

March 10, 1942.

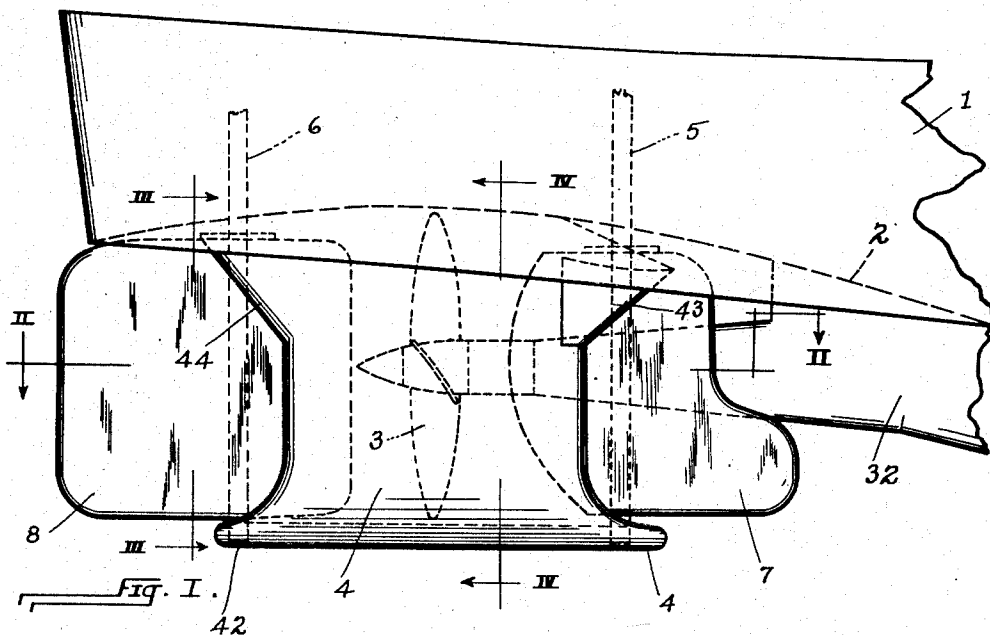
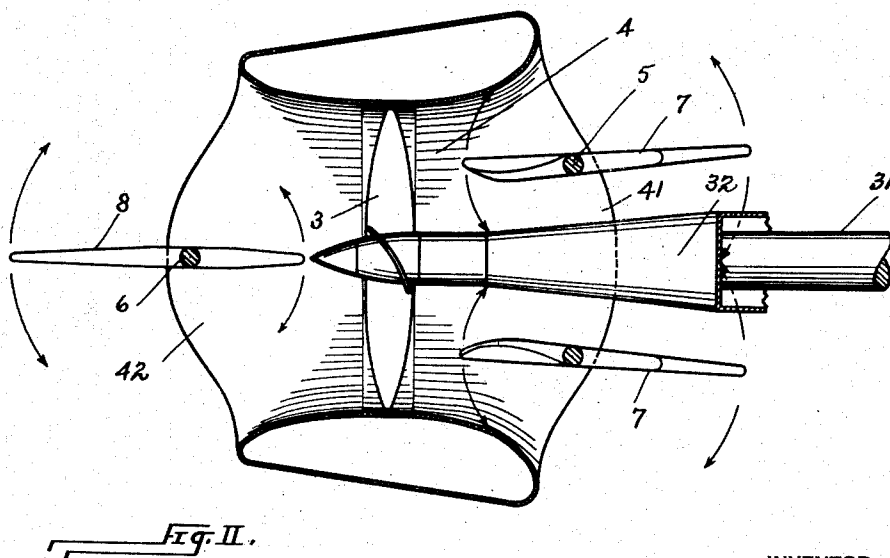
V. B. EDWARDS

2,275,618

BOAT

Filed Aug. 4, 1939

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. III.

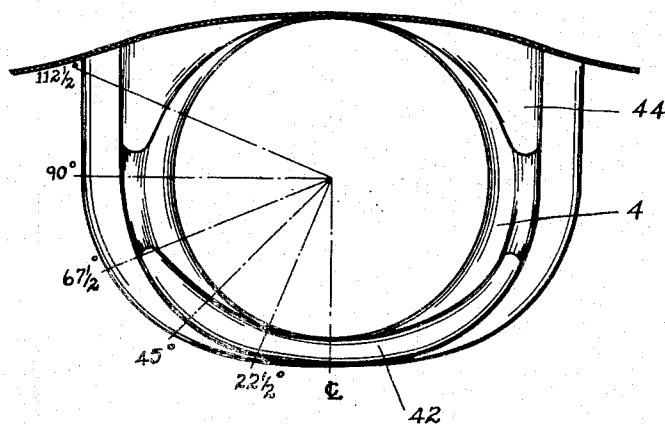
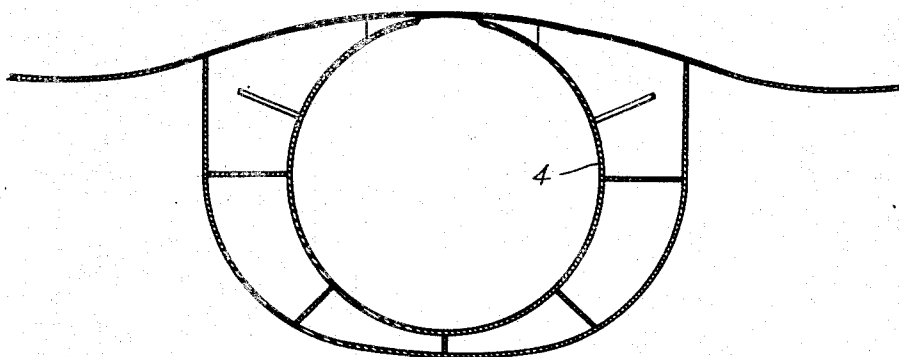
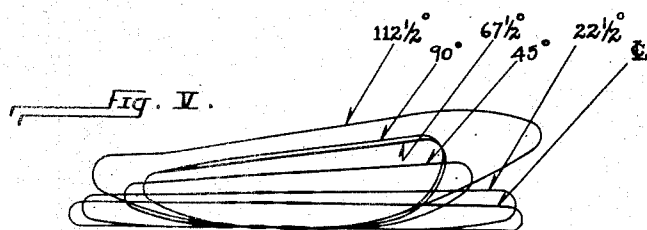


Fig. IV.



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UNITED STATES PATENT OFFICE

2,275,618

BOAT

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Application August 4, 1939, Serial No. 288,260

4 Claims. (Cl. 115—11)

This invention relates to the propulsion and steering of ships by screw propellers. It involves the use of a nozzle, within which the propeller is arranged; and it consists in refinements in the shape of the nozzle, and in the coordination (both structural and functional) of rudder mechanism with the nozzle, with the object in view of gaining superior efficiency both in towing power or thrust and in steering, when the propeller is reversed for astern movement. The invention has been developed in vessels for river navigation, where channels are narrow and tortuous, and beset with shallows; where current and wind augment the difficulties that attend navigation; where landings often are situated under most confining limitations of space; where facility in backing with immediate response to the helm are of peculiarly great importance; and where the practice is followed of lashing the barges to be towed securely to the bow of the towboat.

The invention is illustrated in the accompanying drawings. Fig. I is a view in side elevation, showing fragmentarily the stern of a ship to which the propeller, nozzle, and rudder structure of the invention are applied; Fig. II is a view in horizontal section, on the broken plane indicated at II—II, Fig. I; Figs. III and IV are views in vertical and transverse sections on the planes indicated respectively at III—III and IV—IV, Fig. I; and Fig. V is a diagrammatic view, showing in longitudinal section the outline of one wall of the nozzle, on successive axial planes indicated in Fig. III. These sections are in Fig. V brought, by rotation on the axis of the nozzle, to a common plane.

The hull of the boat may advantageously be shaped at the stern with a tunnel whose centre line is indicated at 2. Within this tunnel the propeller 3, borne by a shaft 31, is assembled, to rotate in usual manner. A flume or nozzle 4, circular internally in cross-section, wide at its forward intake end, narrowing to minimum size, and flaring again sternward, is arranged within the tunnel. The propeller is arranged at or near the point of minimum cross-section, and the size of the nozzle is such that the propeller has clearance for rotation. In the curves of the hull the curves of the nozzle are merged, as the drawings show.

Invention lies, as has been said, in refinements of shape and of organization, and of these attention is first directed to the flare of the nozzle from its narrowest part, where the propeller is situated, sternward. This sternward flare, although not so great as the forward flare, is more

pronounced, and the sternward opening of the nozzle is wider, than has heretofore been the case with such nozzles. Attention is further directed to the aerfoil shape (or, more accurately, the hydrofoil shape) that has been given to the nozzle at its after edge, as well as at its forward edge. That is to say, in axial section the curvature of the inner wall of the nozzle from the point of minimum diameter sternward is of gradually diminishing radius; and the curve of diminishing radius merges in the curve of the rounded after edge of the nozzle. Both the forward and the after edges of the nozzle are rounded or bulbous, as particularly shown in Figs. II and V, and in that respect the structure is adapted to free and easy entrance of water to the propeller in astern operation as well as in forward operation. The exterior sternward tapering shape of the nozzle adapts it best to normal forward travel; but, subservient to that, the widening of the nozzle to its sternward opening and the hydrofoil conformation of the after edge of the nozzle make for increase in the effective thrust of the propeller in backing. The increase in this particular has been found to be of the order of 30 to 40%, over nozzles that heretofore have been used.

The nozzle at the bottom is not tapered, but at that point, on vertical and axial section (in the centre plane of the hull), extends horizontally, and is parallel walled and round ended (cf. Fig. V). Beginning thus at zero, a doubly flaring taper is developed that increases upwardly to a maximum in the horizontal and axial plane, and from that point the taper decreases, and the contour of the nozzle merges in the contour of the lines of the hull.

In its lower portion, extending circumferentially through a suitable angle that may be one third of the circumference or more, the nozzle is prolonged both forwardly and rearwardly, in extensions 41 and 42; and above there are like extensions, 43 and 44. It thus appears that the nozzle is of maximum length at the bottom, and is of gradually diminishing length on successive axial planes from the bottom upward. The lower extensions 43 and 44 of the nozzle have effect in relieving the disturbance of the bottom of the waterway otherwise caused by the suction of the rotating propeller, when the vessel is moving, whether forward or backward, in shallow water. The extensions are further serviceable in organization with the rudders of the vessel.

With the nozzle-encircled propeller, rudders are organized; not a single rudder merely, arranged sternward from the propeller; but rudders

arranged both forward of and sternward from the propeller. Forward of the propeller a pair of rudders 7 is arranged, one on each side of the propeller shaft 31; rearward, a single rudder 8 suffices, arranged on the centre line. The nozzle extensions 41, 42 may afford support for lower pintles of the rudder stocks, and thus afford strength with economy of structure, and efficiency in relative freedom of stream flow. The blades of the rudders extend both fore and aft from the stocks that carry them; and the after extensions of the forward rudders, and the forward extensions of the after rudders are so shaped that, when the rudders are hard over, their edges meet with substantial completeness the surfaces of these extensions, diverting completely the stream flow so as to be fully effective on the rudders, and increasing steering efficiency. The forward rudders, indeed, are so shaped that their after edges throughout all their extent (when in hard-over position) substantially meet the inner surface of the nozzle, while the forward edges come snugly to position against and beneath the extension 32 of the keel of the vessel.

The elaboration described of rudder structure and organization with a propeller-encircling nozzle gives such response in facility in backing and astern steering as to render the vessel peculiarly well suited to the navigation of inland waterways, in localities where barges are towed forward of and firmly attached to the towboat.

The drawings show a single propeller and a single propeller-encircling nozzle, arranged in the center plane of the hull of the vessel. The engineer will understand that two or more propeller and nozzle assemblies may be employed, grouped symmetrically with relation to such centre plane.

I claim as my invention:

1. Propelling and steering apparatus for a ship that includes a propeller rotatable upon an axis, a nozzle borne by the hull and closely encircling the propeller, a plurality of rudder blades borne on posts arranged forwardly of the propeller

and on the two sides of the propeller axis, and a single rudder blade borne on a post arranged sternward of the propeller and in the axis of the propeller, said sternward-arranged rudder blade having a forward extension and adapted in its range of swing to come substantially to edge engagement on the inner surface of the nozzle on the two sides of the axis of the propeller.

2. Propelling and steering apparatus for a ship that includes a propeller, a nozzle borne by the hull in fore-and-aft position and encircling the propeller, and extensions both forward and sternward from the nozzle in its lower portion, rudders arranged both forward and sternward of the propeller whose posts at their lower ends are rotatably borne by said extensions.

3. Propelling and steering apparatus for a ship that includes a propeller rotatable upon an axis, a nozzle borne by the hull and closely encircling the propeller, a plurality of relatively diverging rudder blades borne on posts arranged forwardly of the propeller and symmetrically disposed on the two sides of the axis of the propeller, and a single rudder blade borne on a post arranged sternward of the propeller and in the axis of the propeller.

4. Propelling and steering apparatus for a ship that includes a propeller rotatable upon an axis, a nozzle borne by the hull and completely encircling the propeller and forming a passageway for stream-flow that contracts from the forward and intake end to the point where the propeller is situated, a plurality of rudder blades borne on posts arranged forwardly of the propeller and on the two sides of the propeller axis, the after edges of the rudder blades being shaped to the contour of the nozzle and when in hard-over position meeting the wall of the nozzle, diverting stream-flow and preventing with substantial completeness stream-flow through the nozzle on one side of the vertical plane through the propeller axis.

VERE B. EDWARDS.