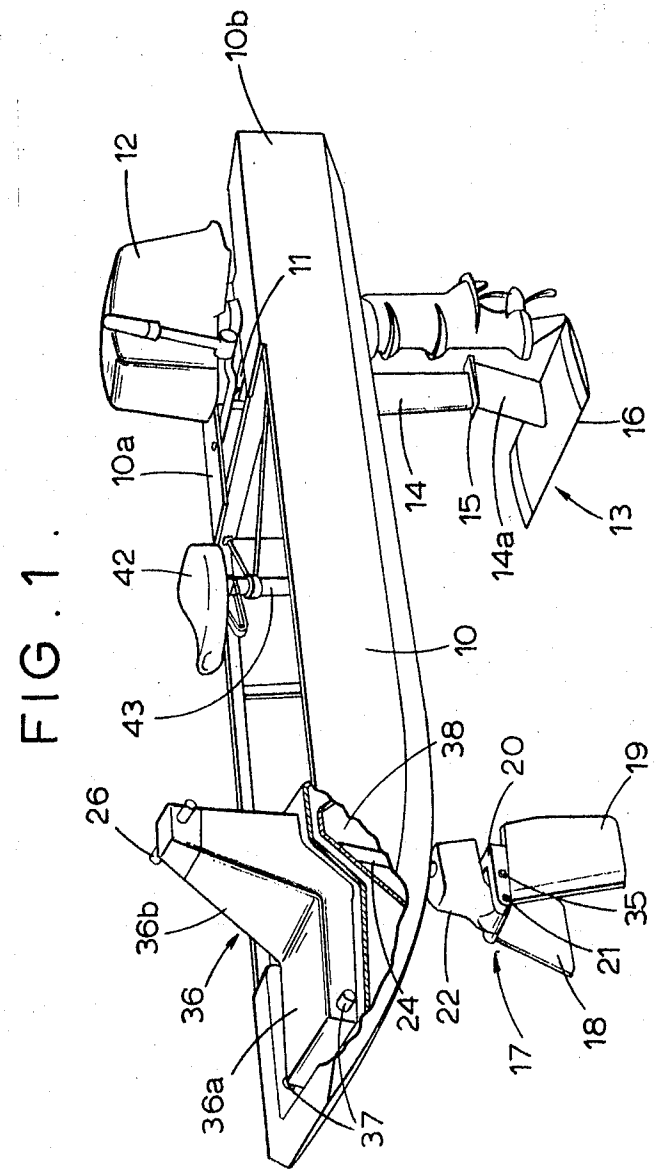
July 22, 1969 P. T. M. NOTT 3,456,609

HYDROFOIL WATERCRAFT

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FIG. 1.



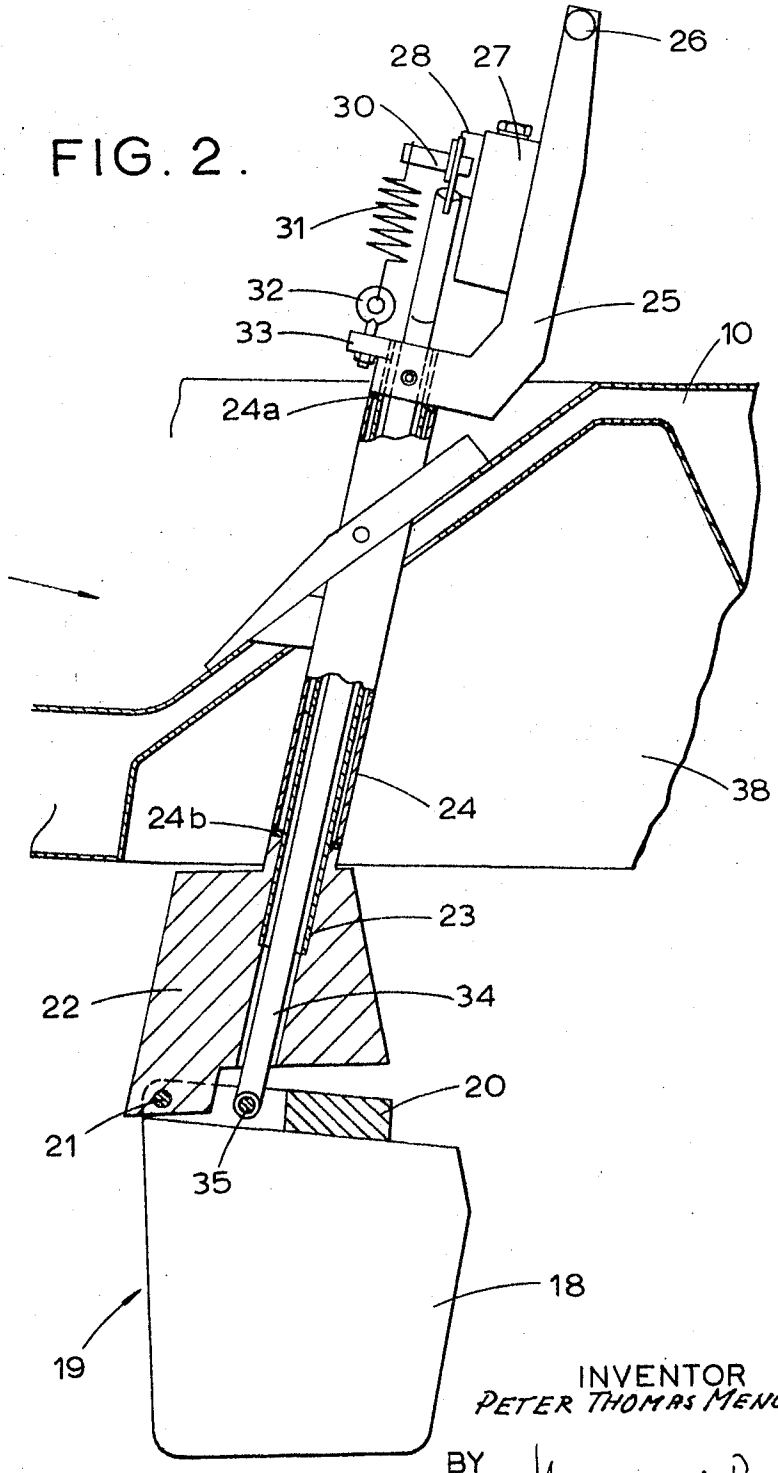
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HYDROFOIL WATERCRAFT

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FIG. 2.



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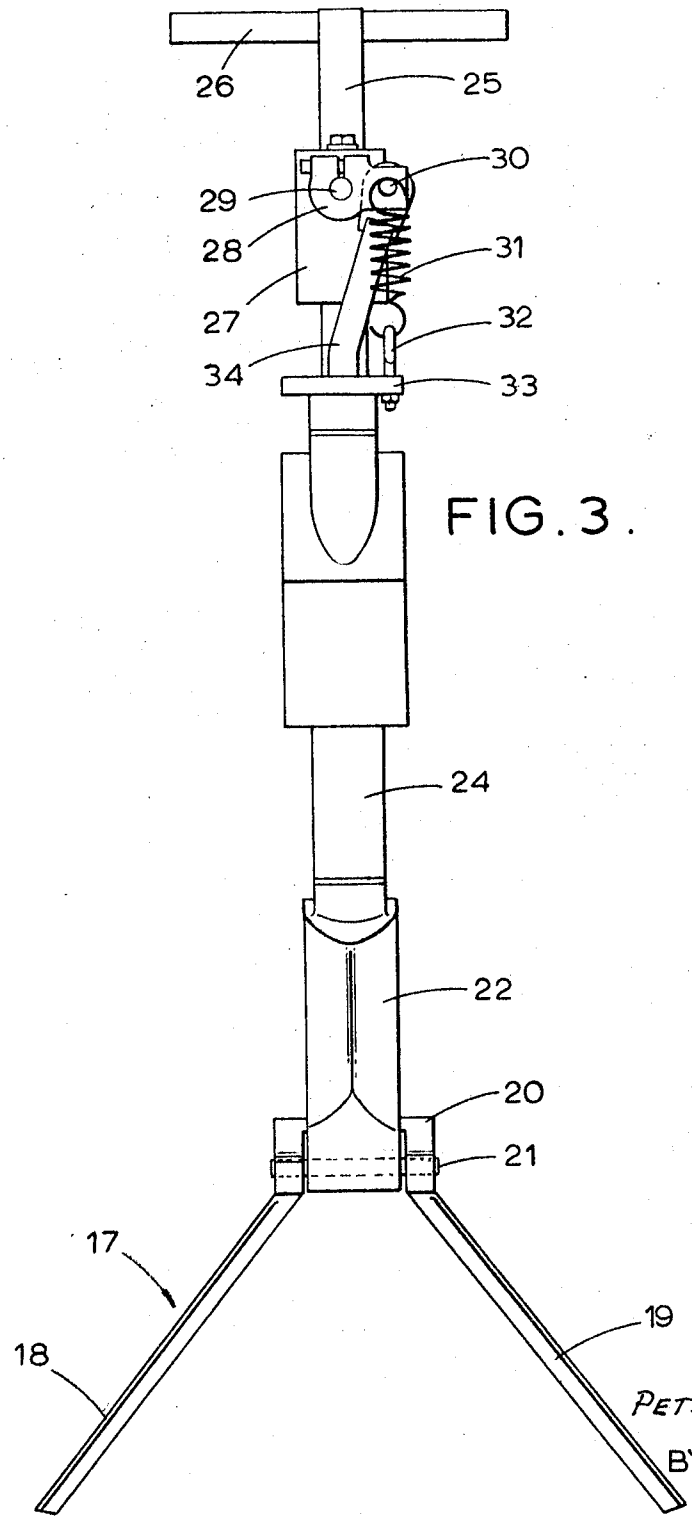


FIG. 3.

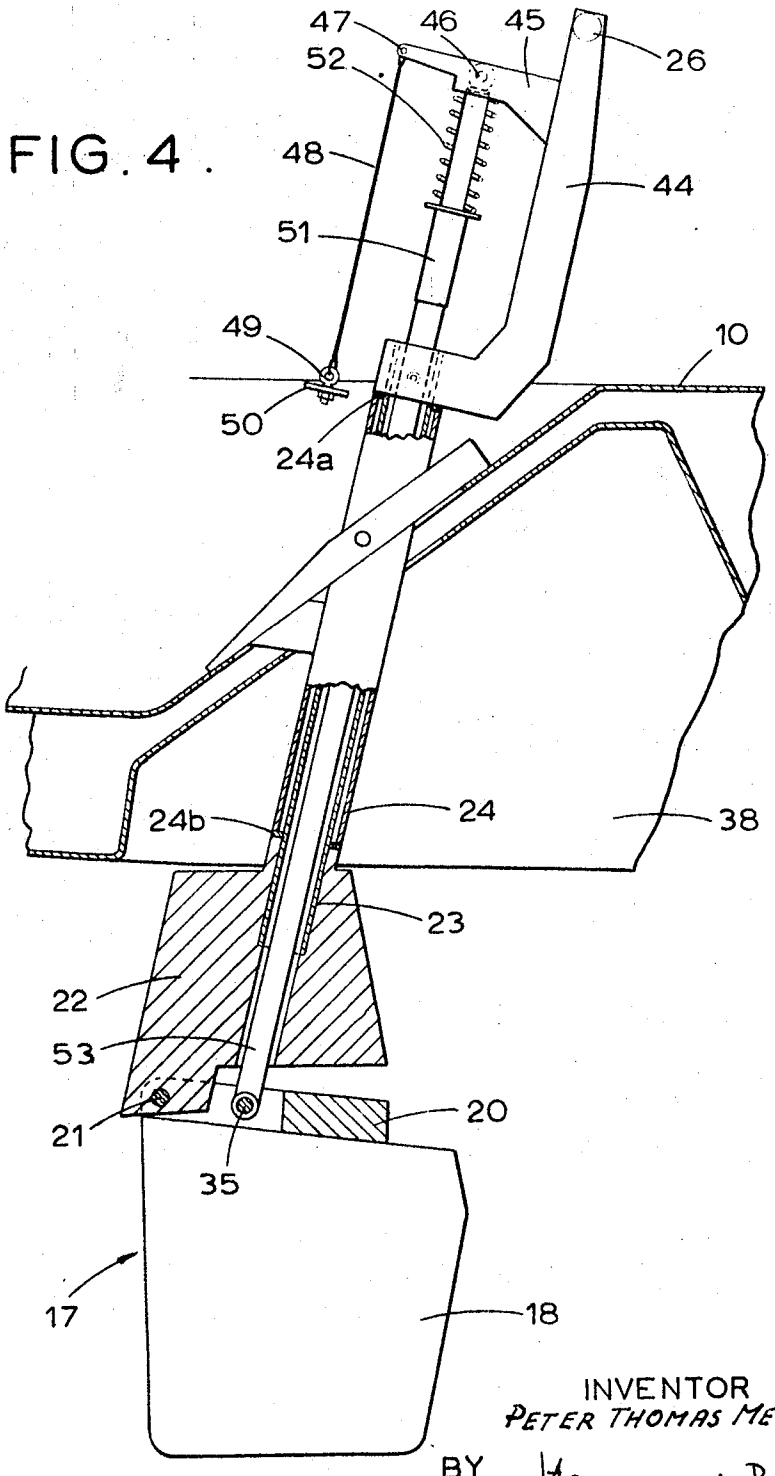
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HYDROFOIL WATERCRAFT

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FIG. 4.



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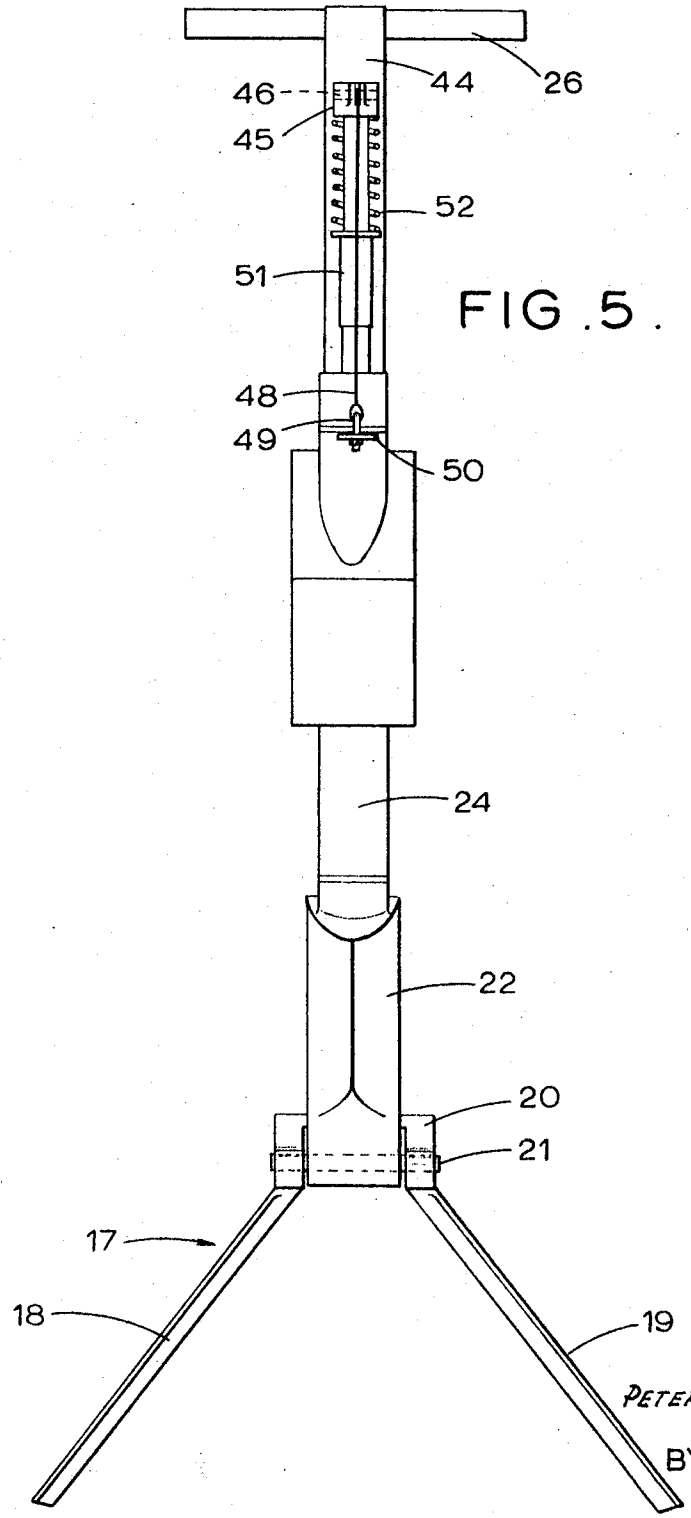


FIG. 5.

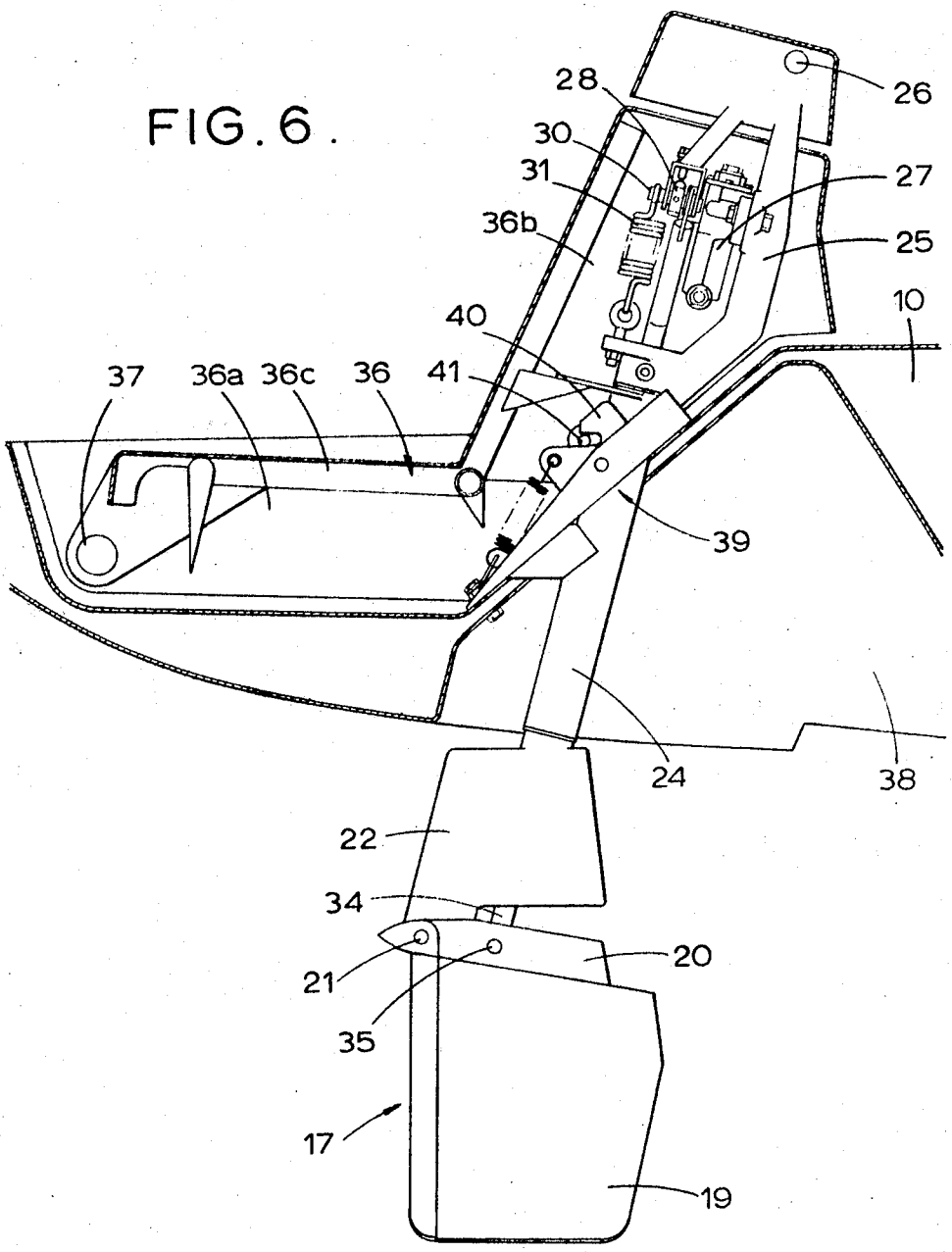
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FIG. 6.



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HYDROFOIL WATERCRAFT

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Int. Cl. B63b *1/30;* B63h *25/00, 21/26*
U.S. Cl. 114—66.5 6 Claims

ABSTRACT OF THE DISCLOSURE

A hydrofoil watercraft having a forward and an aft hydrofoil. Variations in load on the forward hydrofoil cause it to pivot against a spring and alter the angle of incidence of the hydrofoil to minimize pitching. The forward hydrofoil includes two blades. The forward and aft hydrofoils are retractable and the forward hydrofoil is pivotal to effect steering.

This invention relates to hydrofoil watercraft.

It is an object of the invention to provide a hydrofoil watercraft having automatic control of pitching movements. It is a further object to provide retractable hydrofoils to permit easy storage and transport.

According to the invention, a hydrofoil watercraft comprises a hull, a power unit for driving the craft through the water, and rear and forward hydrofoils mounted on struts beneath the hull, one of said hydrofoils comprising two blades extending laterally and downwardly from a central yoke, said yoke being arranged to pivot about an axis transverse to the major axis of the craft to vary the angle of incidence of said one hydrofoil and resilient means for opposing angular movement of said one hydrofoil about said transverse axis. The craft has one rear and one forward hydrofoil, each mounted on a strut, said forward hydrofoil being of inverted V form and mounted on a pivot on said strut, the axis of the pivot being transverse to the major axis of the craft, resilient means being provided for opposing angular movement of said one forward hydrofoil, and the strut of said forward hydrofoil is arranged to pivot about a substantially vertical axis, said forward hydrofoil constituting the sole steering means of the craft and sole sustaining means for the forward end of the craft. The rear and forward struts being pivotally mounted on said hull and retractable, the steering means and the resilient means retracting with said forward strut. Preferably, the forward hydrofoil has damping means associated with said resilient means. The craft has at least one seat for the operator, said seat having an emergency cutout device for the power unit, operable by removal of load from the seat.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a hydrofoil water craft, partly broken away,

FIGURE 2 is a sectional side elevation of a forward hydrofoil and associated structure,

FIGURE 3 is a front elevation of the hydrofoil shown in FIGURE 2,

FIGURE 4 is a side elevation of an alternative forward hydrofoil assembly,

FIGURE 5 is a front elevation of the hydrofoil shown in FIGURE 4, and,

FIGURE 6 is a side elevation partly sectioned, of a hydrofoil assembly mounted on a hull.

In one embodiment of the invention illustrated in FIGURES 1, 2, 3, and 6 of the accompanying drawings, a hydrofoil watercraft has a hull **10** having rearwardly extending portions of the sides of the hull **10***a* and **10***b* and a recessed transom indicated at **11** to accommodate an outboard power unit **12**. A rear hydrofoil **13** is mounted beneath the hull **10**, forward of the outboard power unit **12**. Said rear hydrofoil **13** comprises a strut **14** of wedge cross section, having a sharp leading edge. An anticavitation plate **15** is mounted at the end of strut **14** just below the water line when the craft is supported by the hydrofoils. Below the plate **15**, there is a strut **14***a* having a hydrofoil cross section. At the lower extremity of the strut **14***a* is mounted a substantially horizontal hydrofoil **16**. At the forward end of the hull **10**, a second hydrofoil **17** extends beneath the hull, said second hydrofoil **17** comprising two blades **18** and **19** extending downwardly and outwardly from a yoke **20**, said yoke **20** being mounted by means of a pin **21** on a member **22** so as to be pivotable about an axis transverse to the major axis of the craft. The member **22** is integral with the lower end of a tubular column **23**, which is inclined rearwardly so that its upper end is somewhat to the rear of its lower end.

The column **23** extends upwardly through a sleeve **24** said sleeve **24** having bearing bushes **24***a* and **24***b* at its upper and lower ends. At the upper end of the column **23** is a bracket **25** having handlebars **26** for guiding the craft. An automobile pattern hydraulic lever damper **27** is mounted on the bracket **25** and has a lever arm **28** extending laterally from a shaft **29** of the damper **27**, said lever arm **28** having at its free end, a pivot pin **30** to which is attached one end of a coil spring **31**. The other end of the coil spring **31** is attached to an eyebolt **32** fixed to a lug **33** on the bracket **25**. A rod **34** extends through the tubular column **23**, and is pivotally connected by a pin **35** at its lower end to the yoke **20** and at its upper end is connected to the pin **30** on the arm **28** of the hydraulic damper **27**. The diameter of the rod **34** is smaller than the internal diameter of the tubular column **23** to allow the rod to follow the arcuate paths of the lower pivot **35** and the upper pivot pin **30** during axial displacement of said rod **34**.

The hull **10** has on the upper surface of the forward end, a casing **36** (see FIGURES 1 and 6) comprising a horizontal flat portion **36***a* and a rearwardly inclined pyramidal portion **36***b*. The casing **36** is stiffened by means of internal ribs **36***c* and is adapted to carry the sleeve **24** within the rearwardly inclined pyramidal portion **36***b* so that the axes of the pyramidal portion **36***b* and the sleeve **24** are substantially parallel. The casing **36** is mounted on the hull **10** by means of pins **37** near the forward edge of said horizontal flat portion **36***a* so as to allow said casing **36** to pivot between a first extreme position illustrated in FIGURES 1 and 6 and a second extreme position (not illustrated). The underside of the hull **10** has a recess **38** formed therein to accommodate the forward hydrofoil **17** in said second extreme position of the casing **36**. The hull **10** is provided with fastening means **39** having a hook **40** which cooperates with a pin **41** on the sleeve **24** to retain the casing **36** is said first extreme position.

The hull **10** has a seat **42** mounted thereon for the operator of the craft. The seat **42** has emergency cutout means for the power unit **12**, incorporated in the support **43**, operable by removal of the weight of the operator from the seat **42**.

In a second embodiment of the invention, illustrated in FIGURES 1, 4 and 5, a hydrofoil watercraft is, with the exception of the forward hydrofoil assembly generally similar to the craft described in the first embodiment. Said forward hydrofoil assembly comprises a hydrofoil **17** of inverted V form as hereinbefore described, said hydrofoil being pivotally mounted on a member **22** by a pin **21**. The member **22** is integral with the lower end of a tubular column **23**, which is inclined rearwardly so that its upper end is somewhat to the rear of its lower end. The column **23** is carried in a sleeve **24**, having bearing bushes **24***a* and **24***b* at its upper and lower ends. The

sleeve **24** is fixedly mounted in the pivotable casing **36**. At the upper end of the tubular column **23** is a bracket **44**, which carries the handlebars **26** and has an arm **45** near its upper end, said arm having a pivot pin **46** at substantially its mid point and an eye **47** formed in the free end of said arm **45**. A tie wire **48** is connected at its upper end to said eye **47** and at its lower end to an eyebolt **49** secured to a bracket **50**, the bracket **50** being releasably attached to the hull **10**. A telescopic hydraulic damper **51** has a coaxially mounted coil spring **52**, the damper **51** is pivotally mounted at its upper end on the arm **45** by the pivot pin **46** and has a rod **53** mounted at its lower end. Said rod **53** extends through the tubular column **23** and is pivotally connected at its lower end to the yoke **20** of the hydrofoil **17** by the pivot **35**.

In operation, when the craft has attained sufficient forward speed, the lift from the hydrofoils is sufficient to overcome the weight of the craft and lift the hull clear of the surface of the water. When the craft is supported on the hydrofoils, variation in load on the forward hydrofoil, such as a wave, cause the hydrofoil to deflect against the resilient means and reduce the angle of incidence, thus reducing lift and reducing the tendency for the front of the craft to follow the wave.

As the forward hydrofoil is load actuated, wide differences in weight between different operators may modify the stabilising characteristics of the forward hydrofoil, and adjustment means may be provided for varying the tension exerted by the resilient means.

I claim:

1. A hydrofoil watercraft comprising in combination:
- a floatable hull;
- a rear hydrofoil mounted beneath the hull;
- a forward hydrofoil;
- a mounting assembly for said forward hydrofoil, said mounting assembly including a forward strut axially rotatably but lengthwise fixed to the hull and supporting said hydrofoil pivotal about an axis transverse of the lengthwise axis of the hull for respectively steering the craft by rotating said forward strut and hydrofoil and automatically varying the angle of incidence of the forward hydrofoil in response to the hydraulic pressure acting thereupon;
- an elongate control member lengthwise displaceable in reference to said forward strut and hinged on one end by a hinge means to said forward hydrofoil at a point thereof spaced apart from its pivot axis; and
- damping means yieldably resisting pivotal movements of the forward hydrofoil.

2. A hydrofoil watercraft comprising a hull, a power unit for driving the craft through the water and one rear and one forward hydrofoil mounted on struts beneath the craft, said forward hydrofoil being pivotally mounted on one of said struts, the axis of the pivot being transverse to the major axis of the craft, said one strut being rotatable and constituting, with said forward hydrofoil, the sole steering means of the craft and the sole supporting means for the front of the craft, said forward strut being pivotally mounted on said hull and retractable, the forward hydrofoil retracting with said forward strut.

3. A hydrofoil water craft according to claim **1** wherein said forward strut comprises a tubular member mounting on one end a yoke pivotally supporting said forward hydrofoil, and said control member comprises a rod lengthwise displaceable within said tubular member; and wherein said damping means comprises a spring means secured at one end to said rod and at the other end to a point spatially stationary in reference to said tubular member.

4. A hydrofoil watercraft according to claim **3** wherein the inner cross sectional area of said tubular member is larger than the maximal cross sectional area of the rod portion within the tubular member so as to provide clearance permitting the rod to follow accurate movements of the hinge means joining the rod to the forward hydrofoil when the latter performs a pivotal movement.

5. A hydrofoil watercraft according to claim **1** and further comprising a power drive means secured to the hull at the stern thereof for driving the craft in substantially linear direction, said forward hydrofoil and strut supporting the same constituting the sole steering means of the craft; weight controlled fail-safe cutout means for the drive means; and at least one seat on the hull for the operator of the craft, said cut out means being spatially associated with said seat so that the hinge means is rendered ineffective while and when the seat is loaded by the weight of the operator or a comparable weight.

6. A hydrofoil watercraft comprising:
- a hull;
- a power unit for driving the craft through the water;
- a rear hydrofoil mounted beneath the hull;
- a forward strut protruding beneath the hull, said strut being mounted rotatable with reference to the hull and retracting into the hull;
- a forward hydrofoil supported on said strut for rotation and retraction in unison with the same, said strut and said forward hydrofoil constituting the sole steering means of the craft and the sole supporting means for the bow part of the craft when the same is driven through the water as a hydrofoil craft.

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