WATER-JET PROPELION MEANS FOR BOATS

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Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

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Other objects, features and advantages of this invention will be apparent from the following detailed description and appended claims, reference being had to the accompanying drawings forming a part of the specification wherein like reference numerals designate corresponding parts of the several views.

In the drawings, FIG. 1 is a top plan view of a water-jet propulsion motor made in accordance with the principles of the present invention;

FIG. 2 is an elevational sectional view of the structure illustrated in FIG. 1, taken along the line 2—2 thereof, looking in the direction of the arrows, and showing the lower side of the motor disposed on the same level with the bottom of a boat;

FIG. 3 is a fragmentary, elevational sectional view, with parts removed and parts broken away, of the structure illustrated in FIG. 1, taken along the line 3—3 thereof, and looking in the direction of the arrows;

FIG. 4 is an elevational sectional view of the structure illustrated in FIG. 1, taken along the line 4—4 thereof, and looking in the direction of the arrows;

FIG. 5 is a side elevation view, with parts broken away, of the structure illustrated in FIG. 1, taken along the line 5—5 thereof, and looking in the direction of the arrows;

FIG. 6 is a front end elevation view of the structure illustrated in FIG. 5, taken in the direction of the arrow marked "6";

FIG. 7 is a horizontal sectional view of the structure illustrated in FIG. 2, taken along the line 7—7 thereof, and looking in the direction of the arrows;

FIG. 8 is a horizontal sectional view, with parts broken away, of the structure illustrated in FIG. 2, taken along the line 8—8 thereof, and looking in the direction of the arrows;

FIG. 9 is a top plan view of the propeller employed in the water-jet propulsion motor of the present invention;

FIG. 10 is a side elevation view of the structure illustrated in FIG. 9, taken along the line 10—10 thereof, and looking in the direction of the arrows;

FIG. 11 is a schematic two-view layout of the propeller blade structure illustrated in FIG. 9, taken substantially along the arcuate line 11—11 thereof and looking in the direction of the arrows; and

FIG. 12 is a perspective view of the propeller illustrated in FIGS. 9, 10 and 11.

Referring now to the drawings, and in particular to FIGS. 1, 2 and 3, the numeral 10 generally indicates the drive shaft of the motor. The shaft 10 may be powered by any suitable means as for example by a two-cycle, air-cooled internal combustion engine of the type used in conventional outboard motors, or it may be powered or driven by any conventional inboard type engine. As best seen in FIG. 2, the motor of the present invention includes a circular mounting bracket 11 which is provided with a centrally disposed upwardly extended hub 12. The hub 12 is adapted to be fixedly connected to any suitable supporting member on a boat or a boat engine as by means of the tubular shaft 13 which encloses the power shaft 10. The lower end of the tubular shaft 13 is adapted to receive the circular hub 12 and to be fixedly connected thereto by any suitable means, as by means of a plurality of bolts 14.

As best seen in FIGS. 1, 2, 5 and 6, the water-jet propulsion motor of the present invention further includes a housing 15 which comprises the upper portion generally indicated by the numeral 15 and the lower portion generally indicated by the numeral 16.

As shown in FIG. 1, the over-all plan shape of the housing is substantially circular, with the rear end being opened to form a discharge or outlet opening as more fully described hereinafter. Fixedly secured to the upper side of the upper housing portion 15 by any suitable means as
by welding are a number of radially spaced apart housing bolts 17 which are disposed in a circle and adapted to be received in suitable holes in the circular mounting bracket 11. The bracket 11 is releasably secured on the bolts 17 by suitable lock nuts 18. As shown in FIGS. 2 and 1, the lower end of the power shaft 10 extends downwardly through the axial bore 19 in the hub 12 and is rotatably journaled therein by means of the sleeve bearing 20. As clearly shown in FIG. 2, the central portion of the upper wall of the housing portion 15 is dished or formed with a concave depression as viewed from the upper side of the housing, and as indicated by the numeral 21.

As shown in FIG. 2, a circular hub 22 is integrally formed on the upper side of the dished housing portion 21 and this hub 22 is provided with the stepped axial bore 23 in which is rotatably mounted the lower end of the shaft 10. The sleeve bearing 20 extends downwardly into the upper end of the hub bore 23. The sleeve bearing 20 is further provided with an integral sidewall outwardly extended flange 24 which is disposed against the bottom surface of the mounting bracket 11 and against the upper end surface of the hub 22. A suitable packing or propeller material 25 is mounted in the bore 23 below the lower end of the sleeve bearing 20.

As shown in FIGS. 1 through 6, the housing portions 15 and 16 are provided with the flanges 26 and 27 at the adjacent ends thereof and these flanges are releasably connected together by means of a plurality of lock bolts 28 which are adapted to pass through suitable holes in the flanges and be threadably engaged in the flange 27 on the lower housing portion 16.

As seen in FIGS. 3, 5 and 6, the outer sides of the housing, on the front and two sides thereof, are rounded to form a chamber which has substantially hemispherically-shaped side walls. As shown in FIG. 2 a circular intake opening is formed in the bottom side of the housing portion 16. A cylindrical propeller compartment 29 is formed in an intake opening in the lower housing portion 16 and the vertical walls thereof extend upwardly into the lower housing portion to a point immediately below the horizontal centerline of the housing and adjacent the lower edge 30 of the upper housing portion 15.

As shown in FIG. 2, the power shaft 10 has a reduced diameter lower end portion indicated by the numeral 31, to be slidable mounted through the bore 32 in the propeller hub 33. The shaft lower end portion is threaded and the propeller is adapted to be fixedly secured on the threaded shaft end portion 31 by means of the lock nut 34. As shown in FIGS. 2 and 3, the propeller and the lock nut 34 holding the propeller on the shaft portion 31 is disposed slightly upwardly from the bottom edge 35 of the propeller housing 29. In FIG. 2, the aft end or stern of a boat 36 is shown in broken lines and the boat is disposed relative to the motor to show the positioning of the motor relative to the boat. It will be seen that the lower edge 37 of the motor is on the same level as the lower edge 37 of the boat 36.

As shown in FIGS. 7 through 12, the propeller employed in the motor of the present invention includes a plurality of blades indicated by the numerals 38, 39 and 40. As shown in FIG. 12, the leading edge 41 of the blade 39 is provided with a vertical edge disposed in a horizontal plane at the lowermost part of the propeller. The propeller blade leading edge 41 extends outwardly radially from the propeller hub 33. The blade extends upwardly in a concave curving form to an upper substantially horizontal trailing portion 42 which is provided with the vertical trailing edge 43. The trailing edge 43 of the propeller blade 39 is formed in the vertical plane and is disposed on a radial line extending outwardly from the axis of the drive shaft 10. All of the propeller blades are similarly formed. It will be seen from a study of FIGS. 12 and 11 that the leading edge 41 of one of the blades is disposed beneath and in alignment with the trailing edge 43 of an adjacent disposed propeller blade. In

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FIG. 12, the leading and trailing edges of the three propeller blades 38, 39 and 40 have been marked with similar reference numerals. It will be seen that the form of the propeller blades forces the water, upwardly into the compression chamber formed by the housing portion 15 and 16. It will be seen from an inspection of FIGS. 2 and 3 that when a section view is taken through the propeller, the cross section will show that the cut through the propeller blade is always across a horizontal portion of the blades since the upward curving surfaces of the blades over which the water flows upwardly into the compression chamber is perpendicular to the propeller hub 33.

As shown in FIGS. 2, 4 and 7, the water pumped into the compression chamber formed by the housing portions 15 and 16 is forced out of the rear end of the housing to produce a water jet propulsion. The water leaves the housing through an outlet formed to project an upper and lower stream of water. The outlet for the two streams of water is indicated generally by the numeral 44 in FIG. 2. The outlet 44 is divided by the horizontal wall or plate 45 which is fastened to the enlarged propeller housing wall portion 46 by any suitable means as by the screws 47. As shown in FIG. 7, the plate 45 extends slightly around the rear side of the propeller housing 29 and terminates along the lines 48 and 49. The rear end of the outlet dividing plate is indicated by the numeral 50. It will be seen that water forced into the compression compartment of the motor will be discharged over the plate or horizontal wall 45 and the upper jet stream passing over this plate is produced mainly by the internal pressure and impact of the water. As shown in FIGS. 2 and 8, water is also discharged through the outlet 44 by means of a lower jet stream which passes outwardly from the compression chamber through the outlet portion 51 which is disposed beneath the plate 45 and above the housing wall 52. It will be seen from a study of FIG. 8 that water is discharged through the lower outlet passage 51 in a counterclockwise direction as viewed in FIG. 8. This lower jet stream is produced by internal pressure of the water in the compression chamber and by centrifugal force produced by the propeller. It will be seen in FIG. 8 that a vertical wall 53 extends upwardly to the lower side of the plate 45 to prevent the water from being forced out of the compression chamber and under the plate 45 in a clockwise direction. This portion includes a vertical wall 54 below the plate 45 to direct the water passing out of the curved lower passage 55 toward the rearward direction to provide a resultant straight ahead thrust. The wall 55 functions as a deflector. As shown in FIG. 7, a deflector 56 is formed in the upper stream outlet passage for helping to direct the discharging water jet in a rearward direction to provide straight ahead resultant thrust action.

The propulsion motor of the present invention is provided with the following described reversing structure. As shown in FIGS. 1 through 8, the motor is provided with the lower outer housing generally indicated by the numeral 57 for directing the rearwardly discharging water downwardly and backwardly to provide a resultant backward thrust on the boat 36. The reverse flow housing is provided with the hemispherically curved wall 58 having the discharge opening 59 in alignment with the outlet 44. In FIG. 12, the leading edge 41 of the blade 39 is provided with a vertical edge disposed in horizontal plane at the lowest point of the propeller.

The propeller blade leading edge 41 extends upwardly radially from the propeller hub 33. The blade extends upwardly in a concave curving form to an upper substantially horizontal trailing portion 42 which is provided with the vertical trailing edge 43. The trailing edge 43 of the propeller blade 39 is formed in the vertical plane and is disposed on a radial line extending outwardly from the axis of the drive shaft 10. All of the propeller blades are similarly formed. It will be seen from a study of FIGS. 12 and 11 that the leading edge 41 of one of the blades is disposed beneath and in alignment with the trailing edge 43 of an adjacent disposed propeller blade. In

The reverse housing is provided with a lower wall 65 which is flat and formed as a plate and extends rearwardly

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to the point indicated by the numeral 66. The water discharging rearwardly out of the passages 63 and 64 will flow over the plate 65 in a flat stream line direction. The plate 65 is formed with an upwardly extended flange 67 which is seated against the lower edge of the housing or compartment 29, as shown in FIGS. 5, 6 and 2. The discharging water is directed backwardly through the passages 63 and 64 by means of the swingably mounted, accurately shaped gate generally indicated by the numeral 68. The gate is provided with a pair of mounting arms 69 and 70. The gate is disposed on the housing 57 and 61 as shown in FIG. 4, the mounting arms 69 and 70 are swingingly mounted on suitable pins 71 and 72, respectively, which are rotatably mounted in suitable holes as 73 and 74, respectively, in the guiding walls 60 and 66. The bolts or pins 70 and 71 extend outwardly through the housing walls 60 and 61. Fixedly connected to the bolt 71 is the regulating or operating handle 75 which is adapted to open or close the opening 59 in the rear wall 58 of the reverse housing 57. It will be seen that the discharge passages 63 and 64 communicate at the forward end thereof with the upwardly curved entrance portion 76 in which the reverse gate 68 is normally positioned as shown in FIG. 2. The reverse gate 68 is shown in the reverse position in FIG. 5 and in the forward or head position as shown in FIG. 2. In FIG. 5 the broken lines 77 and 78 indicate the neutral and forward positions of the operating lever 75. The reverse position of the lever 75 is shown in solid lines in FIG. 5. The reverse housing 57 is provided with the closure plates 81 and 82 as shown in FIG. 7. The lower housing 16 is provided with the flow direction guides 79 and 80 on opposite sides thereof adjacent the reverse discharge ports 63 and 64 and there function to direct the discharge stream rearwardly in a straight line to provide a resultant backward thrust. A screen 83 may be mounted over the intake opening 84. It will be seen that the water-jet propulsion means of the present invention is simple in construction and comprises generally a small number of parts, for example, the mounting bracket 11, the upper housing 15, the lower housing 16, the reverse housing 57 and plate 45, the reverse gate 68, the reverse controls (handle and pivoting bolts 75), and the propeller. While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What I claim is:

1. A water-jet propulsion motor for propelling a boat, comprising:
   (a) a housing having an upper portion detachably connected to a lower portion,
   (b) means on said housing lower portion for mounting said housing on a boat,

(c) a vertical power shaft rotatably mounted through said mounting means and having the lower end extended downwardly through the housing upper portion and into said housing lower portion being provided with an intake opening on the bottom side thereof and a propeller compartment including a cylindrical vertical wall extending upwardly from said intake opening to a point adjacent the lower end of said upper portion,

(d) a propeller mounted on the lower end of said power shaft, within said propeller compartment in the lower portion of the housing and above said intake opening, and,

(f) a compression chamber formed by the upper portion of said housing and the communicating part of the housing lower portion around said propeller compartment and being provided with an outlet on the rear side thereof for discharging water forced into the housing by the propeller in a water-jet stream to provide a resultant forward thrust.

2. The structure as defined in claim 1, wherein: said outlet divided into a lower part in the housing lower portion and an upper part in the housing upper portion to form a lower and an upper discharging water-jet stream.

3. The structure as defined in claim 2, wherein: said motor includes a reverse means for directing the water-jet streams rearwardly to produce a resultant rearward thrust.

4. The structure as defined in claim 3, wherein: said reverse means includes
   (a) a reverse housing mounted on the lower side of the lower portion of said first named housing,
   (b) said reverse housing being open at the front end thereof, and,
   (c) a reverse gate means for reversing the discharging water-jet streams in the reverse housing.

5. The structure as defined in claim 4, wherein: said reverse gate is swingably mounted in said reverse housing, and, manual control means for operating the reverse gate.

6. The structure as defined in claim 5, wherein: said upper housing portion is provided with a concave depression on the top side thereof.

7. The structure as defined in claim 6, including, a horizontal plate is mounted on the rear side of the propeller compartment adjacent the upper end thereof for dividing said outlet into said lower and upper parts.

8. The structure as defined in claim 7, wherein: said compression chamber is circularly disposed around said propeller compartment.

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