Dec. 6, 1938. L. KORT 2,139,594

COMBINED PROPELLING AND STEERING DEVICE FOR SCREW PROPELLED SHIPS

Filed June 25, 1937

Fig. 1.

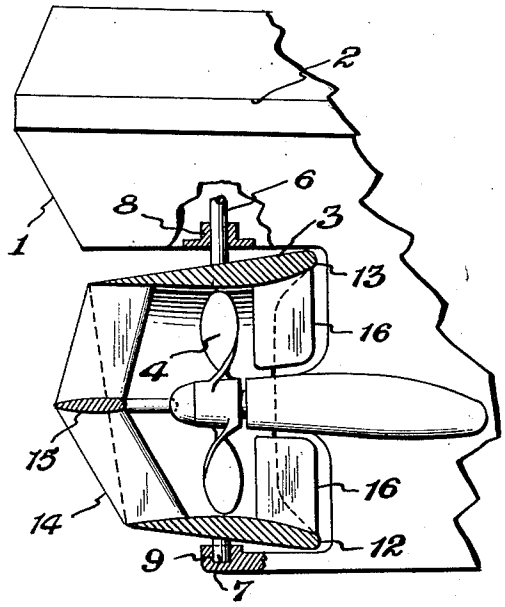


Fig. 2.

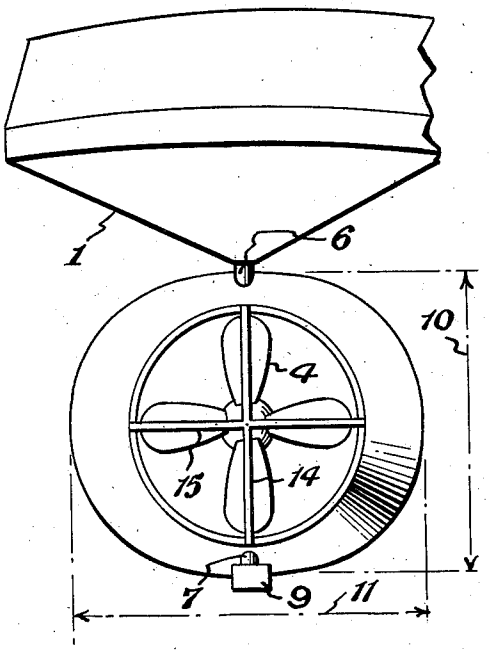


Fig. 4.

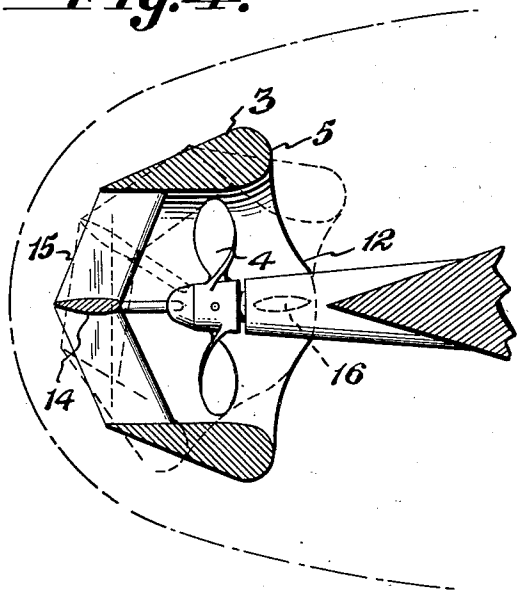
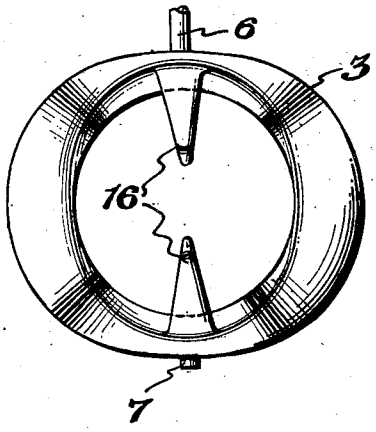


Fig. 3.



INVENTOR:
L. Kort
BY:
Glascock Downing & Seebold
ATTORNEYS.

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COMBINED PROPELLING AND STEERING DEVICE FOR SCREW PROPELLED SHIPS

Ludwig Kort, Hanover, Germany

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In Germany February 8, 1936

7 Claims. (Cl. 114—166)

The present invention relates to means for improving the propulsion and steering of ships and more particularly pertains to an arrangement wherein a tubular nozzle is swingably mounted adjacent the propeller so that the nozzle serves as a steering device and also acts to increase the thrust of the propeller.

In my U. S. Patent 2,030,375 a device is disclosed showing how the propelling effect of a ship's screw propeller may be improved by arranging a tubular ring around the blades of the propeller. The inner part of the tube is shaped like a nozzle, having its entering opening in front of the propeller, while the walls of the ring have profiles comparable with the profiles of the wings of an aeroplane. The suction side of the profiles (upper side of the wing) is turned towards the propeller, and the pressure side (underside of the wing) forms the outside of the nozzle body. The entering edges of the profiles—the mouth of the nozzle—are well rounded off. The ring is connected to the ship and the propeller works independently therein at or near to the narrowest cross sectional area of the nozzle with but little clearance between the wing tips of the propeller and the surrounding walls of the nozzle.

As long as the nozzle forms part of the ship's hull, or is rigidly connected to the same, it is necessary for steering purposes to arrange a separate rudder on the ship which is usually located behind the exit opening of the nozzle. It is, however, possible and found practical in some cases to combine the action of the nozzle with the action of a rudder, by employing the so-called "ring-rudders" around the propeller, which do not produce additional thrust.

It is, therefore, an object of my present invention to provide such a combined device. A more specific object of the present invention is to provide a combined propelling and steering device on screw propelled ships consisting of a screw propeller surrounded by a tubular shaped nozzle as described by my U. S. Patent 2,030,375, wherein pivoting means are provided between the nozzle and the ship's hull allowing the nozzle to be turned with respect to the ship like a rudder.

It is a further object of my invention to indicate what additional arrangements are advisable in order to adapt the nozzle for effectively answering the combined purpose of increasing the propelling thrust and the steering action.

In the accompanying drawing the invention is shown by way of example.

Figure 1 is a side elevation of the stern of a ship and the propeller showing in section the surrounding nozzle.

Figure 2 is a rear view of the ship and the nozzle rudder showing the propeller arranged therein.

Figure 3 is a front view of the nozzle body.

Fig. 4 is a plan-view of the arrangement shown in Figures 1 and 2, indicating in horizontal cross section—taken about in height of the propeller shaft—the nozzle body.

In the various figures the same numerals refer to the same parts. (1) indicates the stern of a ship with the deck-line indicated at (2). (3) is the nozzle body with the propeller (4) arranged therein at or near to its narrowest inner cross section and with but little clearance between the wing tips of the propeller and the surrounding walls of the nozzle. The mouth of the nozzle body is well rounded off at the entering edge 5. (6) is the rudder shaft and (7) the lower rudder pintle. The rudder-shaft and the pintle are rigidly connected to the nozzle ring and pivotably supported by the top-bearing (8) and the lower bearing (9), the latter being connected to a heel piece on the stern post. The rudder shaft (6) is connected in the usual manner to a steering gear so that the shaft and the nozzle connected thereto may be turned at various angles in exactly the same way as is usual in connection with ordinary rudders.

In most cases it is necessary, in order to accommodate a large propeller, that the walls of the nozzle ring should be given a slender cross section in the upper and lower part of the ring, while the mouth of the nozzle should be made rather wide, in order to catch as much water as the propeller can accelerate towards the rear at the service speed of the ship. The total vertical height (10) of the nozzle body therefore is usually made smaller than the total width (11).

In order to avoid at the slender portions of the ring the danger that the incoming water may separate from the inner walls of the nozzle and thereby disturb the propelling effect of the nozzle, it is advisable to carry the mouth of the nozzle at the slender portions of the nozzle ring further forward than that of the side portions of the ring, where the thicker airfoil cross sections of the walls are arranged. This is indicated in Figure 4 by the outside bottom-line (12) of the mouth of the nozzle and by the foremost point (13) of the nozzle body shown in Figure 1.

For improving the rudder action of the nozzle during the forward motion of the ship, and furthermore with a view to turn as far as possible

the cork-screw motion of the water which is leaving the propeller, into a reaction producing useful thrust a vertical guide fin (14)—and eventually also a horizontal guide fin (15)—is arranged in the outlet opening of the nozzle body. In order to have a similar effect during the astern motion of the ship, radially arranged guide fins (16) may also be fitted on the inside of the nozzle in front of the propeller, as is indicated in Figures 1, 3 and 4.

In order to eliminate whirling losses between the adjoining faces of the outside of the nozzle body and the opposite wall of the ship's hull both may be mutually so shaped that there is but little clearance between them and the outside of the nozzle body and the adjoining outside of the ship are homogeneously merging into each other, when viewing them as a fair-lead for the passing water.

While the drawing illustrates the combined nozzle and rudder for side-steering of a single-screw ship, it is, of course, possible to apply the same device in an analogous way to twin-screw ships, and not only for side-steering but also for producing vertical movements of a ship, as may be required for a submarine. In the latter case the turning axis of the rudders must be arranged horizontally instead of vertically as shown in the drawing.

What I claim is:—

1. A steering and propelling device for a screw propelled ship comprising in combination, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, and the walls of the nozzle having airfoil profiles with well rounded entering edges.

2. A steering and propelling device for a screw propelled ship comprising, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, and the longitudinal distance of said edges from a transverse plane through the axis of the pivotable supporting means being less than the radius of the propeller.

3. A steering and propelling device for a screw propelled ship comprising, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, said profiles in the portion of the walls of the nozzle extending generally in the direction of the pivoting axis of the rudder being relatively thick with the entering edges thereof terminated at a given distance from the turning plane of the propeller blades, and the profile portions arranged generally transverse to the pivoting axis of the nozzle being more slender with the entering edges terminated at a greater distance from the turning plane of the propeller blades.

4. A steering and propelling device for a screw propelled ship comprising, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, the profiles of the side wall portions being less slender than the top and bottom portions of the nozzle, the entering edge of the more slender profile portions being located at a greater distance from the turning plane of the propeller blades than the thicker profiles, pivots carried by the slender portions of the nozzle operably associated with the pivot supporting means, and means for turning the nozzle with respect to the hull of the ship.

5. A steering and propelling device for a screw propelled ship comprising in combination, a tubular nozzle surrounding the propeller with the

approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, and guide fins fitted to the inside of the nozzle in front of the propeller in a plane defined by the longitudinal axis of the nozzle and the pivoting axis of the nozzle.

6. A steering and propelling device for a screw propelled ship comprising in combination, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, and radially arranged guide fins fitted to the inside of the nozzle in front of the propeller and behind the propeller, said fins being arranged in a plane defined by the longitudinal axis of the nozzle and the pivoting axis of the nozzle.

7. A steering and propelling device for a screw propelled ship comprising in combination, a tubular nozzle surrounding the propeller with the approximate longitudinal center thereof arranged adjacent the turning plane of the propeller blades, the internal dimension of the nozzle being such as to provide a relatively small clearance between the inner surface of the nozzle and the tips of the propeller blades, means carried by the stern of the ship for pivotably supporting the nozzle, the axis of the pivot supporting means extending through the propeller shaft and adjacent the turning plane of the propeller blades, the inner surface of the nozzle being so shaped that the cross sectional area behind the propeller does not change materially when the longitudinal axis of the nozzle is in alignment with the axis of the propeller shaft, the inner surface of the nozzle being enlarged sharply in front of the propeller to provide an entrance opening at the front edge which is substantially larger in cross sectional area than the exit opening, the walls of the nozzle having airfoil profiles with well rounded entering edges, and the outside of the nozzle having a mutually adapted shape with respect to the hull stern of the ship with a relatively small clearance between the outer surface of the nozzle and the hull stern to provide homogeneous merging of the hull stern and the outside of the nozzle.

LUDWIG KORT.