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R. B. LEE

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Z-DRIVE WATER JET PROPULSION UNIT

Filed July 5, 1961

2 Sheets-Sheet 1

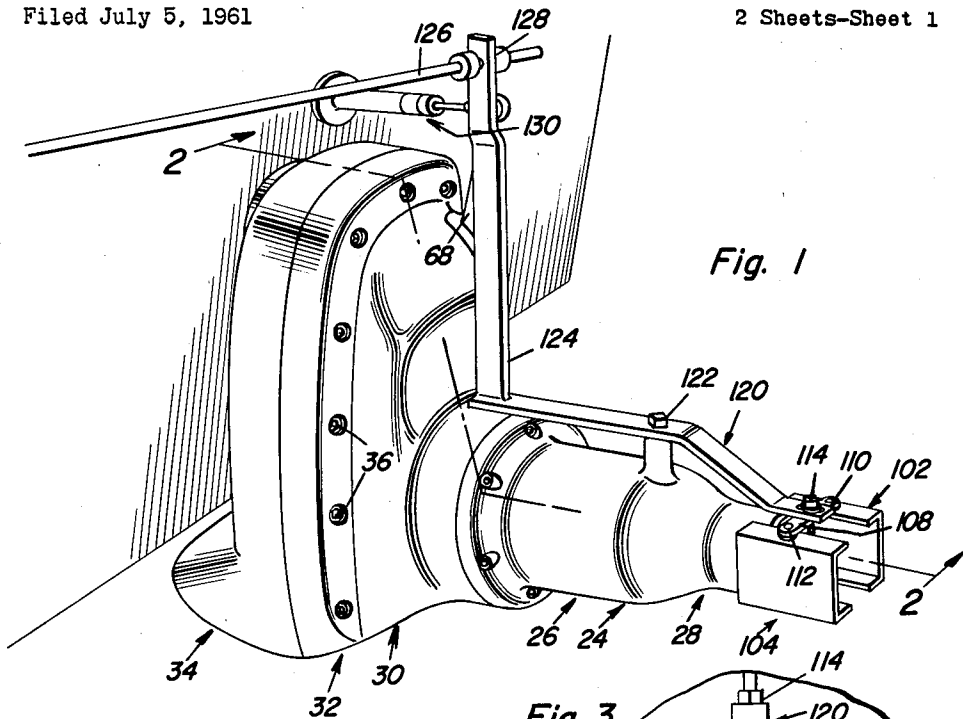


Fig. 1

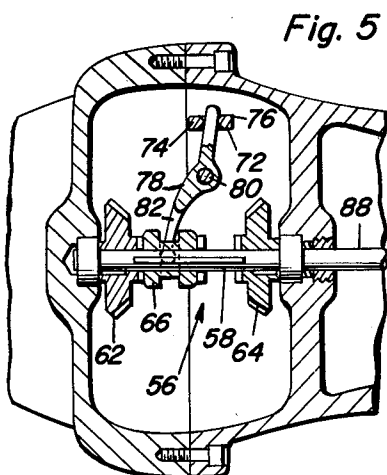


Fig. 5

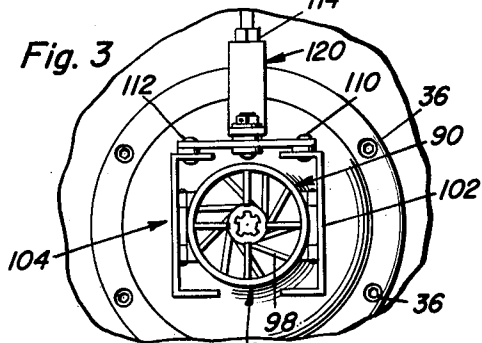


Fig. 3

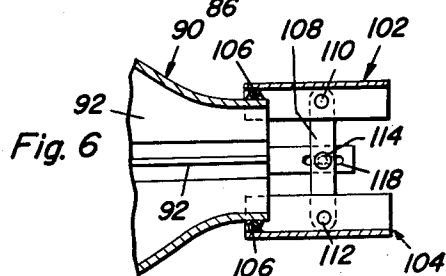


Fig. 6

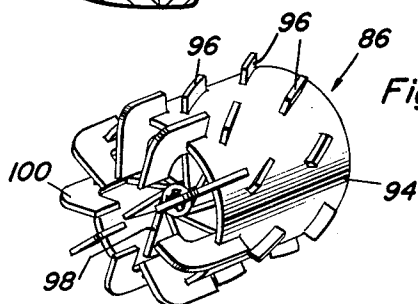


Fig. 7

Robert B. Lee
INVENTOR.

BY *Alvanice A. Orison*
and *Harvey E. Jacobson*
Attorneys

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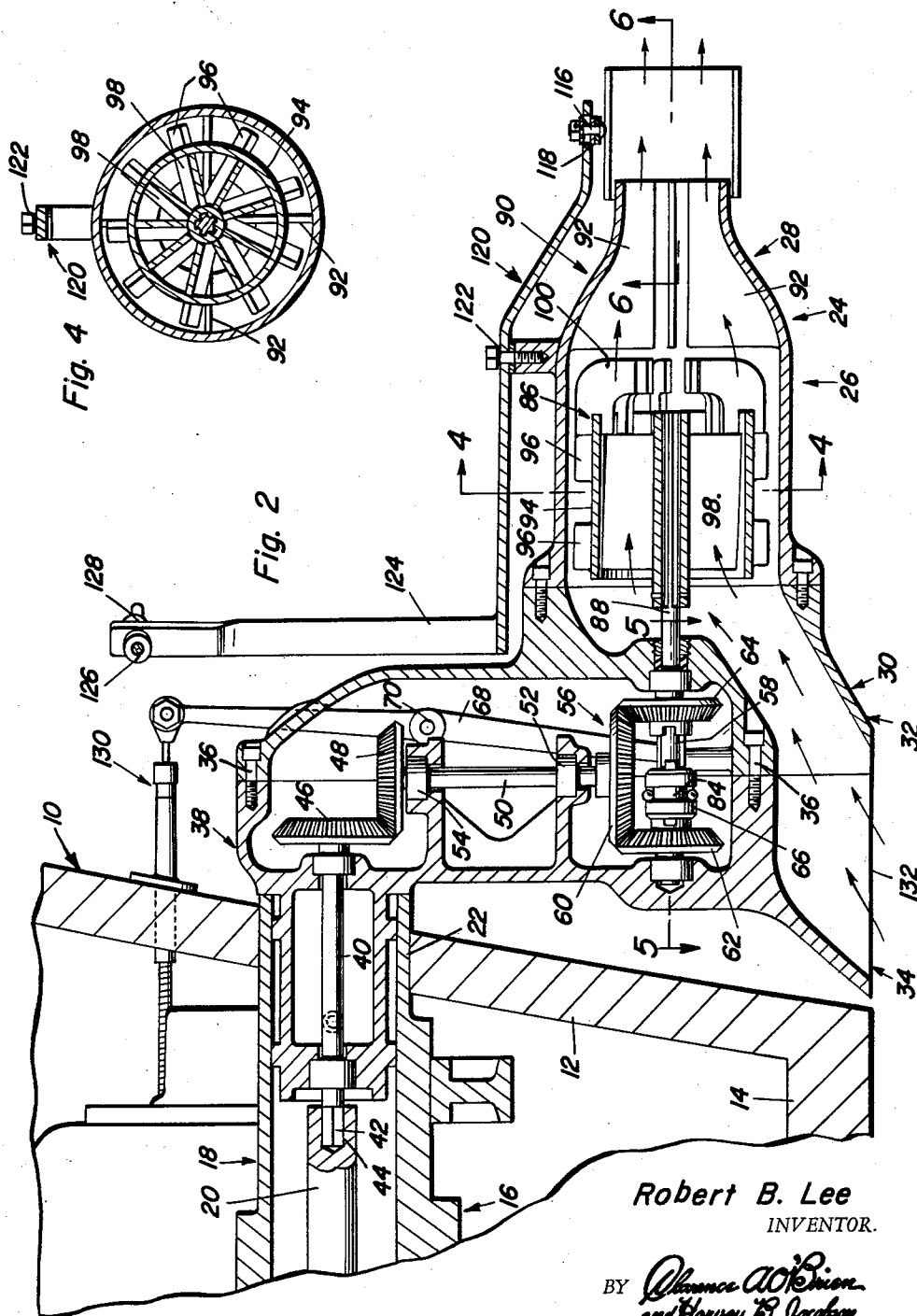
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2 Sheets-Sheet 2



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3,073,277

Z-DRIVE WATER JET PROPULSION UNIT
Robert B. Lee, 810 NE. 4th Ave., Homestead, Fla.
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6 Claims. (Cl. 115-12)

This invention relates to a novel and useful water jet propulsion unit and more specifically to a water jet propulsion unit of the Z-drive type adapted to be removably secured to a transom of a boat equipped with an inboard engine and operatively connected to the output shaft of the inboard engine.

The water jet propulsion unit of the instant invention is also specifically adapted to replace conventional Z-drive propeller type outboard drive units and to be readily and removably secured to boats provided with Z-drive propeller type outboard drive units in place of the propeller type drive unit.

The water jet propulsion unit of the instant invention includes a transmission disposed between the input shaft of the water jet propulsion unit and the rotor thereof for enabling rotation of the rotor to be selectively reversed. In addition, the water jet propulsion unit of the instant invention includes an outlet nozzle for directing the discharge of water from the rotor of the propulsion unit directly rearwardly of the boat to which the propulsion unit is secured and the outlet nozzle includes water jet deflecting means mounted on the housing of the water jet propulsion unit and having portions thereof disposed rearwardly of the nozzle for selectively laterally deflecting the discharge of water from the nozzle to one side or the other in order to steer the boat to which the propulsion unit is secured.

The water jet propulsion unit includes an inlet which is adapted to be disposed immediately rearwardly of the transom to which the water jet propulsion unit is secured and in a horizontal plane in which the bottom of the boat extends. In this manner, the water jet propulsion unit of the instant invention does not project below the bottom of the boat to which it is secured and effect a drag on the boat thus reducing the over-all effective thrust of the propulsion unit. The outlet nozzle of the water jet propulsion unit is disposed above the horizontal plane in which the inlet of the propulsion unit is disposed and thereby insures that the discharge of water from the rotor of the water jet propulsion unit will be discharged rearwardly of the boat and above the surface of the water supporting the boat. In the past it was thought that to discharge a jet of water beneath the surface of the body of water on which a boat was supported was the most effective way of receiving a forward thrust from a rearward jet of water. However, it has been proven unquestionably that substantially the same forward thrust is effected if the rearward jet of water is discharged above the surface of the body of water on which the boat is supported and inasmuch as the discharge nozzle would necessarily be disposed above the surface of the body of water it does not constitute a drag on the water thus enabling the effective over-all thrust of such a water jet propulsion unit to be much greater than if the discharge of water were directed rearwardly beneath the surface of the body of water on which the boat is disposed.

The main object of this invention is to provide a water jet propulsion unit which may be readily used as a replacement unit for conventional Z-drive outboard propeller type drive units which have recently become popular in the boating industry. The use of a water jet propulsion unit of this type rather than the conventional propeller type of propulsion unit which necessarily has to depend downwardly into the water enables the boat to, which the water jet propulsion unit is secured to be used in shallow water without running a chance of damaging

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the propulsion unit by the latter striking the bottom of the body of water. At high planing speeds a boat equipped with the water jet propulsion unit of the instant invention may operate efficiently in a body of water as little as 6" in depth.

A further object of this invention, in accordance with the preceding object is to provide a water jet propulsion unit of the removable outboard drive type which may be secured to conventional types of inboard boats adapted for Z-drive outboard propeller type propulsion units in a manner whereby no portion of the water jet propulsion unit projects below the bottom surfaces of the boat to which it is secured.

A further object of this invention is to provide a water jet propulsion unit utilizing a rotor mounted for rotation about a horizontal axis extending longitudinally of the boat to which the propulsion unit is secured with a discharge nozzle disposed rearwardly of the rotor and provided with radially extending vanes in order to insure that the discharge of water from the rotor will be discharged from the discharge nozzle in a direction paralleling the longitudinal axis of the boat to which the water jet propulsion unit is secured.

A final object of this invention to be specifically enumerated herein is to provide a water jet propulsion unit in accordance with the preceding objects which will conform to conventional forms of manufacture, be of simple construction and easy to install so as to provide a device that will be economically feasible, long lasting and relatively trouble free in operation.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a perspective view of the water jet propulsion unit of the instant invention shown mounted to the transom of a boat;

FIGURE 2 is an enlarged fragmentary longitudinal vertical sectional view taken substantially upon the plane indicated by the section line 2-2 of FIGURE 1;

FIGURE 3 is a fragmentary rear end elevational view of the propulsion unit as seen from the right side of FIGURES 1 and 2;

FIGURE 4 is a vertical transverse sectional view taken substantially upon the plane indicated by the section line 4-4 of FIGURE 2;

FIGURE 5 is a fragmentary horizontal transverse sectional view taken substantially upon the plane indicated by the section line 5-5 of FIGURE 2;

FIGURE 6 is a fragmentary horizontal transverse sectional view taken substantially upon the plane indicated by the section line 6-6 of FIGURE 2; and

FIGURE 7 is a perspective view of the rotor of the water jet propulsion unit.

Referring now more specifically to the drawings, the numeral 10 generally designates a boat having a transom 12 and a bottom 14. The boat 10 includes an inboard motor generally referred to by the reference numeral 16 which includes a power take-off housing generally referred to by the reference numeral 18 that encloses the drive shaft 20 of the inboard motor 16. The power take-off housing 18 projects through an opening 22 formed in the transom 12 and the water jet propulsion unit of the instant invention is generally referred to by the reference numeral 24. The propulsion unit 24 includes a housing generally referred to by the reference numeral 26 and the housing 26 includes a rear horizontally disposed portion generally referred to by the reference numeral 28 and an upstanding forward portion generally referred to by the reference numeral 30. The upstanding portion 30 in-

cludes front and rear sections 32 and 34 which are secured together by means of suitable fasteners 36 and the upper end of the upstanding forward portion 30 terminates in a forwardly directed extension generally referred to by the reference numeral 38. The free end of the extension 38 is adapted for removable securement in the rear end of the power take-off housing 18 and an input shaft 40 is rotatably journaled in the extension 38 and includes a non-circular forward end portion 42 received in a complementary rearwardly opening recess 44 formed in the end of the output shaft 20. The rear end of the input shaft 40 includes a bevel gear 46 which is meshed with a bevel gear 48 carried by the upper end of a drive shaft 50 journaled in the upright forward portion 30 of the housing 26 for rotation about an upstanding axis by means of bearings 52 and 54. A transmission assembly generally referred to by the reference numeral 56 is carried by the lower end of the upright forward portion 30 of the housing 26 and includes an intermediate shaft 58 journaled for rotation about a horizontal longitudinally extending axis. The lower end of the drive shaft 50 has a bevel gear 60 secured thereto which is meshed with a pair of bevel gears 62 and 64 that are journaled for rotation on and relative to the intermediate shaft 58. The confronting faces of the gears 62 and 64 are provided with recesses for selective engagement by a shift coupling 66 which is mounted on the intermediate shaft 58 between the gears 62 and 64 for rotation therewith and for sliding longitudinally thereon for selective driving engagement with the gears 62 and 64.

With attention now directed to FIGURES 2 and 5 of the drawings it will be seen that a shift lever 68 is pivotally secured to the upright portion 30 of the housing 26 for movement about a horizontal axis extending transversely thereof as at 70 and that the lower end of the lever 68 is provided with an inturned bifurcated portion 72 between whose furcations 74 and 76 one end of a shifting lever 78 which is pivotally secured in the upright forward portion 30 of the housing 26 as at 80 for movement about a horizontal transversely extending axis is received. The lower end of the lever 78 is provided with a bifurcated portion 82 whose furcations are disposed in the circumferential groove formed in the shift coupling 66. In this manner, the lever 68 may be pivoted in order to selectively engage the shift coupling 66 with a selected one of the gears 62 and 64 in order to effect rotation of the intermediate shaft 58 in the desired direction relative to rotation of the drive shaft 50.

A rotor generally referred to by the reference numeral 86 is rotatably mounted in the horizontal portion 28 of the housing 26 for movement about a horizontally disposed longitudinally extending axis by means of rotor shaft 88. The rotor shaft 88 is drivingly coupled with the intermediate shaft 58 and it will be noted that the rear end of the horizontal portion 28 of the housing 24 defines an outlet nozzle generally referred to by the reference numeral 90. The outlet nozzle is diametrically reduced at its rear end and includes a plurality of radially extending vanes 92. The rotor 86 includes a generally cylindrical drum-like member 94 which is provided with a pair of longitudinally spaced sets of circumferentially spaced vanes 96. In addition to the vanes 96, the drum-like member 94 includes a plurality of inner and generally radially extending blades 98. The rotor 86 also includes a plurality of circumferentially spaced and radially extending rear end blades 100.

With attention now directed to FIGURES 1, 2, 3 and 6, it will be noted that the rear end of the outlet nozzle 90 is provided with a pair of generally parallel gate members referred to in general by the reference numerals 102 and 104. The gate members 102 and 104 are pivotally mounted on opposite sides of the discharge end of the nozzle 90 for rotation about generally parallel upstanding axes defined by pivot pins 106 and the gate members

102 and 104 are interconnected at points spaced from the pivot pins 106 by means of a connecting strap 108 whose ends are pivotally secured to the gate members 102 and 104 as at 110 and 112 respectively.

The center portion of the connecting strap 108 has a pivot fastener fixedly secured thereto and the pivot fastener includes a shank portion 116 which is slidably received in a slot 118 formed in the rear free end of a steering lever generally referred to by the reference numeral 120. Thus, the steering lever 120 is connected to the gate members 102 and 104 by means of a pin and slot connection defined by the pivot fastener 114. The steering lever 120 is pivotally secured to the horizontal portion of the housing 26 by means of a pivot bolt 122 and the forward end of the steering lever 120 is provided with an upwardly extending steering arm 124 whose upper end is secured to a steering control rod 126 as at 128.

It will be noted that the upper end of the lever 68 is secured to the rear end of a flexible cable assembly 130 which projects through the transom 10 and it is to be understood that the flexible cable assembly 130 and the rod 126 may be manipulated from positions remote from the transom 10 in order to control the operation of the water jet propulsion unit 24.

In operation, as the boat 10 is proceeding forwardly over the surface of a body of water at high speeds, the water immediately rearwardly of the transom 12, being relieved of the weight of the boat 10, has a tendency to rise upwardly and is therefore readily drawn into the inlet opening 132 of the forward upstanding portion 30 of the housing 26. The inlet opening 132 is disposed in a horizontal plane substantially coincidental with the lower surface of the bottom 14 and is communicated with the interior of the horizontal portion 28 of the housing 26. The rotor 86 will of course create a lower pressure area in the inlet opening 34 and draw in large quantities of water. Then, the rotor 86 will discharge the water rearwardly through the outlet nozzle 90 whereby the gate members 102 and 104 may be utilized to laterally deflect the discharge of water from the outlet nozzle 90. The lever 68 may of course be utilized to reverse the rotation of the rotor 86 in order that the boat 10 may be propelled in reverse whereupon the outlet nozzle 90 then comprises the inlet for the propulsion unit 24 and the inlet opening 30 comprises the outlet opening for the water jet propulsion unit 24.

It is to be understood that while the boat 10 is at rest or is proceeding rearwardly over a body of water that the outlet nozzle 90 will be below the surface of the body of water. However, when the boat 10 is proceeding forwardly at high speed, the outlet nozzle 90 is spaced a considerable distance above the surface of the water directly rearwardly of the transom 12 and inasmuch as the inlet opening 34 is disposed in a horizontal plane substantially coincidental with the lower surface of the bottom 14 water over which the boat 10 has passed may be readily drawn into the inlet opening 132.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a boat hull of the type including a bottom and a transom projecting upwardly from the rear of said bottom, a water jet propulsion unit including a housing having an inlet and an outlet and a rotor rotatably mounted therein communicated with said inlet and said outlet, said housing including means removably mounting said housing from and rearwardly of said transom with the portion of said housing defining said inlet opening in substantial horizontal alignment with the lower

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surfaces of the bottom of said hull and immediately to the rear of said transom, said outlet opening rearwardly of said housing and disposed slightly above a horizontal plane containing said inlet said housing including an upright extension at its forward end having an upright drive shaft journaled therein, means drivingly connecting said drive shaft and said rotor, said upright extension including a forwardly projecting and laterally directed extension at its upper end having a generally horizontal input shaft journaled therein drivingly connected to said drive shaft, said forward end of said horizontal extension being removably inserted and secured through said transom and the forward end of said input shaft being adapted for removable driving connection with the output shaft of an inboard engine secured in said boat, said means drivingly connecting said drive shaft and said rotor including transmission means for selectively driving said rotor in opposite directions, said housing including a hollow horizontally disposed extension projecting rearwardly of the lower end of said upright extension and open at its rear end defining said outlet, the lower end of said upright extension being open and defining said inlet and including rearwardly and upwardly inclined fore and aft extending transverse passage means communicating said inlet with the interior of the forward end of said horizontal extension, said rotor being mounted in said horizontal extension for rotation about an axis generally paralleling said bottom.

2. The combination of claim 1 wherein said transmission means also includes means for selectively drivingly disconnecting said rotor and said drive shaft.

3. The combination of claim 1 wherein said outlet is defined by an outlet nozzle carried by the rear end of said housing, said outlet nozzle having an outlet passage

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formed therethrough and longitudinally extending fins for effecting a straight rearward thrust of water from said nozzle.

4. The combination of claim 3 including water jet deflecting means movably mounted on said housing and having portions thereof disposed rearwardly of said nozzle for selectively laterally deflecting the discharge of water from said nozzle to one side or the other.

5. The combination of claim 4 wherein said water jet deflecting means comprises a pair of generally parallel gate members pivotally mounted on opposite sides of the discharge end of said nozzle for movement about generally parallel upstanding axes, extending rearwardly of said nozzle and connected together for simultaneous and substantially equal pivotal movement, means connected between said gate members and said housing for effecting pivotal movement of said gate members.

6. The combination of claim 5 wherein said gate members are each generally C-shaped in transverse cross section and open toward each other.

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