July 11, 1961 G. W. PATTERSON 2,991,749

HYDROFOIL STRUCTURES

Filed Dec. 22, 1959

2 Sheets-Sheet 1

FIG. 1

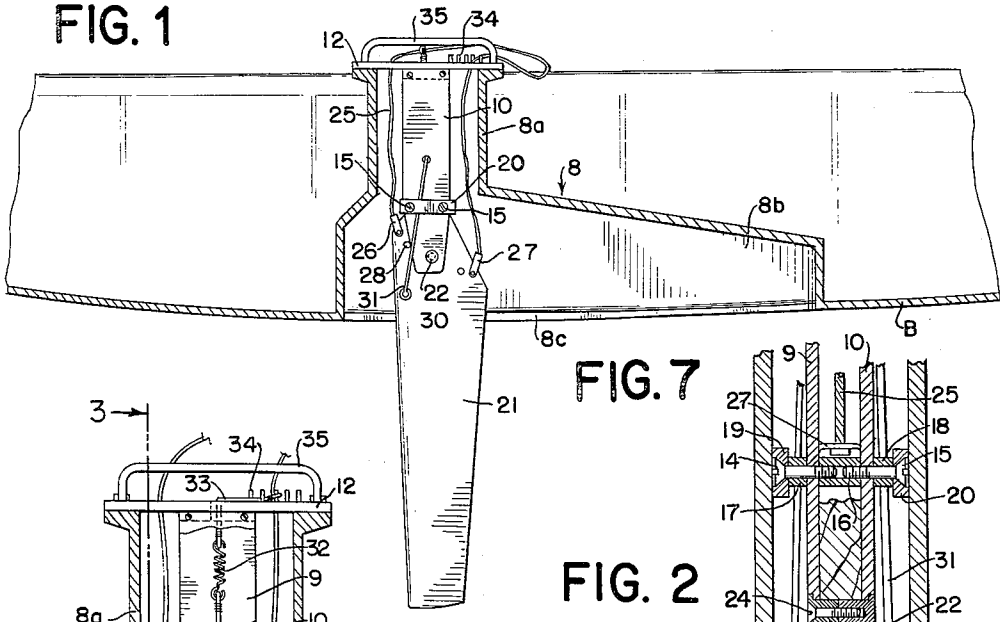


FIG. 7

FIG. 2

3 FIG. 3

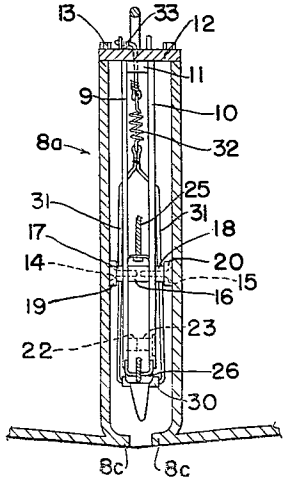
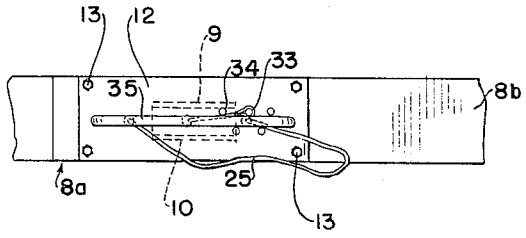


FIG. 4



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FIG. 5

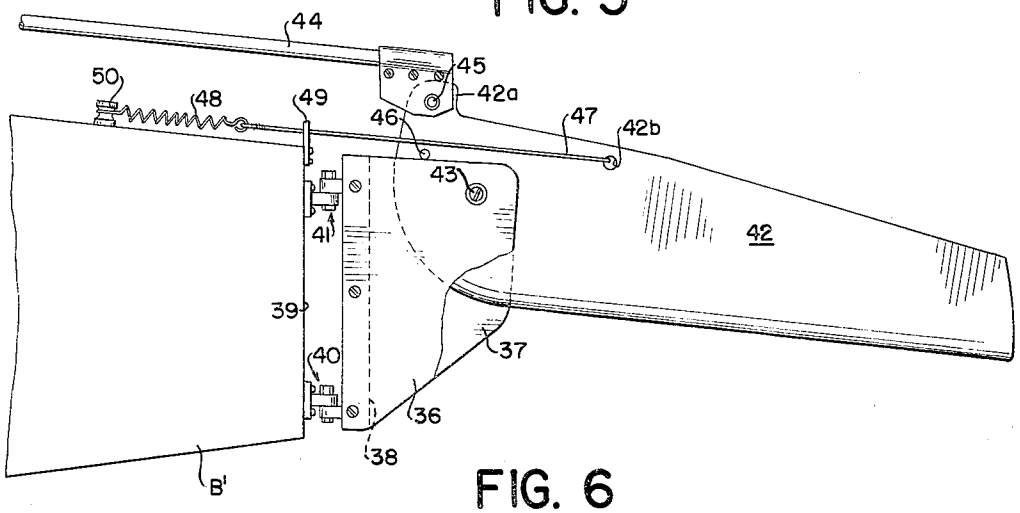
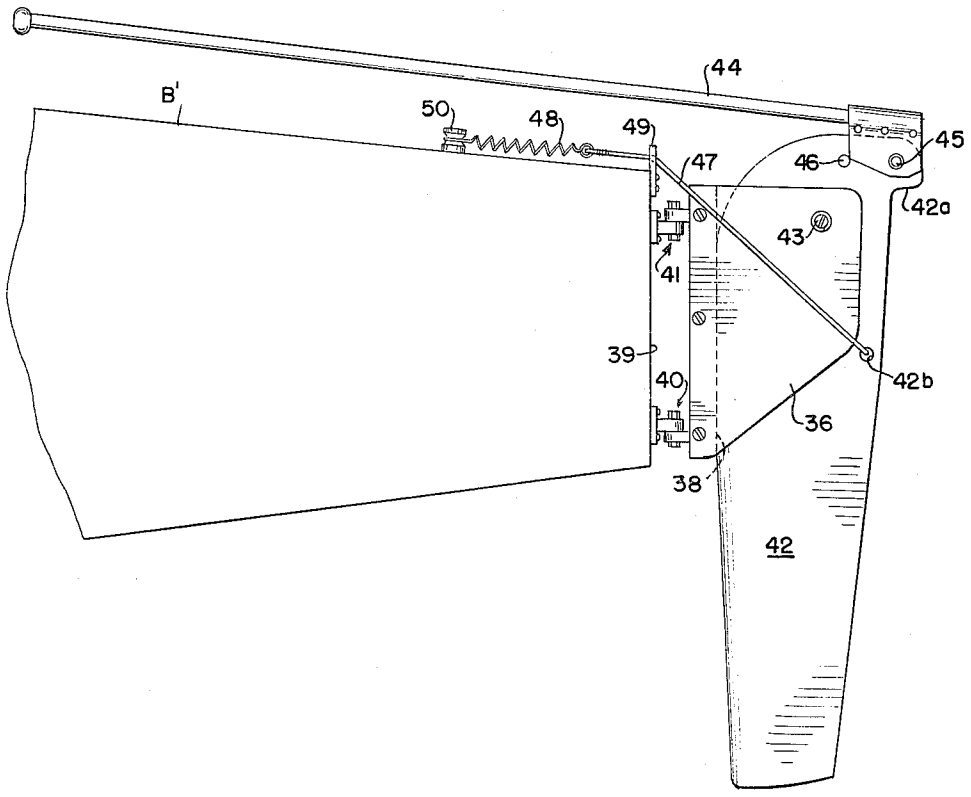


FIG. 6



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HYDROFOIL STRUCTURES

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6 Claims. (Cl. 114—132)

This invention relates to hydrofoil structures including centerboards and rudders for use on boats and particularly on sailboats. More specifically, the invention is concerned with a novel hydrofoil structure, in which the hydrofoil can be moved from within the boat between a vertical operative position and a horizontal inoperative position and is acted on by resilient means urging it at all times toward the position to which it is nearer, and normally holding it at one end of its path of travel. The resilient means protect the hydrofoil, when in vertical operative position, from damage resulting from contact with an obstruction or the ground during forward movement of the boat, in that such contact moves the hydrofoil against the resistance of the resilient means to its horizontal position where it is unlikely to be damaged. In addition, the resilient means complete the movement of the hydrofoil from one position to the other after it has been moved through only a little more than half its path of travel. A manual change in the position of the hydrofoil, accordingly, requires less time than would otherwise be the case.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

FIG. 1 is a vertical longitudinal sectional view through the centerboard trunk of a boat equipped with the new centerboard structure, the centerboard being shown in operative position;

FIG. 2 is a view similar to FIG. 1 with the centerboard in inoperative position and with part of the structure broken away;

FIG. 3 is a sectional view on the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary plan view of the structure and trunk;

FIG. 5 is a view in side elevation of a rudder structure embodying the invention with the rudder shown in inoperative position;

FIG. 6 is a view similar to FIG. 5 with the rudder in operative position; and

FIG. 7 is a sectional view on an enlarged scale on the line 7—7 of FIG. 2.

The new centerboard structure in the form shown in FIG. 1 is intended for use on a boat B having a conventional centerboard trunk 8 formed with a vertical section 8*a* open at the top and a horizontal section 8*b* extending along and open through the bottom of the hull of the boat. The structure includes a frame comprising vertical side plates 9, 10 separated at their upper ends by a spacer plate 11, to which the plates are secured, and the spacer plate is secured to the underside of a cover plate 12 adapted to close the upper end of the vertical section 8*a* of the trunk and secured in place thereon by bolts 13. The side plates 9, 10 are secured together near their lower ends by pairs of flat head screws 14, 15 which extend through the plates and are threaded into spacer sleeves 16 between the plates. Portions of the screws outside the plates are enclosed by bushings 17, 18 and, at the outer side of each of the plates 9, 10, the screws are connected by bars 19, 20 held against the outer ends of the bushings 17, 18 by the screws. A centerboard 21 of hydrofoil form is mounted between the lower ends of the side plates 9, 10 on a pivot made up of two headed parts 22, 23 extending through the side plates and connected by a screw 24 extending through a bore in part 23 and threaded into part 22.

In order to swing the centerboard 21 on its pivot 22, 23 between the vertical position shown in FIG. 1 and the horizontal position shown in FIG. 2, a line 25 is attached to the centerboard at the forward side of the pivot as by a U-shaped fitting 26. The line extends upward from the fitting through an opening in the cover plate 13 and then returns through another opening in the cover plate and is connected to a fitting 27 attached to the centerboard to the rear of the pivot. By pulling on the line adjacent one or the other of the openings in the cover plate, the centerboard can be swung on its pivot between its two positions. At its vertical position, the centerboard is arrested by stop means comprising a pin 28 on the centerboard engageable with the forward edges of the side plates 9, 10 and, at its inoperative position, the centerboard is arrested by stop means comprising a pin 29 engageable with the rear sides of the side plates.

A line 31 extends through a bushing 30 mounted in a transverse opening through the centerboard and one end of the line passes upward through the space defined by the bushings 17, the bar 19, and the outer face of side plate 9 to an opening in the side plate, through which the line passes. The other end of the line 31 extends up from the bushing 30 through the space defined by the bushings 18, the bar 20, and the outer face of the other side plate 10 to an opening in the side plate, through which the line passes. Between the side plates, the ends of the line 31 are connected to the lower end of a resilient element 32 which may be the spring shown or a ring of elastic cord. The upper end of the resilient element is connected to a line 33 which extends through an opening in the cover plate 12 and can be connected to one or the other of a number of pins 34 on the cover plate to adjust the tension of the element.

The bushing 30, through which the line 31 passes, is so located that, as the centerboard is moved from one of its positions to the other, the line passes from one side of the centerboard pivot 22, 23 to the other. As a result, the resilient element 32 acts through the line to urge the centerboard toward the position to which it is nearer, and to hold it in that position. Accordingly, when the centerboard is in operative position, for example, as shown in FIG. 1, the resilient element acting through the line tends to hold the centerboard with its stop pin 28 against the forward sides of the side plates 9, 10. Because of the arrangement described, the centerboard is held resiliently in operative position and, if it strikes an obstruction as the boat is moving forward, the centerboard is swung on its pivot against the resistance of the resilient element toward inoperative position. As soon as the line 31 swings from one side of the pivot to the other as the centerboard is being swung between its positions, the tension of the resilient element tends to complete the swinging movement of the centerboard. Manual movement of the centerboard from one position to the other thus requires little time since, as soon as the movement has been a little more than half completed, the resilient element will act to complete the movement. In its operative position, the centerboard lies in contact at its upper end with the inner faces of the side plates adjacent the pivot and, below the lower ends of the side plates, the centerboard lies close to the inner faces of the internal flanges 8*c* at the entrance to the trunk. The side plates and the flanges co-operate to resist lateral movement of the centerboard and to maintain it in proper position.

The centerboard structure described has no connection to the trunk except through the cover plate 12 and the structure can be removed as a unit by being lifted through the vertical section 8*a* of the trunk. To facilitate the removal of the structure, the cover plate is provided with a handle 35 and, by removing the bolts 13 and placing

the centerboard in operative position, the structure can be readily lifted out of or lowered into the trunk by means of the handle.

The rudder structure shown in FIG. 5 includes a frame comprising a pair of side plates or cheeks **36, 37** secured to opposite faces of one or more spacers **38**. The frame is pivotally mounted on the stern **39** of a boat B' by hinges **40, 41** and a rudder **42** of hydrofoil shape is pivotally mounted between the plates on a pivot **43**. The rudder is provided with an extension **42***a* at one end, to which a tiller **44** is pivotally attached at **45**. The rudder can be raised to vertical inoperative position as shown in FIG. 5 by pulling the tiller **44** forward and the movement of the rudder toward inoperative position is arrested by stop means including a pin **46** mounted on the rudder and engaging the top edges of the side plates **36, 37** when the rudder is substantially horizontal. By moving the tiller to the rear, the rudder can be swung to vertical operative position as shown in FIG. 6 and, at this position, the rudder is arrested by engagement of one of its edges with the rear face of the separators **38**.

A line **47** has one end connected to a resilient element **48** and extends rearwardly through an opening in a guide plate **49** mounted on the stern of the boat. From the guide plate, the line passes rearwardly along one face of the rudder and through an opening **42***b* through the rudder and then returns along the other face of the rudder and through the opening in the guide plate to be connected to the rear end of the resilient element. At its forward end, the resilient element is connected to a post **50** secured to the boat structure.

The position of the opening **42***b* in the rudder, through which the line **47** passes, is such that, when the rudder is swung from one of its positions to the other, the line passes by the rudder pivot. As a result, the resilient element acts through the line to urge the rudder toward the position to which it is nearer and to maintain it in that position. When the rudder is in the vertical operative position shown in FIG. 6, the rudder is held in place resiliently by the action of the resilient element **48** and the line **47** and, if the rudder strikes an obstruction or the ground, it can swing upwardly and toward inoperative position against the initial resistance of the resilient element. If the swinging movement caused by the obstruction continues until the line **47** passes by the rudder pivot, the resilient element **48** acting through the line will complete the movement of the rudder to inoperative position.

I claim:

1. A hydrofoil structure, which comprises a frame adapted to be attached to the hull of a boat, a hydrofoil mounted on a horizontal pivot on the frame to enter the water in which the boat is afloat, and movable between a vertical and a horizontal position only, stop means operable to arrest the hydrofoil in each of its stated positions, resilient means acting on the hydrofoil and urging it toward the nearer of its two positions, the resilient means including a resilient element, means at one side of the pivot for holding one end of the element, means at one side of the pivot for holding one end ment against movement, and a flexible member connected to the other end of the element and passing through the hydrofoil at a point on the side of the pivot remote from the holding means and extending along both sides of the hydrofoil, and means attached to the hydrofoil and operable from within the boat to move the hydrofoil between said positions, the member normally lying at one side of the pivot and passing to the other side as the hydrofoil moves from one position to the other.

2. In a boat, the combination of a hull having a centerboard trunk open at top and bottom, a cover plate closing the top of the trunk, a frame secured to the plate and extending into the trunk, a centerboard mounted on a horizontal pivot on the frame and movable between a horizontal position within the trunk and a vertical position, only in which the centerboard projects downwardly out of the trunk, stop means operable to arrest the centerboard in each of its stated positions, resilient means acting on the centerboard and urging it toward the nearer of the centerboard position, the resilient means including a resilient element, means at one side of the pivot for holding one end of the element against movement, and a flexible member connecting the other end of the element directly to the centerboard at a point on the side of the pivot remote from the holding means, and means attached to the centerboard for moving the centerboard and extending out of the trunk between said positions, the member normally lying at one side of the pivot and passing to the other side as the centerboard moves from one position to the other.

3. The combination defined in claim 2, in which the moving means includes a line connected to the centerboard on opposite sides of its pivot and extending through the cover plate.

4. In a boat, the combination of a hull, a frame pivotally mounted on the stern outside the hull for movement on a substantially vertical axis, a rudder mounted on a pivot on the frame for movement between a horizontal and a vertical position, stop means operable to arrest the rudder in each of its stated positions, a tiller mounted on a pivot on the rudder and operable to move the rudder from one position to the other relative to the frame and to move the frame and rudder on the frame pivot, and resilient means acting on the rudder and urging the rudder toward the nearer of its two positions, the resilient means including a resilient element, means at one side of the rudder pivot for holding one end of the element against movement, and a flexible member connecting the other end of the element directly to the rudder at a point on the side of the rudder pivot remote from the holding means, the member normally lying at one side of the rudder pivot and passing to the other side as the rudder is moved by the tiller from one position to the other.

5. The combination of claim 4, in which the frame includes a pair of side plates, the rudder lies partly between the side plates and is pivoted thereto, the ends of the rudder project from between the plates, and the tiller is pivoted to the rudder adjacent one end.

6. The combination of claim 4, in which the holding means secures one end of the resilient element to the hull and the flexible means extends along both sides of the rudder and through an opening through the rudder.

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