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PROGRESSIVE THRUST PROPELLER

3,070,061

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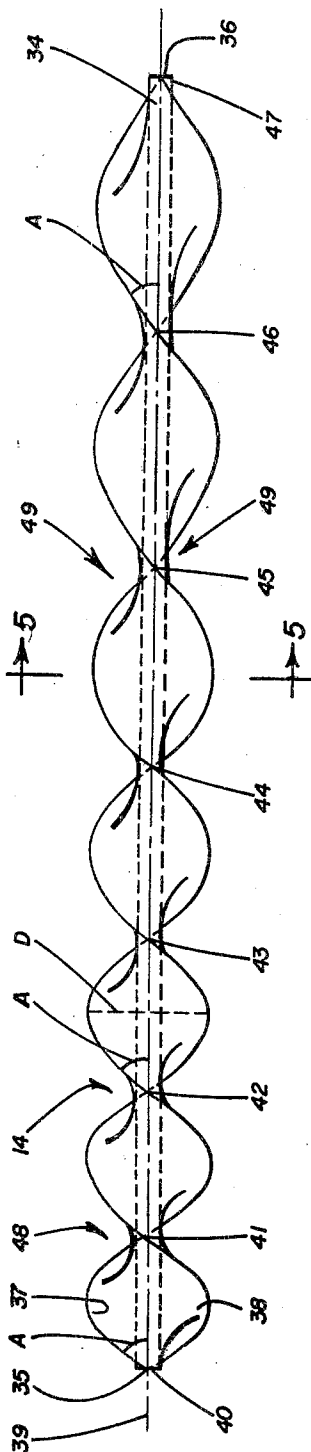


FIG. 1

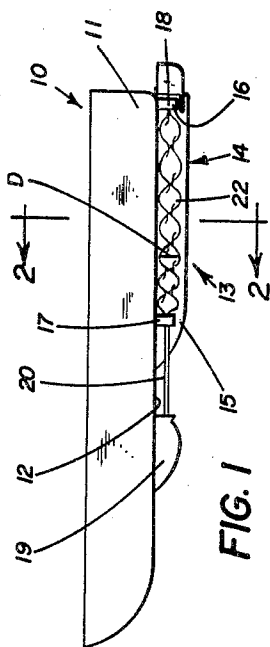


FIG. 2

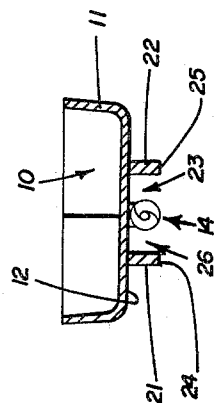


FIG. 3

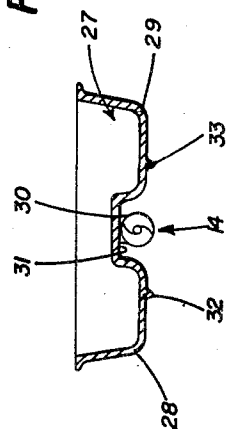


FIG. 4

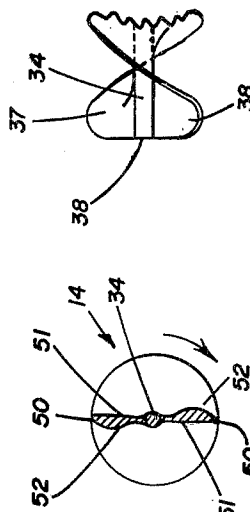


FIG. 5

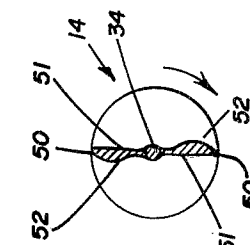


FIG. 6

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1 Claim. (Cl. 115—34)

This invention relates to a progressive thrust propeller, and, in particular, this invention relates to a progressive thrust propeller for water vehicles, such as catamaran type boats or the like.

It is well known in the art to provide a screw propeller comprising an elongated central hub or shaft having one or more vanes or blades spiraled about the hub from the forward end of the hub to the rear end thereof, the vane or vanes defining a continuous channel or channels spiraled about the hub from the forward end to the rear end of the hub. The elongated screw propeller is rotatably mounted to the bottom of the boat and extends longitudinally thereof whereby the screw propeller receives water at the forward end of the propeller and forces the water through the spiraled channel or channels to the rear of the boat whereby the water is expelled rearwardly and thus creates forward thrust forces that cause the boat to be propelled forwardly.

However, it has been found that these prior known screw propellers each tends to expel part of the water from the spiraled channel or channels at an angle thereto throughout the length of the propeller resulting in a loss of forward thrust forces and thus a loss of efficiency.

Accordingly, it is one of the objects of the present invention to provide an improved screw propeller.

It is another object of the present invention to provide an improved screw propeller for a water vehicle, such as a catamaran type boat or the like.

Another object of the present invention is to provide in combination with a water vehicle or the like, an improved screw propeller so constructed and arranged that the same cooperates with the bottom of the vehicle and other structure thereof to provide an improved propulsion means for the vehicle.

Other objects, uses and advantages of the present invention will become apparent upon a reading of the following specification taken in conjunction with the accompanying drawings forming a part thereof and wherein:

FIGURE 1 is a fragmentary, axial cross-sectional view of a water vehicle incorporating features of this invention;

FIGURE 2 is a cross-sectional view of the structure illustrated in FIGURE 1 and is taken on the line 2—2 thereof;

FIGURE 3 is a view similar to FIGURE 2 and illustrates another embodiment of this invention;

FIGURE 4 is an enlarged view of an improved screw propeller formed in accordance with the teachings of this invention;

FIGURE 5 is an axial cross-sectional view of the screw propeller illustrated in FIGURE 4 and is taken on line 5—5 thereof; and,

FIGURE 6 is a fragmentary view of the front end of the propeller illustrated in FIGURE 4, FIGURE 6 illustrating the propeller rotated 90° from the position illustrated in FIGURE 4.

Reference is now made to the accompanying drawings wherein like reference numerals and letters are used throughout the various figures thereof to designate like parts where appropriate, and particular reference is made to FIGURE 1 illustrating the bottom portion of a water vehicle or boat that is generally indicated by the reference numeral 10 and incorporates features of this invention.

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The boat 10 includes a conventional hull 11 having a substantially flat bottom 12 and an improved propulsion means formed in accordance with the teachings of this invention and generally indicated by the reference numeral 13.

The propulsion means 13 includes a screw propeller that is generally indicated by the reference numeral 14 and is formed in accordance with the teachings of this invention, the particular structure of the screw propeller 14 being hereinafter described. The screw propeller 14 has a forward end 15 and a rear end 16 and is rotatably secured to the bottom 12 of the boat 10 by suitable bearing means 17 and 18 located respectively at the ends 15 and 16 of the propeller 14, the screw propeller 14 being mounted along the longitudinal axis of the boat 10. The screw propeller 14 is rotatably driven by a suitable power source, shown schematically at 19 and being interconnected to the forward end 15 of the propeller 14 by an intermediate drive shaft 20. The drive shaft 20 can be formed integrally with the screw propeller 14 or can be formed separately and be suitably secured thereto in a manner well known in the art.

As shown by FIGURE 2, the screw propeller 14 of this invention is mounted between a pair of spaced, parallel, wall-like members 21 and 22 projecting substantially vertically downwardly from the bottom 12 of the boat 10, the members 21 and 22 being disposed longitudinally of the boat 10 and cooperating with the bottom 12 thereof to define an elongated channel-like zone 23. Free ends 24 and 25 of the wall-like members 21 and 22 define an open end 26 of the channel-like zone 23. The screw propeller 14 is rotatably mounted within the channel-like zone 23 in the manner previously described and is so constructed and arranged that an outer diameter D of the propeller 14 does not extend beyond the open end 26 of the channel-like zone 23 for a purpose hereinafter described.

Although the boat 10 has been illustrated as being a conventional flat bottom type boat, it is to be understood that the hull of the boat could be designed and constructed in any manner whereby the screw propeller 14 is mounted within a channel-like zone. In particular, the screw propeller 14 could be mounted between a double hull boat such as a catamaran type boat 27 as illustrated in FIGURE 3. The catamaran type boat 27 includes a pair of hulls 28 and 29 suitably secured together by an intermediate longitudinal portion 30 having a flat bottom 31. Ribs or fins 32 and 33 extend respectively from the bottom of the hulls 28 and 29 and cooperate with the bottom of the boat 10 in substantially the same manner as the wall-like members 21 and 22 previously described whereby the propeller 14 is mounted within an open ended channel-like zone.

The particular structure of the screw propeller 14 of this invention will now be described. Particular reference is now made to FIGURES 4 and 5 illustrating the improved screw propeller 14 of this invention which includes an elongated hub or shaft portion 34 having a forward end 35 and a rear end 36. A pair of vanes or blades 37 and 38 are carried by the shaft 34 and are respectively spiraled about the shaft 34 from the forward end 35 to the rear end 36 thereof, the vanes 37 and 38 being formed integrally with the hub 34 or being formed separately and being secured to the hub 34 in any stable manner. The vanes 37 and 38 are spiraled about the shaft 34 in the same direction except that the vanes 37 and 38 are disposed 180° from each other throughout the longitudinal length of the propeller 14. Each vane 37 or 38 extends from the forward end 35 of the hub 34 to the rear end 36 thereof and makes three and one-half complete revolutions about the hub 34 to

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completely balance the same, i.e., when looking along an axis 39 of rotation of the propeller 14, each vane 37 or 38 intersects or crosses the axis 39 at eight different points from the forward end 35 to the rear end 36 of the hub 34.

In particular, when looking along the axis 39 of rotation of the propeller 14 in FIGURE 4, the vane 37 intersects or is superimposed on the axis 39 of rotation at the eight points, 40, 41, 42, 43, 44, 45, 46, and 47, the vane 37 intersecting the axis 39 on the same side of the hub 34 as points 40, 42, 44, and 46 and on the opposite side of the hub 34 at points 41, 43, 45, and 47. Similarly, the vane 38 intersects the axis 39 at the eight points 40-47 in substantially the same manner as the vane 37 except that the vane 38 intersects the axis 39 at points on the opposite sides of the hub 34 from the side of the hub 34 that the vane 37 intersects the axis 39 at the corresponding points.

The vanes 37 and 38 are constructed in such a manner that each intersects the axis 39 of rotation at progressively increasing intervals from the forward end 35 to rear end 36 of the hub 34, i.e., when looking along the axis 39 in the manner illustrated in FIGURE 4, the longitudinal axial distances between adjacent pairs of points 40-47 progressively increase from the forward end 35 to the rear end 36 of the propeller 14. Accordingly, the vanes 37 and 38 cooperate together whereby a space 48 is created between adjacent vane portions or convolutions when looking along the axis 39, the space 48 progressively increasing from the forward end 35 to the rear end 36 of the propeller 14 and thus defining a continuous channel 49 that spirals about the hub 34 and that has a cross-sectional area that progressively increases from the forward end 35 to the rear end 36 of the propeller 14. Since the two vanes 37 and 38 are provided, there are two channels 49 that spiral about the hub 34, the channels 49 being disposed about 180° apart from each other throughout the length of the propeller 14.

The propeller 14 is so designed that the outer diameter D thereof remains uniform throughout the longitudinal length of the vanes 37 and 38 and is one-tenth of the longitudinal length, the outer diameter D being defined by the radial distance that an outer edge 50 of each vane 37 or 38 extends from the axis 39 of rotation of the propeller 14. In this manner, the outer edge 50 of each vane 37 or 38 intersects or crosses the axis 39 of rotation at an acute angle A (see FIGURE 4) when looking along the axis 39 of rotation of the propeller 14, the angle A progressively decreasing from the forward end 35 to the rear end 36 of the hub 34. As shown in FIGURE 6, the leading or forward ends 35 of the vanes 37 and 38 extend substantially perpendicularly from the hub 34 throughout substantially the entire outside diameter D of the propeller 14 except for a small radius at the outer ends thereof. In this manner, the forward ends 35 of the vanes 37 and 38 act on the water throughout a distance substantially equal to the diameter D of the propeller 14.

As shown in FIGURE 5, the propeller 14 is designed to be rotated in the direction indicated by the arrow for forward motion. However, it is to be understood that the propeller could be designed to be rotated in the opposite direction for forward motion by merely spiraling the vanes 37 and 38 about the hub 34 in the opposite direction. Each vane 37 or 38 is formed in such a manner that the cross sectional configuration thereof throughout the entire length of the particular vane 37 or 38 is defined by a driving surface 51 and an opposed surface 52, the surfaces 51 and 52 respectively extending from the hub 34 and intersecting each other at the outer diameter D of the propeller 14 to define the outer edge 50 of the particular vane 37 or 38. The vanes 37 and 38 are so constructed that the surface area of the driving side 51 of each vane 37 or 38 is substantially smaller than the surface area of the opposed surface 52

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thereof. In this manner, when the propeller is rotating, the vanes 37 and 38 are adapted to create a low pressure zone on the opposed surfaces 52 thereof for a purpose more fully explained hereinafter.

The operation of the propeller 14 in combination with the boat 10 will now be described. When it is desired to propel the boat 10 through the water, the propeller 14 is rotated in the direction illustrated in FIGURE 5 by the power source 19 in a manner well known in the art. As the propeller 14 rotates, the forward end 35 of the vanes 37 and 38 act upon the water within the forward end of the channel-like zone 23 in such a manner that the driving sides 51 of the forward ends of the vanes 37 and 38 force the water that is acted upon rearwardly thereof whereby the water acted upon is forced rearwardly through the spiraled channels 49 by the action of the driving sides 51 of the vanes 37 and 38. Since the water acted upon by the forward ends of the vanes 37 and 38 must travel a greater distance on the opposed surface 52 of the respective vane 37 or 38 than the distance on the driving surface 51 thereof, low pressure zones are created adjacent the opposed surfaces 52 of the vanes 37 and 38 in substantially the same manner that a low pressure zone is created on one side of an air foil to create an opposed lift force. The low pressure zones created on the opposed surfaces 52 of the vanes 37 and 38 are believed to assist in the forward motion of the boat 10 as the low pressure zones tend to pull the propeller forwardly to fill the voids created adjacent the surfaces 52 of the vanes 37 and 38.

Further, since the cross-sectional areas of the channels 49 progressively increase from the forward end 35 to the rear end 36 of the propeller 14, the amount of water forced rearwardly by the forward ends of the vanes 37 and 38 is insufficient to completely fill the channels 49 throughout their lengths whereby low pressure or vacuum zones are created in the channels 49. Because the channels 49 progressively increase from the forward end 35 to the rear end 36 of the hub 34 and thus create these low pressure zones therein, any tendency of the water in the channels 49 to be thrown outwardly therefrom, as previously mentioned in regard to prior known structures, is substantially prevented by the low pressure zones. Further, the vacuum condition created in the channels 49 draws water from the surrounding channel-like zone 23 into the channels 49 to fill the voids therein. Further, any water that is thrown out angularly by the propeller 14 will be substantially confined in the channel-like zone and will be directed rearwardly by the wall-like members 21 and 22 or ribs 32 and 33. In this manner, a greater quantity of water is expelled from the rear end 36 of the propeller 14 than is initially received in the front end 35 thereof whereby greater forward thrust forces are created by the expelled water than are created by conventional screw propellers.

When it is desired to move the boat rearwardly, the propeller 14 is merely rotated counterclockwise when viewing the propeller in FIGURE 5 whereby water expelled at the forward end 35 of the propeller 14 provides the necessary thrust force to move the boat 10 or 27 rearwardly.

If the boat 10 or 27 should become embedded upon a sand bar or the like when the boat was moving forwardly, the direction of rotation of the propeller 14 is reversed in the same manner as if rearward movement is desired. Because the rear ends 36 of the vanes 37 and 38 are now acting upon the water and tend to move the same through the channels 49 toward the front ends 35 thereof, it can be seen that water in the channels 49 will be expelled substantially radially outwardly from the propeller 14 as the rear ends 36 of the vanes 37 and 38 are tending to force a greater quantity of water through the channels 49 than is permitted by the progressively decreasing cross-sectional areas of the channels 49. In this manner, the outward movement of the water in the channel-like zone 23

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flushes the sand or the like away from the bottom of the boat in order to free the same and permit the boat to be moved rearwardly off of the sand bar or the like.

Various screw propellers have been made in accordance with the teachings of this invention and have been successfully operated in the above manner. While the following dimensions are given to illustrate a successfully operated propeller, it is to be understood that the same are not limitations of this invention as the scope of this invention is defined by the appended claims.

One embodiment of the above-mentioned successfully operated screw propellers, has a six inch outer diameter and an overall length of sixty inches. Two vanes are spiraled about the hub of the propeller in such a manner that the longitudinal distances between successive pairs of vane convolutions, when looking along the axis of rotation of the propeller in the manner illustrated in FIGURE 4, are approximately as follows:

- Distance from point 40 to point 41= D
- Distance from point 41 to point 42= $D+0.08D$
- Distance from point 42 to point 43= $D+0.16D$
- Distance from point 43 to point 44= $D+0.33D$
- Distance from point 44 to point 45= $D+0.50D$
- Distance from point 45 to point 46= $D+0.67D$
- Distance from point 46 to point 47= $D+D$,

where D =the outside diameter of the propeller.

The angles that the outer edge of each vane makes with the axis of rotation, when looking along the axis of rotation of the propeller in the manner illustrated in FIGURE 4, are approximately as follows:

- Angle A at point 40= 75° to 68°
- Angle A at point 41= 58°
- Angle A at point 42= 53°
- Angle A at point 43= 49°
- Angle A at point 44= 45°
- Angle A at point 45= 41°
- Angle A at point 46= 36°
- Angle A at point 47= 30° .

Therefore, it can be seen that there has been provided an improved screw propeller that is adapted to cooperate with the structure defining the bottom of a boat or the like to provide an improved propulsion means for the boat.

While the propeller 14 has been described as having a pair of vanes spiraled around the hub thereof, it is to be understood that one or more vanes may be provided as desired, each vane being formed in the manner set forth above.

While the foregoing presents preferred embodiments of the present invention, it is obvious that other modifications and/or improvements may be employed without departing from the scope of the invention, which is defined in the appended claim.

What is claimed is:

In combination with a boat having a bottom and a pair of parallel members extending downwardly from said bottom and defining an open-bottomed channel-like zone therewith, said channel-like zone being of substantially constant cross section, a screw propeller comprising a central elongated hub rotatably mounted to said boat and being disposed in said channel-like zone, said hub having a forward end and a rear end, and a pair of vanes carried by said hub and being spiraled about said hub from said forward end to said rear end thereof, said vanes being feathered toward their inner and outer edges and having rigidifying thicker central portions, said vanes being disposed 180° apart and each making three and one-half revolutions about said hub, said vanes defining the outer diameter of said propeller, said diameter being uniform throughout the length of said vanes and being approximately one-third the width of said channel-like zone and one-tenth of the longitudinal distance that said vanes extend along said hub, the space between convolutions of said vanes progressively increasing from the forward ends to the rear ends thereof.

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