Aug. 31, 1943. C. M. WELLONS 2,328,041

STEERING DEVICE FOR BOATS

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Fig.1.

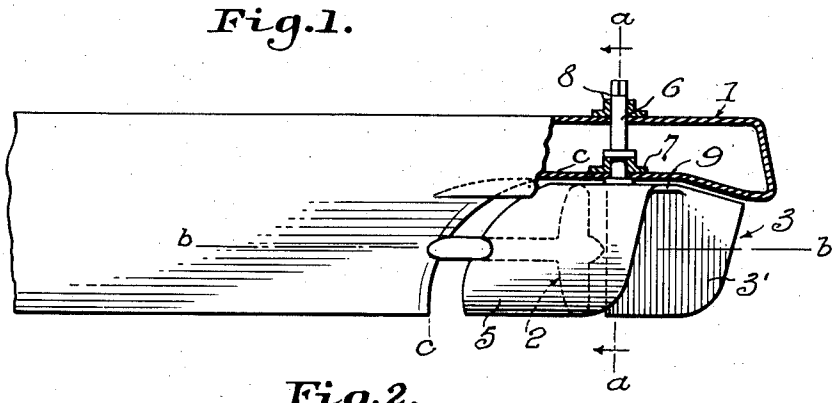


Fig.2.

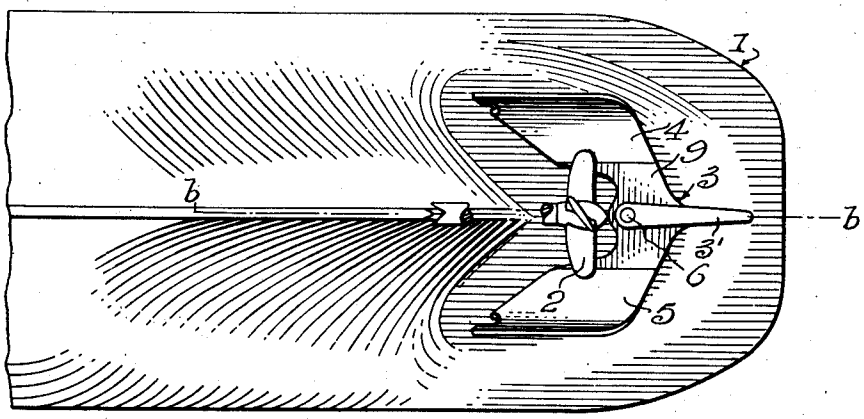
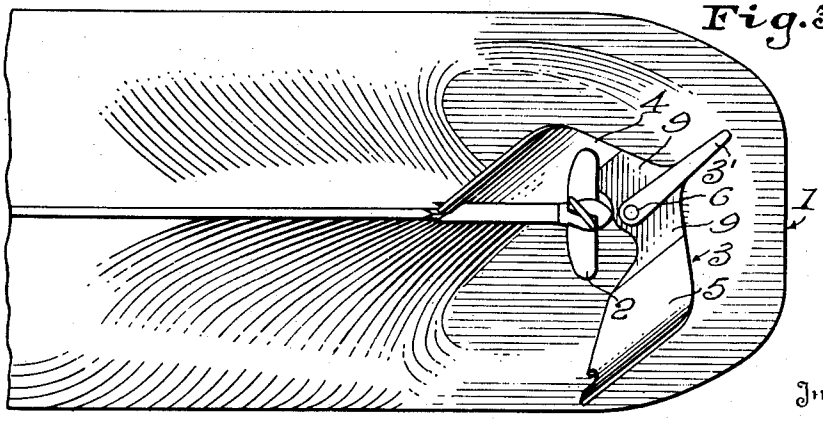


Fig.3.



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Fig. 4.

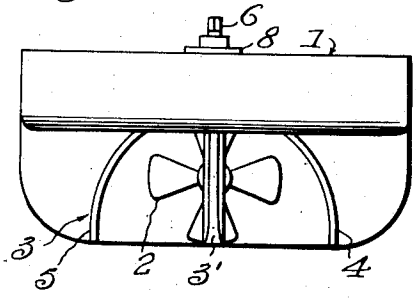


Fig. 5.

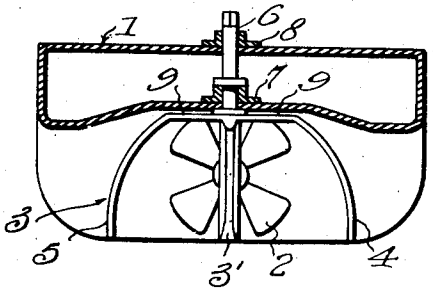


Fig. 6.

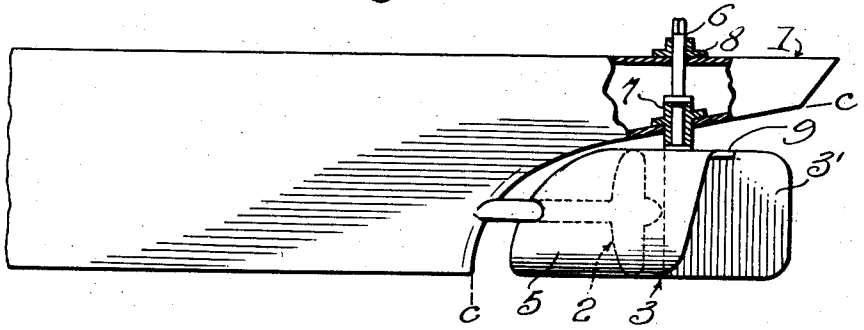
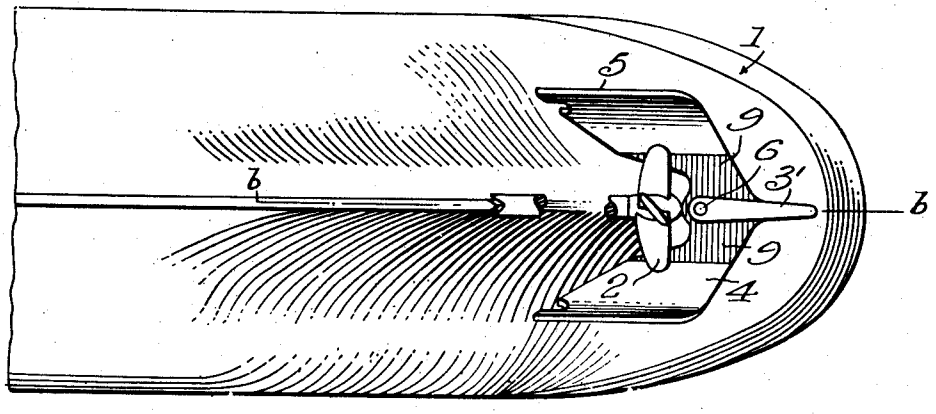


Fig. 7.



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UNITED STATES PATENT OFFICE

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STEERING DEVICE FOR BOATS

Charles M. Wellons, Bellevue, Pa.

Application September 11, 1942, Serial No. 458,040

3 Claims. (Cl. 114—162)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates generally to marine propulsion; more particularly it is directed to towboats of the screw-propeller type having facilities for directing the entire propeller wash so that the maximum in energy delivered by the propeller may be utilized to produce a turning effect upon the boat and its tow.

Specifically, this invention is an improvement on the steering device for which United States Letters Patent No. 2,043,276 were granted to me on June 9, 1936.

It is an object of this invention to modify the form of rudder there disclosed to adapt it to a hull having a more efficient form. The hull form to which the present rudder is adapted is substantially the conventional form for a single screw ship or tug. In addition, the fantail, or overhang, is modified so as to provide a tunnel effect, thus permitting the use of a propeller with a diameter greater than the draft.

In general, the functions of the device now presented are identical with those described in the patent. The device differs essentially in the shape of the hull and the shape of the outer vanes of the rudder. This improved form of hull and rudder not only improves the efficiency of propulsion but makes it possible to raise the interior portion of the overhang area to produce the tunnel effect.

The surfaces of the hull at the after end of the underwater body are concave and designed to minimize the resistance of the hull and to afford free flow of water to the propeller. In this respect they conform to usual ship design. Since these surfaces are concave, they intersect in a curved line. The forward boundary of each of the side vanes of the rudder must coincide with the intersection curve when the rudder is rotated to its extreme position in either direction. This requirement, together with certain additional consideration in respect to the continuity of the hull and rudder surfaces, determines the form of the outer vanes.

Referring more particularly to the accompanying drawings in which corresponding parts are indicated by similar characters:

Fig. 1 is a fragmentary sectionalized side elevation illustrating the mounting and arrangement of my improved rudder with respect to the propeller and hull of the towboat;

Fig. 2 is a bottom plan view illustrating the rudder in its intermediate position;

Fig. 3 is a similar view showing the rudder after it has been rotated in its extreme position in an anti-clockwise direction;

Fig. 4 is a stern view;

Fig. 5 is a transverse vertical section along the line *a*—*a* of Fig. 1;

Fig. 6 is a fragmentary sectionalized side elevation illustrating the invention applied to a ship having the conventional fantail stern; and

Fig. 7 is a bottom view of Fig. 6.

In the illustrated embodiment characterizing this invention, there is shown the after end of the hull **1**, a screw-propeller **2**, and a rudder **3** composed of a middle vane **3'**, outer vanes **4** and **5**, and a rudder stock or shaft **6**, journalled in rudder stock bearings **7** and **8**.

Propeller **2** may be of any type which, when submerged and rotated by the application of sufficient power, will induce or project a flow of water in a direction generally parallel to its axis of rotation. This flow is referred to herein as the wash of the propeller.

That portion of the hull which is normally submerged is shaped so that its side surfaces terminate in an intersection indicated by the line C—C extending in a vertical plane in which lies the axis of the propeller shaft. An overhanging structure, which may form a part of or be attached to the hull, extends aft of the intersection indicated by the line C—C and forms a support for the rudder stock and a protection for the the rudder as clearly shown in Fig. 1 of the drawings.

Referring to Figs. 2, 4 and 5, it will be seen that in its preferred form in horizontal sections near the propeller shaft level, lines through the rudder vane and hull surface are approximately straight. Above the propeller shaft level, corresponding lines curve outwardly on the hull, indicating that, when backing, the upper portion of the hull surface tends to deflect the wash of the propeller downward. In this area the wash would tend to leave the hull surfaces but it is deflected downward and thereby expanded laterally by the upper portion of the hull surface.

The middle vane **3'** of rudder **3** is similar to and functions in the same manner as the type of rudder commonly used for steering screw-propeller driven boats. The side vanes are disposed symmetrically in spaced relation on either side of the middle vane about which they are arranged in diametrically opposed relation and rig-

idly attached by suitable arms 9. The curvature of the outer blades is dependent upon the shape of the hull and the curvature of the line C—C. They are shaped so that in the full degree of turn in either direction the adjacent edges of the contacting blade and the line C—C are continuous. The rudder thus formed is mounted upon and secured to the rudder stock 6, which is arranged to rotate in bearings 7 and 8, which are in turn secured to the overhanging portion of the hull 1. The axis of the rudder stock, indicated by the line *a*—*a*, intersects the axis of the propeller shaft, indicated by the line *b*—*b*.

With this arrangement it is evident when the rudder is rotated in a counter-clockwise direction to its extreme position as shown in Fig. 3, the forward edge of the vane 4 is in contact with the intersection C—C and the inboard side of the said vane forms a surface more or less continuous with the starboard side of the hull. Similarly, when the rudder is rotated in a clockwise direction the inboard side of the vane 5 forms a more or less continuous surface with port side of the hull.

When the propeller is driving ahead and when the rudder is in the position shown in Fig. 3, water will be excluded from approaching the propeller from the port side, that is to say, the side toward the top of the drawing, and will be drawn from the starboard side, or side toward the bottom of the drawing. Also, water projected aft from the propeller will react upon the middle vane 3'. Both effects act to force the stern of the boat toward the starboard side, thus producing a clockwise turning effect upon the boat. When the propeller is operated to back the boat, water is directed to the propeller from the port side by the vanes and the water projected from the propeller reacts upon the vane 4 and the after portion of the starboard side of the hull. Both of these effects act to produce a counter-clockwise turning effect upon the boat. When the rudder is rotated to its extreme position in the opposite direction, effects that are similar but opposite in direction are produced. When the rudder is rotated to positions intermediate between its extreme and central positions and the propeller is rotated to produce a flow of water relative to the hull and rudder, the turning effects similar to but of lesser force than those described above, are produced.

The adaptation of my device to ships having other forms of stern construction will be clear from a consideration of Figs. 6 and 7 in which there is shown a conventional fantail stern. By suitably curving the outer blades of the rudder, similar effects may be obtained.

In the light of the foregoing description, it will be apparent that by virtue of the action of the outer vanes in directing the approach of the water to the propeller, a boat equipped with my invention will have greater steering ability when driving ahead than one equipped with the common device of a single rudder placed aft of the propeller. It will also be evident that, when backing, the entire wash of the propeller may be deflected upon the relatively inclined surface formed by the outer rudder vane and the side of the hull, thus obtaining the maximum turning force available from the energy imparted to the flowing water by the propeller. Also it may be readily seen that water may flow freely to or from the propeller from either one or both sides of the boat at all times, irrespective of the depth of water under the bottom of the hull.

Although in the foregoing, certain elements have been described as best adapted to perform the functions alotted to them, nevertheless it is to be understood that various minor changes may be resorted to within the scope of the appended claims without departing from or sacrificing any of the principles of this invention.

Having described my invention, what I claim as new and wish to secure by Letters Patent is:

1. In a boat of the screw-propeller type, the combination with a hull formed with underwater surfaces, the latter converging inwardly toward the stern to an intersection on a curved line lying in a vertical plane central of said hull, and a propeller disposed to the rear of said line and having its axis of rotation in said vertical plane, of a multi-vane rudder pivoted about an axis behind said propeller and in the same plane as the line of intersection of the underwater surfaces, said rudder comprising a middle vane rotatable about said rudder axis, and a pair of forwardly and laterally offset curved outer vanes disposed in opposed relation such that rotation of said rudder about its axis will place the forward edge of one of said outer vanes in juxtaposition with respect to the intersecting line of the underwater surfaces to form a continuation of one of said surfaces and screen the propeller from water flowing along one side of the hull while directing the water flowing along the opposite side to and from the propeller through a restricted channel.

2. In a boat of the screw-propeller type, the combination with a hull formed with an overhang and having its underwater surfaces inwardly converged toward the stern to an intersection on a curved line located in a plane normal to the bottom of the overhang and central of its opposite sides, and a propeller to the rear of said line and having its axis of rotation in said plane; of a multi-vane rudder pivoted about an axis located immediately behind the propeller and in the same plane as the line of intersection of the underwater surfaces, said rudder comprising a middle vane rotatable about said rudder axis, and a pair of forwardly and laterally offset curved outer vanes disposed in opposed relation with their upper edges disposed immediately beneath the bottom of said overhang such that rotation of the rudder about its axis will place the forward edge of one of the outer vanes in juxtaposition with respect to the intersecting line of the underwater surfaces to form a continuation of one of said surfaces and screen the propeller from water flowing along one side of the hull, while directing the water flowing along the opposite side to and from the propeller through a channel defined by the bottom of the overhang and the outer vanes of the rudder.

3. In a boat of the screw-propeller type, the combination with a hull formed with an overhang and having its underwater surfaces converged inwardly toward the stern to an intersection on a curved line located in a plane normal to that of the bottom of the overhang and central of its opposite sides, of a propeller to the rear of said line and having its axis of rotation in said plane; of a multi-vane rudder situated immediately behind the propeller and having its axis in the same plane as the line of intersection of the underwater surfaces, said rudder comprising a middle vane and forward and lateral offset curved outer vanes, the latter being disposed in opposed relation and having their upper edges disposed immediately beneath the bottom of the overhang and their lower edges coincident with

those of the underwater surfaces, said outer vanes having a curvature such that rotation of the middle vane about its axis will place the forward edge of one of the outer vanes in juxtaposition with respect to the intersecting line of the underwater surfaces to form a continuation of one of said surfaces and to screen the propeller from water flowing along one side of the hull while directing the water flowing along the opposite side to and from the propeller through a channel defined by the bottom of the overhang and the outer vanes of the rudder.

CHARLES M. WELLONS.