FIN-PROPELLED WATERCRAFT

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ABSTRACT

A floating body is operable to rock about a predetermined axis. A torsion-elastic fin stem is mounted on the floating body and substantially intersects the axis and has a free end portion extending from this body. A fin is secured to the free end portion and adapted to produce a thrust in response to a rocking motion of the body about the axis.

5 Claims, 15 Drawing Figures
FIN-PROPELLED WATERCRAFT

SUMMARY OF THE INVENTION

The invention relates to a watercraft, which is propelled by movable fins. For this purpose, the fin or fins are secured to one end of a torsion-elastic fin stem, which substantially intersects the axis about which the fins can rock. In one embodiment, the fin stem is or the fin stems are rigidly connected to the hull of the vehicle and the watercraft is propelled by being rocked about a natural axis of oscillation. This may be accomplished by the user of the watercraft, which stands with spread-apart legs on the watercraft and alternately angles one leg and the other to impart a rocking motion to the watercraft. The fin stem or fin stems may be, alternatively, arranged to rock about an artificial axis of oscillation, which is substantially parallel to the longitudinal axis of the hull of the craft. In this case, motion can be imparted to the hull of the vehicle by a pivotal movement of the stem of the fin. The fin or fins may consist of rigid members and are suitably substantially streamlined. Alternatively, they may consist of resiliently flexible blades.

Where a pivoted fin stem is or pivoted fin stems are used in one embodiment, that portion of the fin stem which lies within the hull of the craft may be provided with an upstanding hand lever. In another embodiment, that portion of the fin stem which lies within the hull of the craft may be connected to a substantially horizontal treadle plate.

It will be suitable to stiffen the fin stem transversely to the plane in which the fins are in position of rest.

DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a side elevation showing an embodiment of the invention in which a flexible fin is secured to a fin stem which is rigidly connected to the hull of the craft.

FIG. 2 is a front elevation showing the watercraft of FIG. 1 in operation.

FIG. 3 is an enlarged cross-sectional view taken on line III—III in FIG. 1.

FIG. 4 is an enlarged transverse sectional view taken through the fin on line IV—IV in FIG. 1.

FIG. 5 shows a modification of the watercraft of FIG. 1 with an oblique fin stem extending obliquely laterally and rearwardly.

FIG. 6 is a transverse sectional view showing a modified fin which consists of a rigid streamlined body.

FIG. 7 is a transverse sectional view taken on lines VII—VII of FIG. 8 and showing a modified embodiment having a movable fin stem.

FIG. 8 is a fragmentary longitudinal sectional view taken on line VIII—VIII in FIG. 7.

FIG. 9 is a sectional view taken on line IX—IX in FIG. 10 and showing a canoe embodying the invention and having two angled, rigid fin stems.

FIG. 10 is a side elevation of the canoe according to FIG. 9.

FIG. 11 is a diagrammatic transverse sectional view showing a reciprocating piston for driving the movable fin stem.

FIG. 12 is a side elevation showing a watercraft embodying the invention and comprising two finned and nonpropelled fin stems, one of which can be rotated about its longitudinal axis and fixed in position.

FIG. 13 is an enlarged view showing a detail of FIG. 12.

FIG. 14 shows a surfboard which is provided with a fin according to the invention.

FIG. 15 is a side elevation showing another embodiment of the invention in a watercraft which comprises two fins, one of which is small and movably mounted on the hull whereas the other is arranged on a fin stem, which is pivotally movable about a substantially horizontal axis which is substantially at right angles to the longitudinal axis of the vehicle.

SPECIFIC DESCRIPTION

In the first embodiment shown in FIGS. 1, 2, 3 and 4, the hull 1 of the watercraft is completely closed on all sides and a guide passage for the fin stem 2 extends through the hull. The fin stem consists of hardwood and a steel strip 6, which is inserted in and firmly adhered to the wood in the highly stressed portion between the hull 1 and the fin 3. This strip will prevent a substantial lateral deflection of the stem. On the other hand, the stem can be resiliently twisted about its longitudinal axis. A wing screw 4 clamps the stem in a bushing 7, which forms an extension of the guide passage at the top end thereof. When a person stands on the hull 1, which floats in the water, and more weight is applied to the left-hand side of the hull in FIG. 2, as is shown there, the hull will be inclined to the left and the fin 3 will be moved to the right about the natural horizontal axis of oscillation A-B. The resistance presented to the fin 3 by the water will cause the fin stem 2 to be slightly twisted and the fin 3 to be pivotally moved about the torsion axis C-D of the fin stem; the torsion axis C-D is at right angles to the axis A-B. This causes the fin to assume an oblique position relative to the direction of travel. The resilient end of the fin is rearwardly deflected at the same time so that the water is displaced to the rear. The fin 3 is suitably somewhat harder at the lower edge than at the upper edge because the lower edge moves somewhat faster so that it encounters a larger resistance by the water. Unless the lower edge were harder, it would be more highly deflected to the rear and the water would be partly displaced downwardly rather than to the rear.

Because of the resistance encountered by the fin 3, the hull 1 is inclined so slowly that the person standing thereon has time to load the other side so that the fin 3 is deflected. The person stands desirably with his two feet on respective slip-proof treads 5 and 5a, which are raised like wedges toward the outside, and may hold himself at the upwardly protruding end portion of the fin stem 2. When the wing screw 4 has been released, the depth of the fin 3 can be adjusted and the fin stem 2 can be pulled out entirely when the watercraft is to be transported. The watercraft can be climbed upon from the water without difficulty. It has a very good response to steering actions performed by a shifting of weight so that there is no need for a steering device although the craft can be provided with such device in a simple manner.

The embodiment shown in FIG. 5 has a fin stem 2, which is secured to the tip of the hull 1 and extends obliquely in a lateral and downward direction. The fin stem 2 does not include a steel strip so that the stem will be laterally deflected and twisted if the fin 3 is caused to oscillate under water about a horizontal axis A-B. In the same manner, a second pivotal movement is produced, which causes the fin 3 to extend at an oblique angle to the direction of travel but which is not performed about an exactly defined axis.

Instead of a resilient fin, a rigid fin 3 consisting of a streamlined member as shown in FIG. 6 may be used to drive the craft.

In the embodiment shown in FIGS. 7 and 8, the twistable fin stem 2 is pivotally movable by means of an articulated joint about a horizontal axis. For this purpose, a bearing 11 for a rotatable shaft 17 is arranged in a trough-shaped recess 12 in the bottom of the hull 1. This shaft 17 extends outwards through a horizontal opening at the end of the trough-shaped recess. The fin stem 2 is secured to the shaft 17 at the portion thereof which is outside the recess. Two brackets 13 for a treadle plate 14 are rigidly connected to the shaft 17. An arm lever 15 is secured to the forward bracket 13. A person who desires to use the boat stands with slightly spaced-apart legs on the treadle plate 14 and shifts his weight so that the plate 14 is alternately tilted to the right and left and the fin stem 2 is pivotally moved into the respective opposite direction. Two rubber buffers 16 mounted on the treadle plate 14 avoid any hard impact of the treadle plate 14 on the floor of the boat. The arm lever 15 may be used to assist the work of the legs or the boat may be propelled by the arms alone so that it does not rock.

FIGS. 9 and 10 show how a canoe may be provided with propelling fins according to the invention. Two wedge-shaped
treads 5 are secured beside the seat hatch. A mounting 19 for a crossbar 18 is secured to the forward end of each tread. A fin stem 2 is secured to each end of the crossrod 18 and has an angled portion followed by a much slenderer portion. The fin stem 2 carries at its lower end a fin 3. Owing to the angled portion of the fin stems 2, one of the end portions of the fins 3 is directed exactly to the axis of oscillation A–B of the boat. The slender portions of the fin stems 2 below the angled portion can be resiliently twisted whereas the thick portions above the angled portion yield only to a small extent.

The watercraft shown in FIG. 11 is driven by a steam engine, the steam boiler, not shown, the fin stems and a cavity 58 under a gate valve 56, which opens a flow path into one of the steam passages 57. From the latter, the steam enters the right-hand chamber of a cylinder 46 to force a piston 47 against the other end of the cylinder. The piston rod 48 is moved by the piston 47 and at its end carries a pin 49, which is received by a slot 50 formed in a lever 51 so that the latter moves the fin stem 2 by means of an articulated joint 17. A second pin 33 slides in a second slot 52 of the lever 51 to move a rod 54 which controls the gate valve 56. A guide 55 holds the rod 54 parallel to the piston rod 48. When the piston 47 reaches the other end of the cylinder 46, the control rod 54 pulls the gate valve 56 to the other side and the steam flows into the left-hand chamber of the cylinder 46 and steam can escape from the right-hand chamber. In this way the watercraft can be moved forward without need to transform the linear piston movement into a rotary movement. Instead of pressurized steam, other gases or liquids may be used as a source of power.

In the embodiment shown in FIGS. 12 and 13, a tube 31 is disposed in the hull 1 of the watercraft and the fin stem 2 of a rear fin 3 extends through that tube. The upper end of the tube 31 is closed by a metal bush 32, which is firmly connected to the tube. As in the preceding embodiments, a wing screw 4 is mounted in the tube 31 to clamp the fin stem 2 so that it has the desired elevation. The upper flange 20 of the bush 32 is formed with grooves 21, which are spaced 15° apart and which can receive a spring 33 to prevent a rotation of the bush 32, the tube 31 and the fin stem 2. The lower end flange 22 of the bush 31 is formed with a groove 23, which receives an inner spring 34 when the fin 3 is in its normal position for a straight-on travel of the craft. The spring 34 is connected to the first spring 33. The two springs 33 and 34 are shown in a snapped-in condition and secured to a reinforcing member 24 of the deck. The end of the inner spring 34 forms a hook 25, which embraces the outer spring 33. The end of the latter forms an eye 26, to which a rope 35 is tied. A hand lever 36 is connected to the upper part of the fin stem 2 and is fixed to the tube 31 by means of a wing screw 37. A short transverse spar 27 is secured to the free end of the hand lever 36 to form a T therewith and provides a handle, which can well be gripped by both hands. The other end of the rope 35 is tied to the transverse spar 27.

The rope 35 is pulled when it is desired to change the direction of travel. This will first pull the upper spring 33 out of its groove 21. As the pull on the rope is continued, the spring 33 engages the hook 25 of the spring 34 to pull the latter out of the groove 23 in the lower flange. When the swing is now discontinued for some time, the hand lever 36 can be operated to move the fin 3 easily into the position which is required for a travel of the craft along a bend having the desired radius. The rope 35 is then released so that the spring 33 snaps into one of the grooves 21 associated with it. This is important because during the swing the water pressure acting on the axis is maximum and it causes the fin with the hand lever 36 to move to the position of the spring 34. When the craft has completed the travel along the arc, the rope 35 is pulled once more to withdraw the spring 33 from the groove. The pull should not be so strong that the lower spring 34 is also withdrawn from the flange 22. As the hand lever 36 is returned to its normal position, the lower spring 33 slips on the flange 22 and automatically snaps into the correct position. The rope 35 can then be released.

When it is desired to travel along an arc to the right, the two springs 34 and 33 may be pulled out of the grooves 23 and 21 when the boat is being rocked from the left to the right. The water pressure will then cause the fin 3 to swing to the right and the spring 34 may be allowed to fall in when the fin 3 has reached the desired position. Similarly, the fin 3 can easily be moved to its normal position when the boat is being rocked from the right to the left and the spring 33 is pulled out of the groove at the same time and the spring 34 is allowed to slip on the flange 22 until it snaps into position to lock the fin. The hand lever 36 need not be touched throughout this maneuver and could even be omitted. On the other hand, the hand lever 36 is of great help when the watercraft is to be turned round while it is not traveling. For this operation the two springs 34 and 33 are pulled out of the grooves and the hand lever 36 is used to pivotally oscillate the fin 3 approximately between angles of 60° and 120° relative to the normal position so that the fin 3 produces a thrust which acts transversely on the rear end of the watercraft and causes the latter to turn about the foremost fin 3. A reverse travel is also possible if the fin 3 is swing through as much as 180°. The reverse travel is slightly impeded by the foremost fin 3.

In addition to an extreme directional stability, the watercraft in this embodiment has a very high maneuverability.

FIG. 14 shows how a surfboard 42 can be propelled with the aid of a fin 3. The fin stem 2 is rotatably mounted on a horizontal transverse pin 40 and can be pivotally moved to the rear into a horizontal position, in which it is received by a groove 43, which extends on the underside of the surfboard 42 from the slot to the rear end. In this position the fin 3 extends upwardly behind the surfboard and does not disturb the surfer. A short hand lever 38 may be used to swing the fin stem 2 and is also received by a groove 44 formed on the upper side. A protruding nose 45 at the fin stem 2 forms the rigid steering fin, which is usual with conventional surfboards. When the fin 3 has been swung down, the surfboard can be propelled by a rocking motion so that the surfer can travel out against the surf and then ride back on a wave although the flat surfboards are not so well suited for fin propulsion, which in this case requires a greater effort. The groove 43 on the underside may extend forwardly from the slot rather than rearwardly; in this case, the fin stem 2 is mounted to extend in the opposite direction so that the craft when propelled by the fin travels in a direction which is opposite to its direction when carried along by a wave.

In the embodiment shown in FIG. 15, the hull 1 has a slot which is as wide as the fin stem 2. The upper end portion of the latter forms a lever 38. Near the upper end of the slot, two bearing sides of the lever 38 are shown through said bearings and can be fixed in position. The fin stem 2 has a through bore and is mounted on the pin 40, which holds the fin stem in position so that the main fin 3 can be swung upwardly in forward and rearward directions.

When it is desired to disembark at or embark from a flat beech, the lever 38 is pushed forward as far as possible so that the main fin 3 is swung up to the hull 1 and the craft can travel even in water having a depth of about 50 centimeters. Whereas the watercraft does not have a very high stability with the fin in this position, it can still be balanced. In deep water, the main fin 3 is adjusted to an intermediate position, which is most desirable for fast propulsion. The main fin 3 is designed so that the thrust produced by it in that position has a horizontal direction. A resilient tail fin 41 is connected to the hull 1 and serves to stabilize the direction of travel. The tail fin 41 produces only a small thrust because it is too close to the axis of main fin 3 and it is desired to produce the major portion of the thrust is disposed before the center of gravity of the watercraft, the latter is pulled by the main fin. The point where the resistances presented by both fins surfaces to a lateral flow are balanced lies behind the center of gravity so that the watercraft will not turn round when the thrust is discontinued. In this case, the watercraft would turn round if the tail fin 41 were omitted. Slight changes in direction can be induced by certain weight-shifting operations. To travel along
a sharp curve, the main fin 3 is swung forwardly as far as possible and the change in direction is initiated at the same time. The point where the resistances presented by both fin surfaces to a lateral flow are balanced is now disposed before the center of gravity so that the watercraft travels along a sharp bend. A fast travel can be stopped quickly in this way. When it is desired to turn round on the spot while the watercraft has no or only a slow speed, it will be swung to one side with the main fin 3 advanced and to the other side with the main fin 3 directed rearwardly.

The main fin can be adjustably mounted with different means. For instance, the fin stem may be freely movable in a slot so that it can be pulled up or swung. Alternatively, a carriage could be provided, which is displaceable in the longitudinal direction of the watercraft and in which the fin stem is mounted to be displaceable in height. The fin stem may be fixed in position with different means so that it need not be held by hand.

What is claimed is:
1. A watercraft comprising:
a floating elongated body having a bow and a stern and adapted to rock about a longitudinal axis of the body extending from the bow to the stern;
an elongated stem extending downwardly from said body substantially in the plane of and generally transverse to said axis at a location intermediate said bow and said stern, said stem being secured to said body but having a lower free end resiliently twistable relative to said body; and
a fin attached to said free end at a forward portion of the said fin and with spacing below said body, said fin having an edge proximal to said body of lesser stiffness than the edge of said fin distal from said body, said fin having a trailing portion resiliently deflectable independently of said stem.
2. The watercraft defined in claim 1 further comprising means for mounting said stem movably on said body.
3. The watercraft defined in claim 1 wherein said stem is provided with an extension, running above said body.
4. The watercraft defined in claim 1 wherein said stem converges toward said axis in the direction of the bow.
5. The watercraft defined in claim 1 wherein said stem projects from said body perpendicularly to said axis.

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