Feb. 28, 1939. A. F. ANDERSON 2,149,155

PROPELLING DEVICE FOR SHIPS

Filed April 25, 1938 3 Sheets-Sheet 1

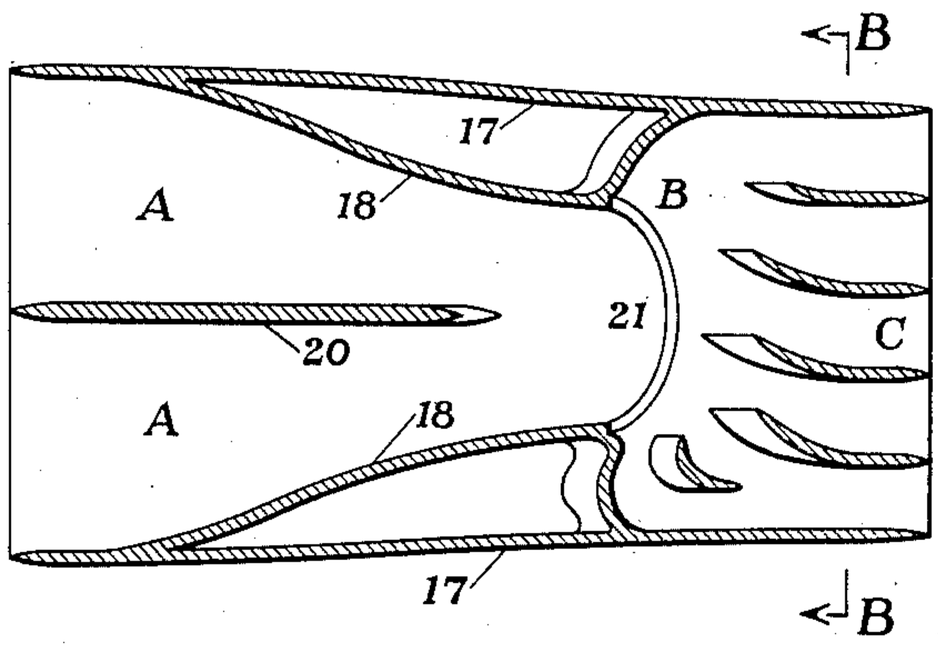

FIGURE 2

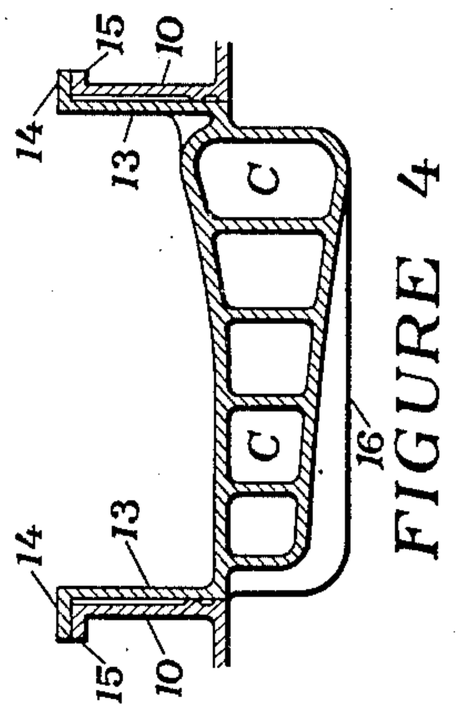

FIGURE 4

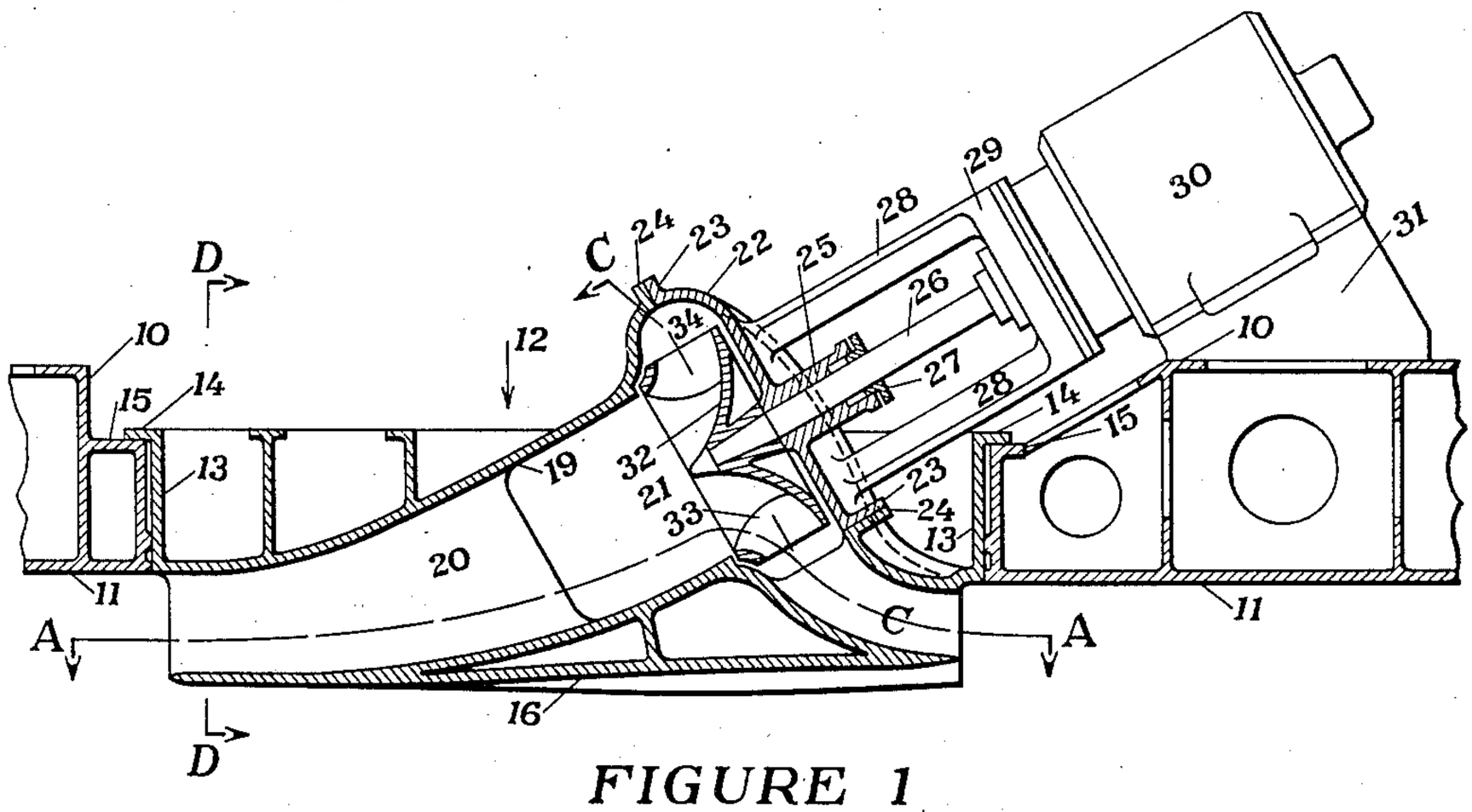

FIGURE 1

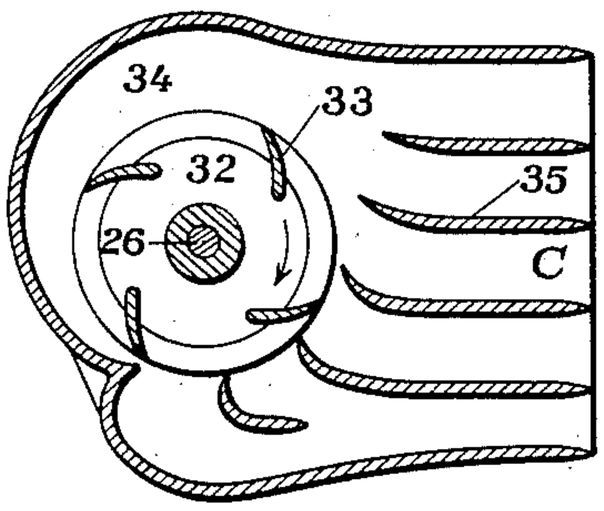

FIGURE 3

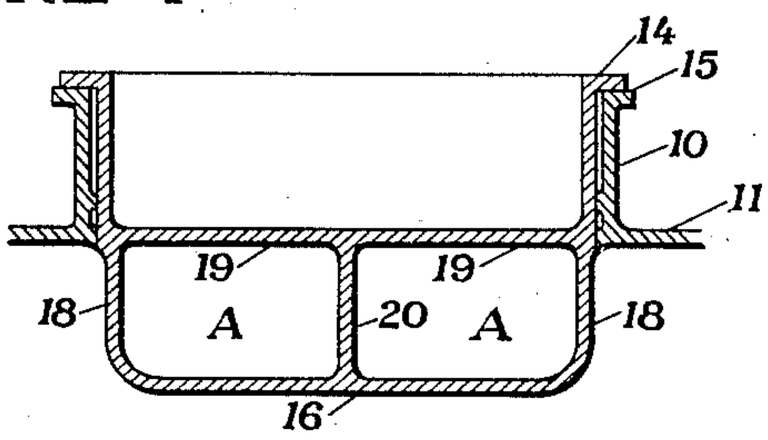

FIGURE 5

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PROPELLING DEVICE FOR SHIPS

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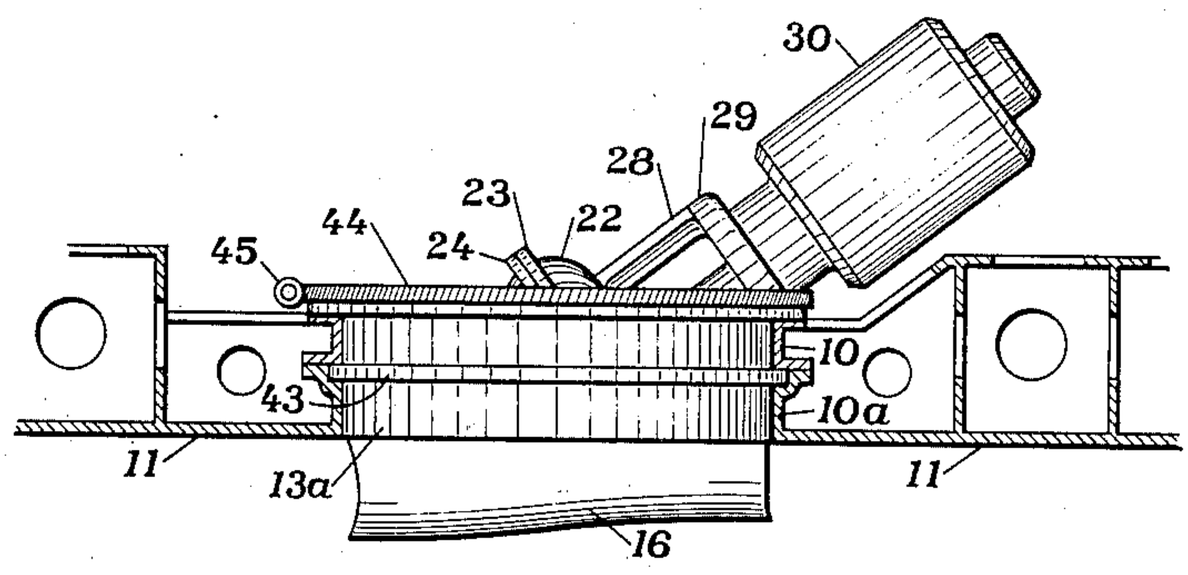

FIGURE 6

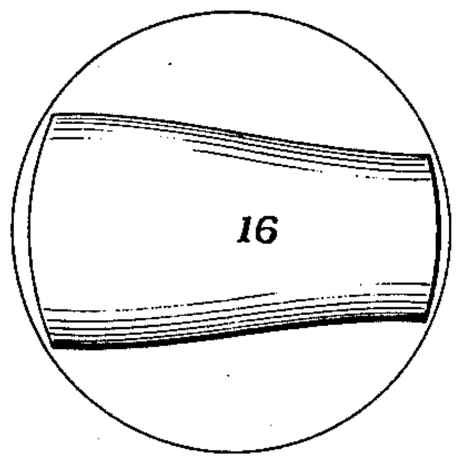

FIGURE 7

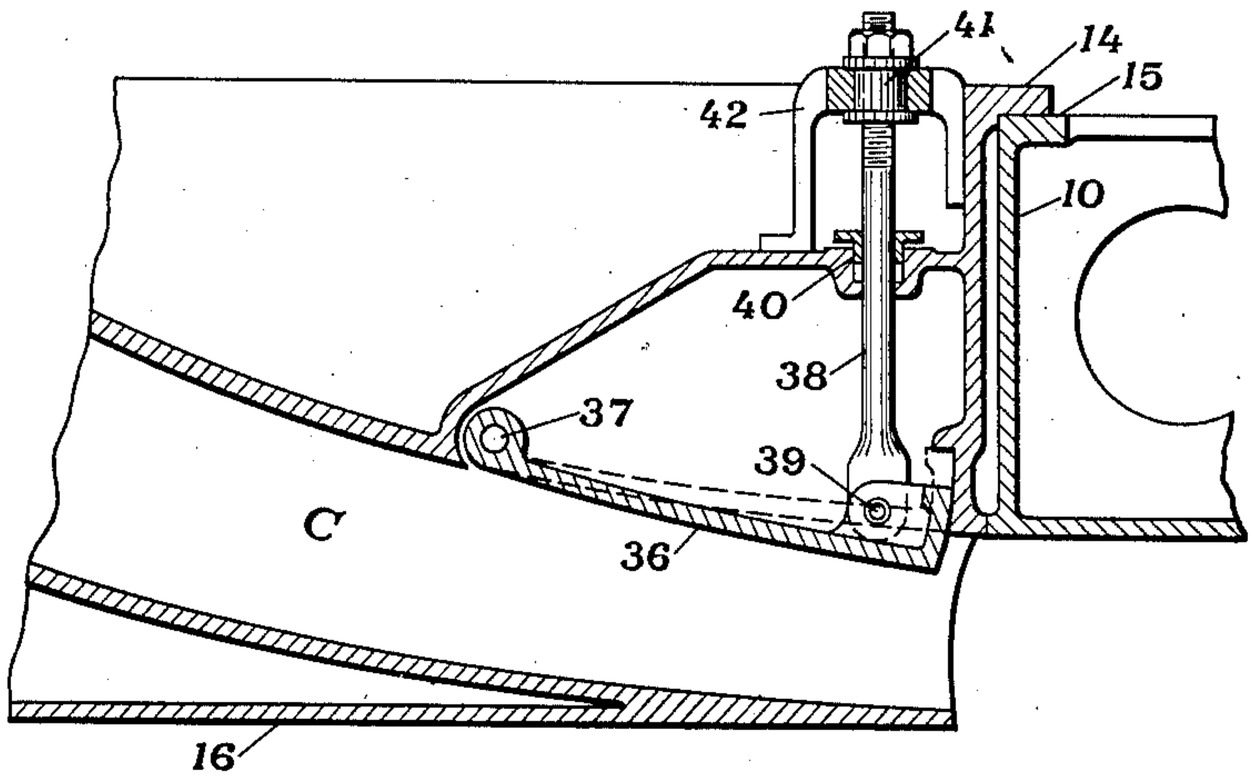

FIGURE 8

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PROPELLING DEVICE FOR SHIPS

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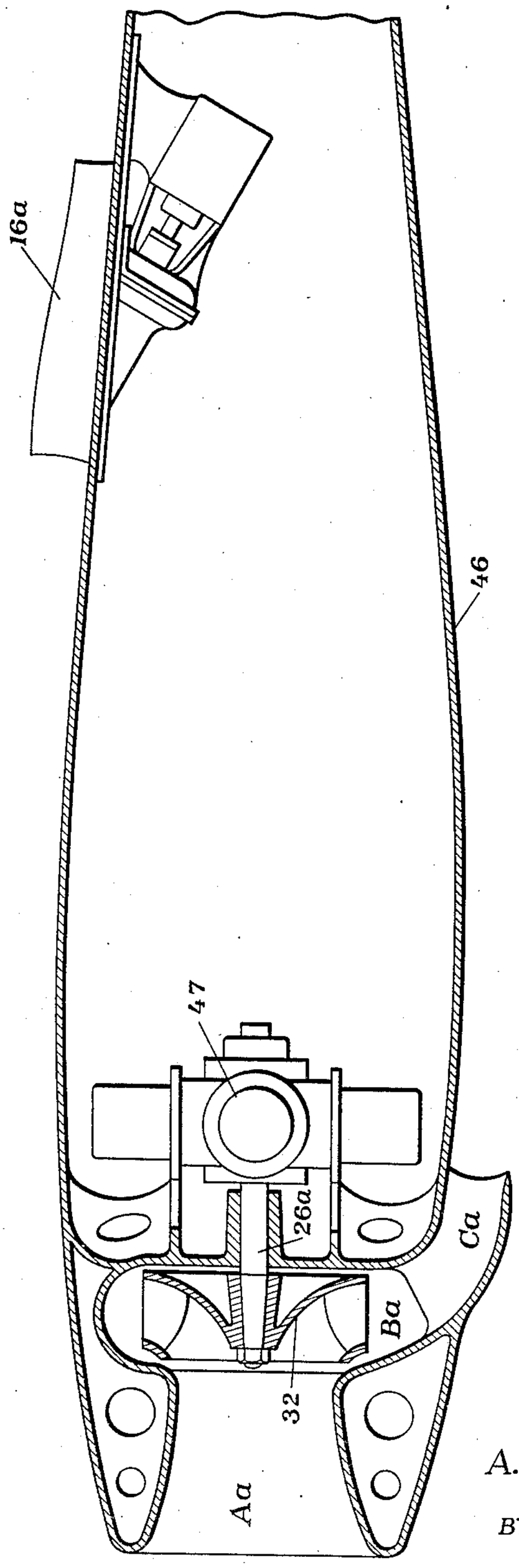

FIGURE 9

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Patented Feb. 28, 1939 2,149,155

UNITED STATES PATENT OFFICE

2,149,155

PROPELLING DEVICE FOR SHIPS

Albert F. Anderson, San Francisco, Calif.

Application April 25, 1938, Serial No. 204,134

7 Claims. (Cl. 115—16)

This invention relates to improvements in ships' propellers of the type employing a thrust casing having a passageway or conduit extending entirely through it in the direction of travel and in which is positioned an impeller which operates to produce a flow of water or other fluid through it and to expel the same at the discharge end at an increased velocity.

This invention relates more particularly to an improvement in the propeller shown and described in U. S. Letters Patent No. 2,112,948, granted to me on April 5, 1938.

It is well known that the resistance which a body offers to movement through water or air can be greatly modified by its shape and bodies which are shaped to offer the least resistance are said to be "streamlined".

It is an object of this invention to produce a propeller thrust casing designed to offer a minimum of resistance to movement through a fluid.

In propellers of the type here under consideration, a thrust casing is attached to the hull of the vessel to be propelled, usually to the bottom of a ship and in any other suitable position on an airship. The casing is provided with a passageway extending in the general direction of ship travel, and through which the water or air is flowed under the action of an impeller positioned therein, the cross sectional area of the passageway being greatest at the inlet and decreasing progressively towards the discharge opening, the ratio of the areas of the intake and the discharge openings being preferably 2 to 1. Since the same quantity of water flows past any given transverse plane in the same time, it is evident that the velocity at the discharge is twice that at the intake and the passageway is so designed that the increase in velocity is attained by continuous positive acceleration.

The efficiency of a propeller of the type here under consideration is dependent, to a great extent, on the type of impeller used and on the position of the impeller relative to the flow of fluid. It is also desirable to employ a construction in which the impeller is not subjected to any thrust in the direction of its axis of rotation, as it is in screw propellers. By avoiding end thrust, thrust bearings can be dispensed with.

It has been found that by positioning an impeller, of the centrifugal pump type, in the casing, and in the passageway, in such a manner that its plane of rotation is inclined to the direction of a line joining the centers of the inlet and the discharge openings and in which the fluid enters the eye of the impeller and leaves the impeller chamber at the peripheral edge thereof nearest the discharge opening, all as will be hereinafter described and shown on the drawings, an increased efficiency is obtained.

Having thus, in a general way, described the invention and its objects, the same will now be described in detail and for this purpose reference will be had to the accompanying drawings in which the invention has been illustrated and in which:

Figure 1 is a longitudinal section through the propeller, taken on a vertical median plane;

Figure 2 is a horizontal section taken on line A—A Fig. 1;

Figure 3 is a section taken on line C—C Fig. 1;

Figure 4 is a section taken on line B—B Fig. 2;

Figure 5 is a section taken on line D—D Fig. 1;

Figure 6 is a side elevation of a propeller unit, showing the same mounted for rotation in an opening in the ship's bottom;

Figure 7 is a bottom plan view of the propelling unit shown in Fig. 6;

Figure 8 is a fragmentary vertical section through the discharge end of the casing, showing adjustable means for varying the cross-sectional areas of the outlet; and

Figure 9 is a section, on a vertical plane, through a propeller unit designed for use on airships.

In the drawings reference numeral 10 designates a portion of the frame comprising the bottom 11 of a ship. The ship's bottom has a rectangular opening for the propeller that has been designated in its entirety by number 12. The propeller assembly comprises a frame of rectangular shape, having an outer frame member 13 provided along its upper edge with an outwardly extending flange 14 that overlaps the upper flat surface 15 of the frame 10. The propeller assembly is secured in place by suitable bolts or other means that have not been shown.

Supported by the frame of the assembly is a thrust casing whose bottom has been designated by number 16 and whose sides have been designated by number 17. Extending longitudinally through the casing is a passageway comprising three sections A, B and C, designating respectively the inlet, the impeller chamber and the discharge opening. The passageway, section A, is enclosed by side walls 18 and a top 19 and has a vertical partition 20 that divides it into two parts and terminates in a circular opening 21 that is concentric with the impeller and through which water or other fluid flows into the eye of the impeller. The impeller chamber B is formed by an enlargement of the passageway and its plane is upwardly and forwardly inclined with respect to a line joining the centers of the intake and the outlet openings. In the drawings the inlet section A of the passageway has been shown as upwardly and rearwardly curved and its axis, at the opening 21, is practically parallel with the axis of rotation of the impeller. The impeller housing has a removable section 22, provided with flanges 23 that fit against flanges

24. The removable section has an axial opening 25 through which the impeller shaft 26 extends, a stuffing box 27 serves to prevent leakage at this point. Section 22 has spaced integral portions 28 that connect it with an annular end member 29 to which the electric motor 30 is attached. The motor is also attached to a base 31. Secured to the forward end of shaft 26 is an impeller 32 having curved vanes 33, Fig. 3.

The impeller chamber has a special conduit 34 and its bottom communicates with the discharge section C of the passageway. The impeller is usually rotated in the direction of the arrow in Fig. 3 and produces a flow of fluid from the inlet to the outlet. It will be observed that the discharge from the impeller chamber takes place at its lowest point and in a direction approximately parallel with the plane of impeller rotation, the discharge section C of the passageway slopes downwardly and rearwardly in a gentle curve as shown in Fig. 1.

In order to prevent turbulence, to change the direction of the fluid and to receive thrust forces, the discharge passage has been provided with a plurality of thrust vanes 35 whose inner, or forward ends are curved in the opposite direction to that in which the impeller rotates. The resultants of the forces acting on the fluid at this point are resisted by the curved ends of vanes 35.

From Fig. 4 it will be seen that the vertical depth of the discharge section C decreases in the direction of impeller rotation. This is for the purpose of inducing a greater proportion of fluid to flow out while making the least change in its direction of flow.

The velocity of the buid flowing through the propeller is usually very high and on this account the passageway is not made unnecessarily long; as the loss of efficiency from this source is directly proportional to its length.

However, this loss is more than compensated for in some instances; as when engines having horizontal power shafts are employed and the impeller and chamber must be accommodated to this position, the passageway then is extended and circumvoluted accordingly; but its cross sectional areas are progressively changed to produce the required continuous acceleration of the fluid; otherwise, losses of energy are incurred which reduce the efficiency of the propeller still further.

In the embodiment of the invention illustrated in Figs. 1 to 5, the casing is not rotatable but is fixed and it can therefore not be used to steer the ship but only to propel it. Let us assume that the propeller described above is attached to an ocean going ship. The passage through the casing is always full of water since the casing is immersed.

When the impeller is rotated in the direction indicated by the arrow in Fig. 3, water is forced to flow from the intake to the outlet and, since the cross sectional area of the passageway decreases towards the discharge end to an area substantially one-half of that of the intake opening, the water will be increased in velocity twofold. This increase is accomplished by a gradual decrease in the cross sectional area of the passageway and results in a continuous positive increase in acceleration. The force required to accelerate the water varies directly as the acceleration and the energy with the mass and the square of the velocity. It is evident that the velocity at which the water is discharged has a great effect on the propulsive force but various practical considerations make it more economical to move a greater mass than to employ very high velocities.

Although these propellers operate at their maximum efficiency, which corresponds to a theoretical condition representing 100% efficiency, when the water or fluid is discharged at velocities of twice that of the ship, yet it is sometimes desirable to change the ratio between the areas of the intake and the outlet openings and in Fig. 8 a simple means for this purpose has been shown. In the modified construction shown in Fig. 8, the upper wall of the discharge section C of the passageway is provided with a section 36 that can be rocked about the pivot 37. A bolt 38 is attached to the upper surface of the movable section by a pivot 39 and extends through a stuffing box 40 into the ship. A nut 41 is mounted for rotation in a bracket 42 and is held from longitudinal movement by circular flanges. When the nut is rotated bolt 38 moves up or down in accordance with the direction of rotation and this varies the cross sectional area of the outlet.

It is sometimes desirable to be able to use the propeller for steering the ship and when this is desired the propeller frame is made round instead of square and is mounted for rotation in a round opening in the ship's bottom. In Fig. 6 the frame 13*a* is circular and is provided with an annular flange 43 that is positioned in a groove in the frame 10*a*. The propeller frame is provided around its upper edge with a worm gear 44 that is engaged by a worm 45 secured between suitable bearings attached to the ship. When the worm is rotated the propeller frame is turned about a vertical axis. Means for rotating the worm has not been shown but any suitable mechanism such as is used for rudder control can be used. It is evident that when the propeller is rotatable, a rudder becomes unnecessary.

In Fig. 9 I have shown how a propeller of the type above described can be applied to an airship and substituted for the ordinary propeller. Numeral 46 designates the nacelle in which is positioned the motor 47. Shaft 26*a* carries an impeller 32. The inlet section of the fluid passage which corresponds to section A in Fig. 1, has been designated as A*a* and is short and straight with forwardly flared wall. The outlet C*a* communicates with the impeller chamber B*a* at the lowest point thereof and curves rearwardly so that the air will be discharged rearwardly along the nacelle surface.

In addition to having a propeller at the nose, others may be provided at various places as indicated by numeral 16*a*.

It will be seen from the above description that the propeller forming the subject matter is designed for efficiency and simplicity, that it does not impose its propulsive thrust on the impeller shaft and that its installation is more easily effected than the ordinary screw propeller and the maximum efficiency attainable is greater.

With the shape of blades used in the type of impeller shown in Fig. 3, the direction of flow of the fluid can be reversed by reversing the direction of rotation of the impeller. Such reversal may be a convenience under certain conditions. At very high impeller speeds, however, the reversal of flow is impeded by the counter action of the centrifugal force which, at extremely high speeds, nullifies the effect.

Having described the invention what is claimed as new is:

1. A ship propulsion mechanism comprising in combination, an elongated casing having a passageway extending longitudinally therethrough and adapted to be secured to a ship, one end of the passageway being the inlet and the other end the outlet, a line joining the centers of the inlet and the outlet being substantially parallel with the direction of ships travel, the cross sectional area of the passageway decreasing progressively from the inlet to the outlet opening, in a manner to produce continuous acceleration of a fluid flowing therethrough, a portion of the passageway forming an impeller chamber, an impeller of the radial discharge centrifugal type, mounted for rotation in the chamber, the axis of rotation of the impeller being upwardly and forwardly inclined with respect to the direction of travel, and means for changing the cross sectional area of the outlet whereby the velocity of discharge can be varied.

2. A ship propeller mechanism, comprising in combination, an elongated casing having a passageway extending therethrough in the direction of ship travel, the front end serving as the intake for water and the rear end as the outlet, the wall of the passageway having an enlarged zone serving as an impeller chamber, positioned at an intermediate point, the plane of the zone being upwardly inclined in the direction of the intake, an impeller mounted to rotate in the enlarged zone about a power shaft upwardly inclined in the direction of the outlet, the casing having a portion of the impeller chamber wall removable, the removable portion having an opening for the power shaft, the intake and the discharge openings being aligned with the direction of ships travel, the under wall surface of the intake and discharge openings connecting respectively with the eye and the lowermost portion of the impeller chamber by curved portions.

3. An elongated propeller thrust casing adapted to be attached to a ship, the casing being exteriorly streamlined to reduce resistance to movement through water to a minimum, the casing having a passageway extending from one end to the other in the direction of ships travel, the ends of the passageway being substantially parallel, means comprising a fluid impeller positioned in the passageway for acting upon water contained therein to increase its velocity, said impeller being rotatable in a plane upwardly inclined in the direction of the intake, the outlet being below the lower edge of the impeller, means comprising walls having curved surfaces, for changing the direction of the fluid stream as it leaves the impeller, means comprising the walls of the intake opening to direct the fluid to the eye of the impeller, the passageway decreasing in cross section from the intake to the discharge whereby the fluid passing through the same will be increased in velocity from intake to outlet, and means comprising a pivoted wall section for changing the cross sectional area of the outlet opening.

4. A hydraulic propeller unit for attachment to a ship's hull having an opening in its bottom comprising a frame having an outwardly extending flange for supporting the frame in the opening, a thrust casing attached to the frame, the casing having a passageway, the intake and the discharge openings of the passageway being located below the level of the under surface of the frame, a portion of the passageway being enlarged to form an impeller chamber, both ends of the passageway curving upwardly towards the impeller chamber, a single eye impeller in the chamber, mounted for rotation about an axis substantially parallel with the axis of the communicating end of the intake passage, the upper end of the discharge passage being substantially parallel with the plane of rotation of the impeller.

5. A ship propulsion mechanism comprising, in combination, a casing having a passageway extending therethrough and adapted to be attached to a ship, one end of the passageway being the inlet and the other end the outlet, a line joining the centers of the inlet and the outlet being substantially parallel with the direction of ship travel, the cross sectional areas of the passageway decreasing progressively from the inlet to the outlet opening in a manner to produce continuous acceleration of a fluid flowing therethrough, a portion of the passageway forming an impeller chamber, an impeller of the radial discharge centrifugal type operatively mounted in the chamber, and means for changing the cross sectional area of the outlet whereby the velocity of discharge can be varied.

6. A ship propeller mechanism, comprising, in combination, a casing having a passageway extending therethrough in the direction of ship travel, the front end serving as the intake and the rear end as the outlet, the passageway having an enlarged zone serving as an impeller chamber, positioned at an intermediate point, an impeller mounted to rotate in the enlarged zone, a power shaft passing through the casing wall and operatively connected with the impeller, the casing having a portion of the impeller chamber wall removable, the removable portion having an opening for the power shaft, the intake and outlet openings being aligned with the direction of ship travel, the intake and outlet openings connecting respectively with the eye and the peripheral portion of the impeller chamber by passageways having curved walls.

7. In combination with a ship having an opening in the bottom of its hull, a propulsion apparatus positioned in the opening, said apparatus comprising a thrust casing having a passageway extending therethrough, one end forming an inlet and the other the outlet, the distance between the inlet and the outlet being less than the corresponding dimensions of the opening whereby the casing may be inserted from the inside of the ship, an intermediate portion of the passageway being enlarged to form an impeller chamber, a line joining the inlet and outlet openings being substantially parallel with the direction of ship travel, a continuous wall attached to the casing above the inlet and outlet opening, the wall being of a size and shape to fit the opening in the hull, the upper edge of the wall having an outwardly extending element for projecting over the wall of the opening in the ship's hull to support the casing, the inlet and outlet openings being positioned wholly below the hull, the passageways connecting the inlet and outlet openings curving upwardly to an impeller chamber which is positioned within the hull, the portion of the casing below the hull being streamlined.

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