vertical plane it is merely necessary to pivot the handle of the tiller 122 about the pivot pin 114 which causes the increasingly greater radial distance between the pivot pin 114 and the peripheral edge of the leaf 120 to cam the pin downwardly and force the rudder 130 to pivot about its pivot pin 132 in a vertical plane.

While underway, the configuration of the rudder and tiller assembly is as shown in FIG. 9. When the sailboat is to be folded, the tiller 122 is first swung in a horizontal 180° arc to position the handle of the tiller aft. This rotates the tube 106 about its axis and rotates the rudder 130 about the axis of tube 106 in a 180° arc. At this time the rudder remains extending vertically downward into the water. The handle of the rudder 122 is then swung in a 180° vertical arc which, because of the increasing vertical radial distance between the pivot pin 114 and the peripheral edge of the leaf 120 in contact with the pin 144, cams the pin 144 downward against the stud 142 of the rudder 130, thereby cocking the rudder 130 about its pivot pin 132 in a vertical plane upwardly and forwardly. The hulls are then folded together as previously described which carries the center control spar 20, forwardly to position the rudder and tiller assembly between the hulls, producing a compact easily transportable package in which neither the rudder nor the tiller project beyond the exterior dimensions of the folded package.

Looking now at FIG. 10, the telescoping mast 12 may be formed of two sections; a bottom section 150, and a top section 152. The external diameter of the top section 152 is slightly smaller than the internal diameter of the bottom section 150 to permit the top section 152

to telescope downwardly within the bottom section **150**.

To provide a smooth exterior surface for the mast **12**, the sections may be telescoped upwardly by a mechanism located completely within the interior of the mast **12**. The mechanism includes a stanchion **154** supported within the bottom section **150** by a bolt **156** which extends diametrically through the section **150** and the stanchion **154**. A pulley **158** is journaled for rotation at the bottom of stanchion **154** by a pivot pin **160**. A pulley **162** is journaled for rotation at the top end of the stanchion **154** by pivot pin **164**. A line which could be braided steel cable or the like is fastened at one end to a connector **168** at the bottom of the top section **152** and passes upwardly over the pulley **162** and then down again and under pulley **158** and out through an opening **170** on the bottom section **150** of the mast **12**.

To raise the mast is merely necessary to pull on the line **166** which raises the secured end of the line **166** at its attachment **168** and causes the top section **152** to slide upwardly through the bottom section **150** to its erect position. The line **166** is then secured to a cleat (not shown) until the mast is to be telescoped.

Another embodiment of the mast for use with the inventive wind propelled vehicle is shown in FIGS. **11** and **12**. In this embodiment, the exterior diameter of the bottom section **150'** of the mast is slightly smaller than the interior diameter of the top section **152'** to permit the bottom section **150'** to telescopically slide within the top section **152'**. A stanchion **154'** is connected near the top of the top section **152'** of the mast by a pin **156'** extending diametrically through the top section **152'** of the mast and the top of the stanchion **154'**.

A pulley **158'** is pivotally mounted on the bottom end of stanchion **154'** by means of a pivot pin **160'**, and another pulley **162'** is pivotally mounted at the top end of the bottom section **150'** of the mast by means of a threaded fastener **164'** or the like. A pulley **165*b*** is mounted in a bracket **167*b*** secured in the base end of the bottom section **150'** of the mast opposite an opening **170*b*** therein and another pulley **165*t*** is mounted a similar bracket **167*t*** secured in the top end of the top section **152'** of the mast opposite an opening **170*t*** therein.

A halyard **166'** is connected to a grommet in the top of a sail connected along one edge thereof to a plurality of rings concentrically disposed on the mast. The halyard **166'** extends through the top opening **170*t*** in the top section **152'** of the mast and is trained around the pulley **165*t***. From there, the halyard **166'** extends downwardly through the mast, around the pulley **158'** and back upwardly to and around the pulley **162'** fastened to the top of the bottom section **150'** of the mast. The halyard then extends downwardly again through the mast, around the pulley **165*b*** and out through the bottom opening **170*b*** in the bottom section **150'** of the mast.

In operation, the mast and the sail may be erected and raised by merely pulling on the end of the halyard **166'** extending through the opening **170*b***. Pulling the halyard through opening **170*b*** is effective to raise the sail up to snub against the opening **170*t*** and then raise the pulley **158'** toward the pulley **162'** secured to the top of the bottom section **150'** of the mast. The resulting upward force on the pulley **158'** is effective to raise the stanchion **154'** to which the top section **152'** is attached. When the mast is raised to the limit permitted by a pair of stays **169** connected to a pair of stay brackets **171** integral with the bottom of the bottom section **152'** of the mast, the halyard is secured to a cleat (not shown) at the base of the mast. Alternatively, the halyard could be connected to a winch through which a predetermined tension could be applied to the halyard to maintain the mast in erect configuration with a predetermined tension in the stays **169**.

An alternative halyard arrangement is shown in FIG. **13** wherein the halyard **166''** instead of passing over the pulley **165*t*** to its connection with the sail, is fastened to a bracket **164*b*** connected to the top of the lower section **150'** of the mast by means of the same screw **164'** that holds the pulley **162'** to the top of the lower section of the mast **150'**. This arrangement achieves a better mechanical advantage for the pulley arrangement and facilitates erection of the mast by requiring a less forceful pull on the lower end of the halyard **166''**.

Since the upper end of halyard **166''** is not connected to the sail, a separate halyard **166*s*** is connected to the sail and passes over the top of pulley **165*t***, thence passes down through the interior of the mast and around the second groove of a double groove pulley **165*dg*** and then out through the same opening **170*b*** through which passes the lower end of the halyard **166''**.

The length of the sail halyard **166*s*** is equal to the distance between pulleys **165*b*** and **165*t*** with the mast in collapsed configuration plus the length of the top section **152'** of the mast. With this arrangement, the lower end of the halyard **166*s*** may be permanently attached to the lower end of the lower section **150'** of the mast thereby dispensing with a need for a double groove pulley **165*dg***. Thus, when the mast is erected the upward movement of the top section **152'** of the mast automatically raises the sail so that when the mast is fully erected, the top of the sail has reached the top of the mast.

If it is not desirable to arrange the sail halyard **165*s*** so that the length of line on the outside of the mast in collapsed configuration is the same length as the top section **152'** of the mast, or if for any other reason it is desired to erect the mast and sail separately, then the double pulley **165*dg*** is used and after the mast is erected by pulling on halyard **166''** and fastening the end thereof to its appropriate cleat on the mast, the sail halyard **166*s*** is then used to raise the sail and when the sail is fully raised, the end of the halyard **166*s*** is likewise secured to a cleat on the mast.

It is now apparent that the collapsible catamaran sailboat described above provides a rigid, stable, reliable platform while underway and yet may be folded into a small compact package suitable for easy transportation and storage. The design is simple for economical fabrication and also for quick and easy erection and collapse, yet provides the strength and reliability of performance comparable or superior to conventional non-collapsible catamarans.

These same advantages are obtained by the wind propelled vehicle shown in FIGS. **14** and **15**. In this embodiment of the invention, the vehicle takes the form of a trimaran skiboat having a pair of longitudinal members **172*p*** and **172*s*** pivotally connected at their fore ends to a fore bracket **174** and connected at their aft ends to aft brackets **176*p*** and **176*s*** respectively. A

strut 178, formed of a starboard section 178*s* and a port section 178*p*, is connected between the longitudinal members 172 at the brackets 176 and is centrally hinged to a rear connector 180. Also connected to the rear connector 180 is a center control spar 182 which extends from the rear connector 180 axially forward to its forward end somewhat forward of midships. At its forward end, the center control spar 182 is embracedd by the upstanding arms of a U-shaped bracket 184 connected thereto, which also embrace the hell of the mast 186 and pivotally support the mast by means of a pivot pin extending through both bracket arms and the heel of the mast. A telescoping shaft 188, connected at its forward end to the fore bracket 174, telescopes within the center control spar 182. A stop is provided by a pin 189 extending upwardly through the crosspiece of bracket 184 and through a longitudinal slot in the underside of the telescoping shaft 188 to prevent the struts 178 from opening beyond 180°. A lock is provided, consisting merely of a pair of lateral holes through the center control spar 182 and the telescoping shaft 188 which align when the skiboat is fully erect and through which a pin 189′ may be inserted to lock the skiboat in erect configuration.

A mast brace spar 190 is connected at one end to the fore bracket 174, and at the other end is pivotally connected to a bracket 192 fastened near the top of the mast 186. A mast brace spar 190 provides longitudinal support for the mast in operation, and lateral support is provided by a pair of stays 191*p* and 191*s* connected to the top of the mast 186 and respective longitudinal members 172*p* and 172*s*.

A vertically extending standard 194 is rotatably supported within each of the two aft brackets 176 and rigidly mounted in the fore bracket 174. The lower end of each standard 194 is connected to a carrier such as a pontoon, an ice skate, a wheel or as illustrated in FIGS. 14 and 15, a ski 196.

Motive power for the vehicle is provided by the wind acting on a sail 198 connected by suitable booms to the mast 186. Steerage control is obtained by shifting, in unison, the angular orientation of the aft carriers, or in the case of a waterborne vehicle, shifting the angular orientation of rudders such as illustrated in FIGS. 4–9. The carriers or rudders are rotated by tillers 200 connected to each of the aft standards 194.

When in use, the vehicle is in the erect configuration illustrated in FIGS. 14 and 15. To collapse the vehicle for convenient transportation and storage, it is merely necessary to disengage the lock 189′ and exert a forwardly directed force on the rear connector 180 or the base of the mast 186 which will cause the center control spar 182 to slide forwardly in telescoping relation to shaft 188. The mast brace spar 190 acts as a fulcrum about which the mast 186, acting as a lever, pivots to facilitate the folding operation. Forward movement of the center control spar 182 is effective to pivot the strut 178 at its midpoint and draw the aft ends of the longitudinal members 172 inwardly toward each other. In fully collapsible position, the forward end of the center control spar 182 lies adjacent the aft face of the fore bracket 174 and the longitudinal members 172 lie parallel and adjacent each other. The mast swings down to lie horizontally adjacent the longitudinal members 172 and the entire vehicle is folded in a compact package for convenient transportation and storage.

Obviously numerous modifications and variations of the above described preferred embodiment are possible in light of the above described preferred embodiment. For example, the center control spar 20 shown in the embodiments in FIGS. 1–3, may be replaced with a third hull 20′, as shown in FIG. 16, which performs the same functions as the center control spar 20 and translates forwardly in the same manner when the sailboat is folded, but also provides vertical support to the deck (not shown) and provides the improved stability afforded by a trimaran. The third hull 20′ must have a slot formed in its stern to receive the rudder when it cocks forwardly in folded configuration. Thus it will be understood that the term "center control spar" also contemplates a central hull which performs the same functions as the disclosed center control spar. Therefore it is expressly to be understood that the invention may be practiced otherwise than as specifically described while remaining within the scope and spirit of the appended claims.

I claim:

1. A collapsible catamaran comprising:
two buoyant hulls;
strut means connecting said hulls together in spaced relationship, said strut means comprising a forward strut and an aft strut, each hinged at a point centrally thereof for allowing said strut means to pivot at said hinge points between an extended configuration in which said catamaran is erect and a folded configuration in which said catamaran is collapsed;
a center control spar connecting said forward and aft struts at said hinge points;
disengageable locking means for holding said catamaran erect, and disengageable to allow said strut means to fold at said hinge points and swing said hulls toward each other to collapse said catamaran; and
steering means for controlling the direction of said catamaran while underway.

2. A collapsible catamaran as defined in claim 1, further comprising:
a mast;
means for pivotally stepping said mast on said control spar; and
fulcrum means connected between said mast and said hulls for providing fulcrum support for said mast whereby erection of said mast translates said control spar relative to said hulls and straightens said struts to spread said hulls apart.

3. A collapsible catamaran as defined in claim 2, further comprising:
spring means for biasing said mast in erect configuration to automatically erect said catamaran.

4. A collapsible catamaran as defined in claim 1, wherein:
said steering means is connected to the aft end of said center control spar and includes
a rudder;
means for mounting said rudder for rotation in a vertical plane;
a tiller;
means for mounting said tiller in said vertical plane;
means connecting said tiller and said rudder for rotating said rudder in said vertical plane by movement of said tiller;

means for rotating said common vertical plane of said rudder and tiller in a 180° horizontal arc; and

said center control spar is shiftable relative to said hulls to the extent that said rudder is carried substantially between the confines of said hulls when said catamaran is in collapsed configuration.

5. A collapsible wind propelled vehicle, comprising:

a plurality of laterally spaced carriers;

a pair of struts pivotally connected between said carriers;

a center control spar connected to said struts;

hinge means on said struts for hinging said struts at said control spar between a folded configuration and an extended configuration;

lever and fulcrum means connected to said center control spar and said carriers for shifting said control spar axially relative to said carriers to effect lateral movement of two of said carriers relative to said control spar;

means on said lever means for connection of a sail; and

steering means for controlling the direction of said vehicle while underway.

6. A collapsible wind propelled vehicle as defined in claim 5, wherein:

said lever means includes a mast pivotally connected to said center control spar at the heel of said mast; and

said fulcrum means includes a mast brace spar for providing longitudinal support for said mast in erect position, and for providing fulcrum support about which said mast pivots during erection and collapse of said mast.

7. A collapsible wind propelled vehicle as defined in claim 5, further comprising:

stop means for stopping said struts at their fully extended configuration; and

lock means for locking said struts at their fully extended configuration.

8. A collapsible wind propelled vehicle as defined in claim 5, wherein:

said carriers include a pair of watertight hulls;

said steering means is connected to the aft end of said center control spar;

said steering means includes a rudder and a tiller; each mounted for rotation in a common vertical plane, and means connecting said rudder and tiller for rotating said rudder in said vertical plane by movement of said tiller in said vertical plane; and

said center control spar is shiftable relative to said hulls to the extent that said rudder is carried substantially between the confines of said hulls when said vehicle is in folded configuration.

9. A collapsible wind propelled vehicle as defined in claim 5, further comprising:

spring means for biasing said carriers apart to facilitate erection of said vehicle.

10. A collapsible wind propelled vehicle as defined in claim 6, further comprising:

spring means for biasing said mast in erect configuration to facilitate erection of said mast.

11. A collapsible wind propelled vehicle as defined in claim 6, wherein said mast comprises:

a first section and a second section;

said second section having a smaller external cross-sectional dimension than the corresponding internal cross-sectional dimension of said first section;

a stanchion supported in said first section and extending axially therethrough;

pulley means connected to said stanchion adjacent the end thereof opposite to the end thereof connected to said first section;

a line extending axially through said mast, around said pulley, and then back again axially through the mast, at least one end of said line extending outward to the exterior of said mast;

whereby pulling on said line causes said first section and said second section to slide telescopically apart to raise said mast.

12. A collapsible wind propelled vehicle as defined in claim 11, further comprising:

a plurality of rings coaxially disposed around said mast;

a sail connected to said rings along one edge of said sail at spaced locations therealong;

said sail having an upper corner and a grommet formed in said corner;

said line having formed at the other end thereof a connection for attachment to said grommet;

whereby, pulling on said line causes said sail to be hoisted simultaneously with said mast.

13. A collapsible wind propelled vehicle as defined in claim 12, wherein:

said second section is pivotally connected to said center control spar;

said first section further comprises a pair of stay brackets connected to the lower end thereof;

a pair of mast support stays connected between said stay brackets and said carriers for providing lateral support for said mast in the erect configuration thereof and for limiting the height to which said mast may be telescopically raised.

14. A collapsible wind propelled vehicle as defined in claim 13, wherein:

the internal diameter of said rings is less that the maximum dimension between the external edges of said stay brackets;

some of said rings being disposed on said mast above said stay brackets and the balance of said rings being disposed on said mast below said stay brackets;

whereby said mast may be telescopically raised and lowered without causing interference between said rings and said stays.

15. A collapsible wind propelled vehicle, comprising:

two longitudinal members;

carrier means operatively connected to said longitudinal members for supporting said vehicle above a medium over which it travels;

a strut connected between said longitudinal members;

hing means centrally disposed on said strut for folding said strut centrally on itself between a folded configuration in which said two longitudinal members lie adjacent each other, and an erect configuration in which said two longitudinal members are laterally separated at at least one end thereof;

a center control spar connected to said strut at said hinge means, said center control spar being shift-

able mounted for longitudinal translation relative to said longitudinal members;

a mast hingably connected to said center control spar and adapted to support a sail;

fulcrum means connected to said mast; and

steering means attached to at least one end of said vehicle.

16. A collapsible wind propelled vehicle as defined in claim **15,** wherein:

said mast is connected at the heel thereof to the forward end of said center control spar; and

said center control spar is forwardly shiftable to carry said heel of said mast forwardly and cause said mast to pivot about said fulcrum means to lie parallel and adjacent to said longitudinal members when said center control spar has reached the forward limit of its translation.

17. A collapsible wind propelled vehicle as defined in claim **15,** wherein:

said center control spar includes a pair of telescoping sections;

said mast is connected to one of said sections;

said fulcrum means is connected to the other of said sections;

whereby telescoping of said center control spar causes translation in opposite directions of the portions of said mast connected to said one of said sections and said fulcrum means to rotate said mast and thereby to erect and collapse said mast.

18. A collapsible wind propelled vehicle as defined in claim **15,** wherein:

the front ends of said longitudinal members, and one end of said fulcrum means, and a front carrier are all connected to and supported by a front support member;

the aft end of both of said longitudinal members are laterally spaced and connected to and supported by a respective one of two aft support members, each of which is also in turn connected to and supported by a respective one of two aft carriers.

19. A collapsible water borne vehicle comprising:

two buoyant hulls;

strut means connecting said hulls together in spaced relationship;

hinge means connected to said strut means intermediate the ends thereof for allowing said strut means to pivot at said hinge means between an extended configuration in which said vehicle is erect and a folded configuration in which said vehicle is collapsed;

spring means for biasing said hulls apart to automatically spread said hulls apart and erect said vehicle;

disengageable locking means for holding said vehicle erect, and disengageable to allow said strut means to fold at said hinge means and swing said hulls toward each other to collapse said vehicle; and

steering means for controlling the direction of said vehicle while underway.

20. A collapsible water borne vehicle as defined in laim **19,** wherein said strut means comprises a forward strut and an aft strut, each hinged at a point centrally thereof, and further comprising a center control spar connecting said struts at said hinge points.

21. A collapsible water borne vehicle as defined in claim **20,** further comprising:

a lever pivotally connected to said center control spar;

a brace pivotally connected diagonally between at least one of said hulls and said lever, the connection of said brace to said lever being vertically spaced from the connection of said brace to said hull;

wherein said spring means bears against said lever causing said lever to pivot about the connection thereof with said center control spar, thereby causing said diagonal brace to straighten and spread said hulls apart to erect said catamaran.

22. A collapsible water borne vehicle as defined in claim **21,** comprising a third buoyant hull connected to said center control spar.

23. A collapsible water borne vehicle as defined in claim **21,** wherein said lever comprises a mast having means thereon for connection of a sail.

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