Sept. 1, 1964 S. THEN 3,146,587

WATER-JET PROPULSION MEANS FOR BOATS

Filed April 9, 1962 4 Sheets-Sheet 1

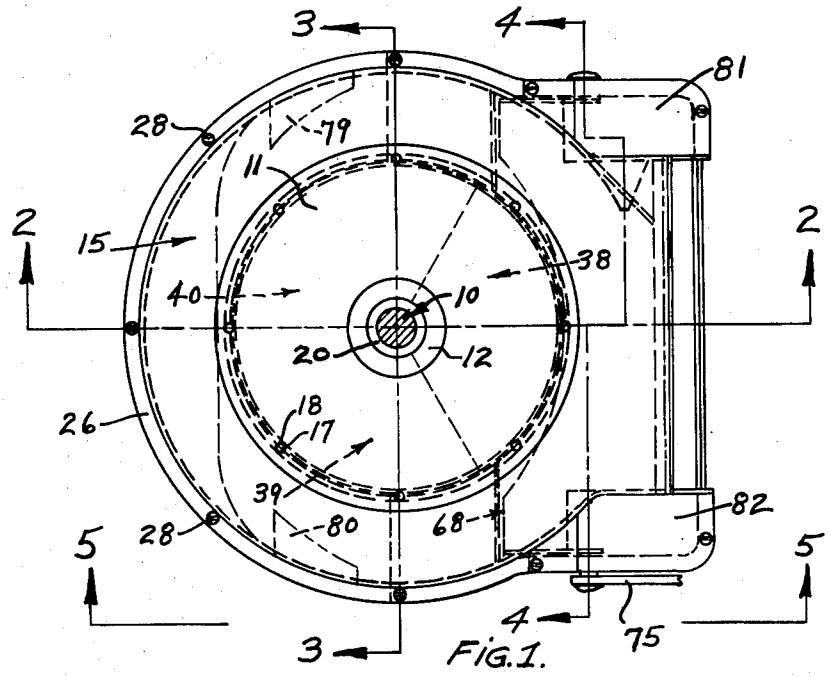


FIG. 1.

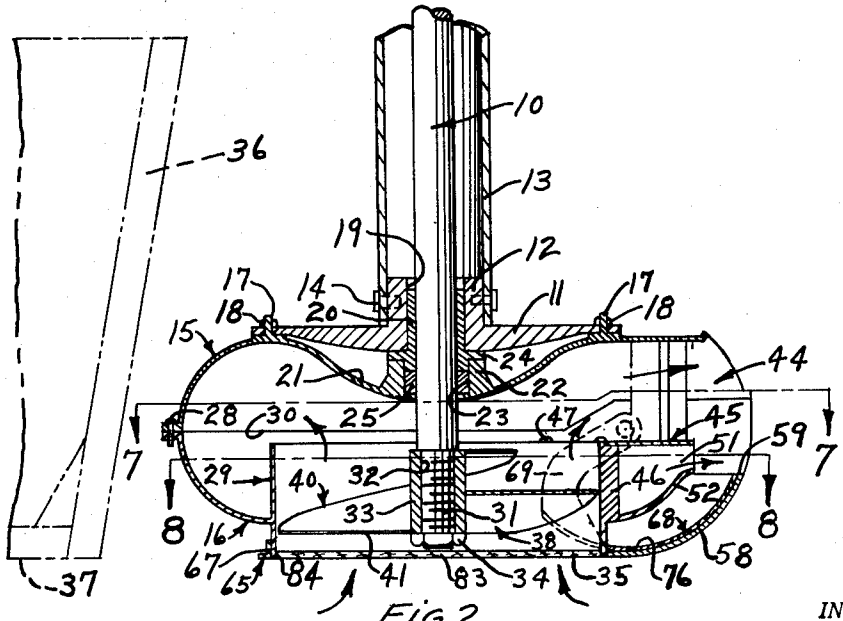


FIG. 2.

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WATER-JET PROPULSION MEANS FOR BOATS

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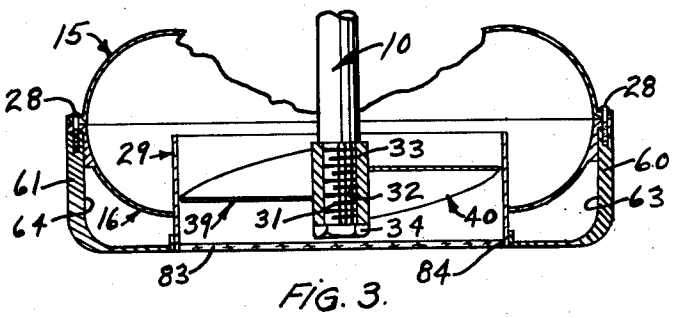


FIG. 3.

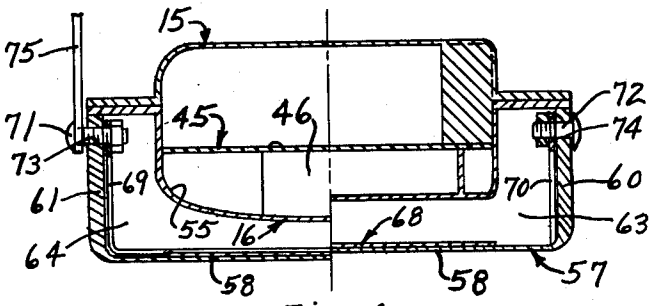


FIG. 4.

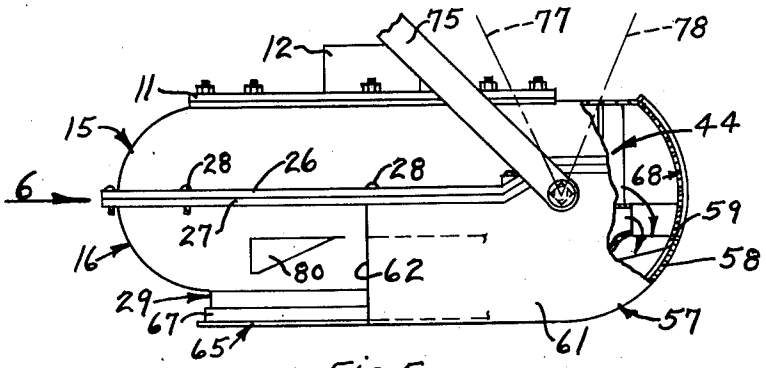


FIG. 5.

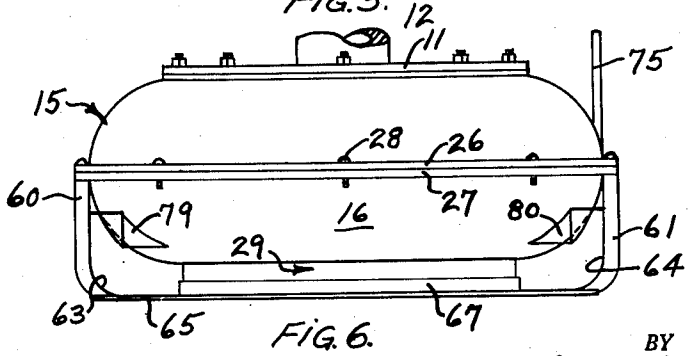


FIG. 6.

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WATER-JET PROPULSION MEANS FOR BOATS

Filed April 9, 1962 4 Sheets-Sheet 3

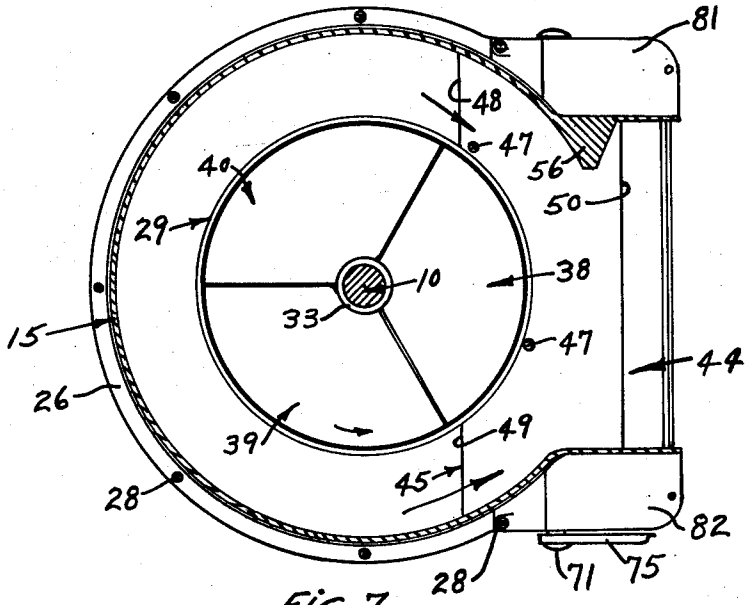


FIG. 7.

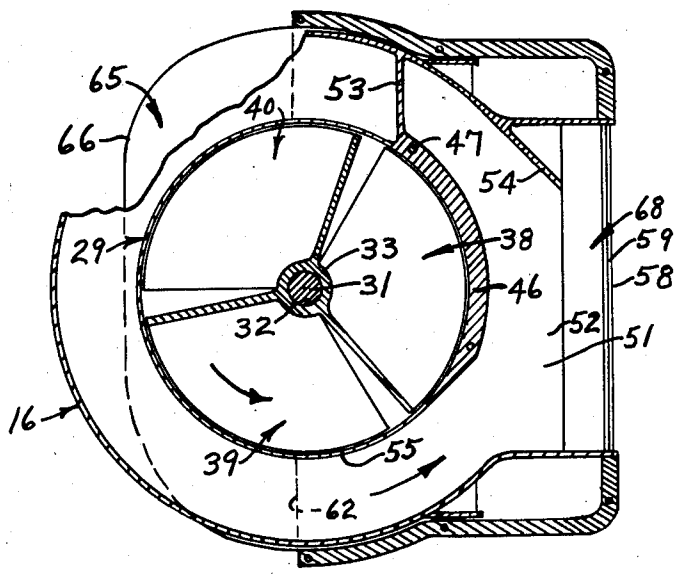


FIG. 8.

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WATER-JET PROPULSION MEANS FOR BOATS

Filed April 9, 1962 4 Sheets-Sheet 4

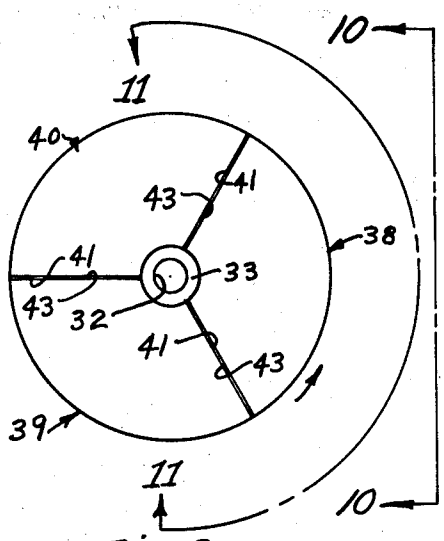


FIG. 9.

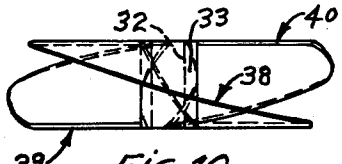


FIG. 10.

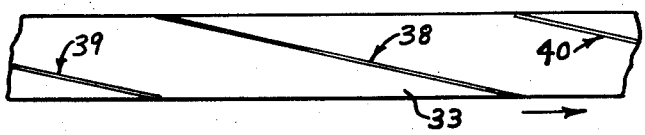


FIG. 11.

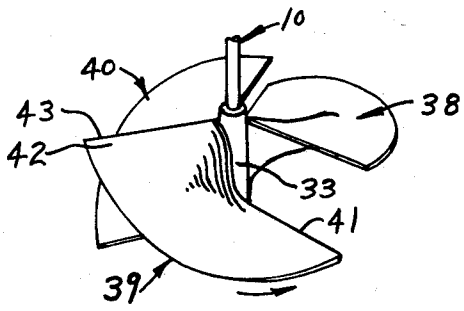


FIG. 12.

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3,146,587
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3,146,587

WATER-JET PROPULSION MEANS FOR BOATS

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Filed Apr. 9, 1962, Ser. No. 186,001
8 Claims. (Cl. 60—35.54)

This invention relates generally to propulsion means for boats, and more particularly, to a novel and improved water-jet propulsion means which incorporates a novel compression chamber and which is adapted for use on outboard motor boats or for use as inboard motors.

It is an important object of the present invention to provide a novel and improved water-jet propulsion apparatus which is adapted to be mounted on a vertical power input shaft and which includes a housing and in which is operatively mounted a novel propeller which draws water into a compression chamber formed in the housing. The improved water-jet propulsion apparatus is provided with the majority of the water by means of a novel propeller that draws water through an opening in the lower side of the housing, and also partially from two reverse water jet outlets on the front side of the housing. The water which is forced into the compression chamber in the housing is forced out of the housing through an outlet at the rear side of the housing. The propulsion apparatus or motor of the present invention comprises an outlet which is divided by a horizontal wall so as to produce an upper and lower jet stream of water. The upper jet stream is produced mainly by internal pressure and impact. The lower jet stream is created mainly by internal pressure and by centrifugal force produced by the propeller and is supplemented by the aforementioned water entering the two reverse water jet outlets on the front side of the housing. The water jet propulsion motor outlet is provided with deflector means which control the two jet streams so that the resultant combined thrust of these two jet streams is directed in a straightforward direction in alignment with the direction of the boat's course.

It is another object of the present invention to provide a novel and improved water-jet propulsion motor which is provided with outlets on the front and rear sides thereof so as to provide rearward and forward thrusts, respectively, on a boat, and to provide efficient and precise braking of the boat.

It is a further object of the present invention to provide a novel and improved water-jet propulsion motor which does not need any shifting gears for providing forward and rearward movements to a boat on which it is mounted.

It is still another object of the present invention to provide a novel and improved water-jet propulsion motor which is simple and compact in construction, economical of manufacture, easy to control and operate and efficient in operation.

It is a still further object of the present invention to provide a novel and improved water-jet propulsion motor which may be mounted for use on a boat as either an outboard type motor or as a built-in motor for use as an inboard motor and wherein the motor may be mounted on the same level with the lower surface of the bottom of a boat so that the boat may safely cruise in shallow waters, weeds, swamps and the like without interfering with the operation of the motor so long as the boat is afloat.

It is still another object of the present invention to provide a novel and improved water-jet propulsion motor which incorporates efficient steering characteristics and which can be landed on a beach because it does not protrude below the bottom of the boat, and which can safely be used to propel a boat between swimmers with no danger to them or to the boat because the entire operating mechanism of the motor is screened by a housing with no moving or protruding parts extending outside of the housing.

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 elevational 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 elevational 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 elevational 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-plan lay-out 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 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. 1 and 2, the lower end of the power shaft **10** extends downwardly through the axial bore **19** in the hub **12** and is rotatably journalled 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 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 sidewardly 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 sealing 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 edges 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 flange **26** and be threadably engaged in the flange **27** on the lower housing portion **16**.

As clearly 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 the 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 slidably 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 **35** 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. 9 and 12 that the leading edge **41** of one of the blades is disposed beneath and in alignment with the trailing edge **43** of an adjacently disposed propeller blade. In 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 portions **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 upper working 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 produce 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 stream is produced mainly 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. The housing 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**. Integrally formed with the rear end wall **58** are the side walls **60** and **61** which are substantially vertical and which extend straight forwardly to the point where they engage the curved surface of the housing from whence they are curved to their rear end as shown in FIG. 5 by the numeral **62**. As shown in FIG. 3, the reverse housing is connected to the lower compression chamber housing **16** by means of the screws **28**. The walls of the reverse housing are spaced apart from the walls of the lower housing portion **16** and form a conduit for diverting the fluid from the outlet **44** backwardly and out through the reverse discharge passages indicated by the numerals **63** and **64**. The reverse housing **57** is provided with a lower wall **65** which is flat and formed as a plate and extends rearwardly

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 propeller 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, arcuately 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 inside of the reverse housing **57** below the housing **16**. As shown in FIG. 4, the mounting arms **69** and **70** are swingably mounted on suitable pins **71** and **72**, respectively, which are rotatably mounted in suitable holes as **73** and **74**, respectively, in the housing walls **61** and **60**. 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 directional guides **79** and **80** on opposite sides thereof adjacent the reverse discharge ports **63** and **64** and they function to direct the discharge stream forwardly 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, as 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,

(*d*) 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,

(*e*) 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 forwardly 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 into 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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