DRIVE FOR A PEDAL POWERED KAYAK

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A pedal powered boat having a drive assembly including an eccentric idler provides adjustment or tension for a chain used as part of the drive assembly to power the boat. A crankshaft assembly and a bevel gear assembly are uniquely combined to produce a smooth pedaling operation for the user. The bevel gear assembly is operable to change the direction of rotation 90 degrees and increasing the speed three times for a net overdrive of six times for creating the speed necessary for a propeller drive.
DRIVE FOR A PEDAL POWERED KAYAK

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

This invention relates to watercraft, and more particularly to a drive assembly for an occupant-powered watercraft.

[0002] 2. Description of the Related Art

Pedal-type watercraft have never been popular due to the weight and maintenance of the gearing assembly. However, in recent years, popularity has increased due at least in part to participants active in biking, swimming, canoeing and other types of water sports for individuals who are health-conscious. With new recent legislation restricting the use of motorized watercraft such as jet skis due to safety concerns, water bike have increased in popularity. In addition, the pedal powered water vehicles have great advantages for use in hunting and fishing as they run silent and can be taken into rocky hazardous areas with the fear of damaging the motor. Pedal powered watercraft can travel greater distances faster than our powered craft and can be quickly stabilized without dropping a rod or a gun to pick up an our to maintain stability of the boat.

[0005] One type of pedal-powered watercraft is disclosed in U.S. Pat. No. 4,795,381 issued to Willems on Jan. 3, 1989. The watercraft disclosed by Willems includes a floating body upon which a pedal assembly and recumbent seat are mounted. The seat can be adjusted toward or away from the pedal assembly to accommodate different sizes of users. An endless drive chain, reduction gearing, and a drive shaft connect the pedal assembly to a propeller. In one embodiment of this patent, the propeller and drive shaft extend downwardly and rearwardly from the floating body. A tandem seating arrangement is also shown.

[0006] Beres U.S. Pat. No. 5,460,551 discloses a pedal-powered watercraft shaped as a kayak with an integrally molded seat. A pedal assembly is connected to a propeller through a transmission and drive shaft arrangement. A front storage compartment as well as a rear storage compartment are provided.

[0007] U.S. Pat. No. 6,210,242 further discloses a pedal powered watercraft made with a unitary hull. The hull is made of a pair of spaced sponsons located on each side of the hull. Each sponson has a front wall that meets the water head on but becomes unstable as the water enters the keel at the tip of the boat causing a rocking motion. The rocking is caused by movement of the watercraft when water enters into the tunnel at the bow portion and exit the tunnel at the stern portion. Although the propeller is retractable, a large portion remains in the water during storage in the tunnel area.

[0008] Pedal-powered watercraft of the past also fail to present a hull design for traveling in rough water. Most hulls for these types of watercraft are designed for a one time user to get on and off the boat without falling into the water from the boat tipping. Such uses are in marinas or small ponds where the water is generally calm and the boat does not have to generate speed for long distance travel. There is a need in the recreational boat field for a pedal powered watercraft which is designed for high speed but stable enough for maneuvering in water around rocks and debris in the water.

There is a greater need for a pedal powered kayak with a drive assembly and hull which is simple to operate and designed for speed.

SUMMARY OF THE INVENTION

[0009] An object of the present invention is to provide a watercraft with an eccentric idler for a drive assembly of a kayak.

[0010] Another object of the present invention is to provide a novel drive assembly for a pedal powered kayak.

[0011] Another object of the present invention is to provide a watercraft with a crankshaft assembly for a drive assembly for a pedal powered kayak.

[0012] It is still another object of the present invention to provide a pedal-powered watercraft having a bevel gear assembly.

[0013] It is a further object of the invention to provide a pedal-powered watercraft which has a cassette assembly for a drive assembly of a pedal powered watercraft.

[0014] It is an even further object of the invention to provide a pedal-powered watercraft with a means for tensioning the chain during operation of a pedal powered kayak.

[0015] According to the invention, a pedal powered kayak is presented which has Other objects and advantages of the invention will become apparent upon reading the following detailed description and appended claims, and upon reference to the accompanying drawings.

[0016] A pedal powered boat having a drive assembly including an eccentric idler provides a tension and adjustment during operation of the pedal drive. A crankshaft assembly and a bevel gear assembly are uniquely combine to produce a smooth pedaling operation for the user. The bevel gear assembly is operable to change the direction of rotation 90 degrees and increasing the speed three times for a net overdrive of six times for creating the speed necessary for a propeller drive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The preferred embodiments of the present invention will hereinafter be described in conjunction with the appended drawings, wherein like designations denote like elements, and wherein:

[0018] FIG. 1 is a perspective view of a pedal-powered watercraft according to the invention;

[0019] FIG. 2 is a plan view of a half section of the drive assembly of the present invention;

[0020] FIG. 2a is a plan view of a half section of the drive assembly of the present invention;

[0021] FIG. 3 is an exploded view of the drive assembly of the present invention.

[0022] FIG. 4 is a side view of the drive assembly of the present invention.

[0023] FIG. 5 is a side view of the drive assembly of the present invention.

[0024] FIG. 6 is a side view of the drive assembly of the present invention.

[0025] FIG. 7 is an exploded view of the bevel gear assembly of the present invention.

[0026] FIG. 8 is an exploded view of the gear clamp assembly of the present invention.

[0027] FIG. 9 is an exploded view of the crank assembly of the present invention.

[0028] FIG. 10 is an exploded view of the prop cassette assembly of the present invention.
FIG. 11 is a side view of the eccentric idler assembly of the present invention.

FIG. 11a is a schematic view of the drive assembly of the present invention.

FIG. 11b is a schematic view of the drive assembly of the present invention.

FIG. 11c is a schematic view of the drive assembly of the present invention.

It is noted that the drawings of the invention are not necessarily to scale. The drawings are merely schematic representations, not intended to portray specific parameters of the invention. The drawings are intended to depict only typical embodiments of the invention, and therefore should not be considered as limiting the scope of the invention. The invention will now be described with additional specificity and detail through the accompanying drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is directed to an improvement over U.S. Pat. No. 6,210,242 which is hereby incorporated by reference.

With reference to FIGS. 1, a pedal-powered watercraft or kayak 10 according to the invention is illustrated. The watercraft 10 includes a hull 12, a pedal drive assembly 13, a deck 14, a keel 15, a stern 16 and a retractable rear rudder 17. The keel 15 is closed within the hull 12 to move within the water without allowing the water to pass through the watercraft from keel 15 to stern 16. Unlike the watercraft described in U.S. Pat. No. 6,210,242, the water is forced out of the way of the watercraft during travel and leaves substantially no wake in the path of the kayak 10. The hull further includes a central body portion 18 having a bottom surface 19 with a centrally formed concave recess 20 extending the length of the central body portion 18. A retractable rear rudder 17 is attached to the rear of the stern 16 and is used for guiding the watercraft 10.

Turning to FIGS. 2-11, the drive assembly 13 includes a drive housing 100 comprised of an injection-molded glass reinforced urethane material and is vacuum molded by forming a first half section 101 and a second half section 102. Positioned into the drive housing 100 is an upper crankshaft assembly 103 complete with crank arms 104, 105 (70, 71) and pedals 104, 105. The crankshaft assembly 103 operates a chain 110 which turns a bevel gear assembly 120. The bevel gear assembly 120 rotates a prop cassette assembly 140. The chain 110 is tensioned by an eccentric idler 111. The bevel gear assembly 120 changes the direction of rotation 90 degrees as well as increasing the rotating speed three times. The rotating speed is also increased between the crankshaft assembly 103 and the bevel gear assembly 120 three times, for a net overdrive of approx. six times, creating the speed necessary for a propeller drive. This overdrive ratio between the pedals 104, 105 vs. propeller shaft can be adjusted, by changing the crankshaft sprocket size to approx. 5:1 to over 8:1.

The drive assembly 13 is completed by joining the first half section 101 and second half section through means of a gloved glue joint 108 entirely encircling first half section 101 and second half section 102 and prop-shaft cassette 140. Glue is also inserted in the chain guide groove 109 creating a center reinforcing rib 109a in the drive assembly 13 when tongue portion 112 of chain guide 113 is joined as the first half section 101 and second half section 102 are brought together. The glue joint 108 has standoff points all around its perimeter, leaving a 0.030" void 108b around the perimeter. This 0.030 void 108b leaves room for adjustments in size between the first half section 101 and the second half section 102.

With reference to FIG. 9, the upper crankshaft assembly 103 consists of a crankshaft 160 machined on each end to accept bicycle style crank arms into which standard bicycle pedals 106, 107 are fitted. The crankshaft 160 has a keyway 161 machined for a key 162 which locks a chain sprocket 163 to the crankshaft 103. The chain sprocket 163 rests firmly against a spacer 164 held in place by a lock ring 165 fitted into a groove 166 machined into the crankshaft 103. Metal bearing races are fitted into the inside of first half section 101 and of second half section 102 and sealed with O-rings 168. Outer metal seal races 168 with lip seals 169 installed are then threaded into female threads inside the bearing races 172. This creates a metal race firmly clamped to the first half section 101 and the second half section 102 for the crankshaft bearings 173. There is an internal groove inside the bearing races 172 with an o-ring 170 fitted in that groove. This completes sealing the races 168, 172 to the first half section 101 and the second half section 102. Bearings 173 mounted into the races 172 provide support during rotation of the crankshaft assembly 103, while the seals 169 seal oil in and water out. When the housing 100 is joined, a wavespring 174 holds the bearings 173 firmly in their races 168 and inhibits side to side thrust of the crankshaft assembly 103.

The crankshaft assembly 103 moves the chain 110 which rotates the bevel gear assembly 120. It does so by turning a bevel gear 121 with a sprocket 122 attached. A hardened axle 123 is inserted through the hole 124 in the bevel gear 121. The gear 121 and axle 123 rotate on bushings 125 fitted into bores 126, 127, the first half section 101 and the second half section 102. The bevel gear 121 is positively positioned by a shim washer 128 fitted between the back side of the bevel gear 121 and the bushing 125.

The bevel gear assembly 120 turns the prop-shaft assembly 140 and changes the direction of rotation 90 degrees. It does so by engaging the pinion gear 141 which is attached to prop-shaft 142 by a roll pin 143 inserted through holes 144, 145 in the prop-shaft 142 and pinion gear 141. The prop-shaft 142 rotates on bearings 146 positioned on the prop-shaft by a spacer 147 which rests firmly against the pinion gear 141. The bearings 146 are spaced apart by an inner spacer 148 and an equal length outer spacer 149. The bearings 146 are held tight against the pinion gear 141 and spacer 151 by a wavespring 152 sandwiched between 2 washers 152a and held firmly in place by a lock ring 153 fitting into a groove 154 machined into the prop shaft 142. Prop-shaft/ bearing assembly 155 slides into prop-shaft cassette 140 with the assembly resting against a wavespring 156 held into the prop-shaft cassette 140 by a lock ring 156a fitting into a groove machined into the inside of the prop-shaft cassette 140. This entire assembly is held in place in the prop shaft cassette 140 by the prop-nut 157. The prop-nut 157 screws into female threads in the prop-shaft cassette 140. There is a lip 157a on the front of the prop-nut 157 that rests on the bearing 146 outer-race. This forces the bearing/prop-shaft assembly 155 inward against the wavespring 152a hence the pinion gear 141 in against bevel gear 121 this is how their gear lash is adjusted. The amount the prop-nut 157 is threaded in is set by shims 158 between the edge 159a of the prop-nut and the edge 159b on the prop-shaft cassette 140. The prop-nut
(29) is sealed to the cassette 140 by an o-ring 159c fitted into a machined groove in the cassette 140. The prop-shaft assembly 140 is double sealed by two lip seals 159d pressed into the prop-nut 157 sealing oil and water out. The wavesprings 152, 152e also act simultaneously as thrust springs for the prop-shaft 142.

[0041] The chain 110 is adjusted and tensioned by the eccentric idler 111. This is done with a chain idler sprocket 201 and chain idler sprocket bearing 202 mounted between two eccentric housings 203, 204. The eccentric housings 203, 204 are fitted so that the idler sprocket 201 and bearing 202 are mounted on a shaft 205 created when the eccentric housings 203, 204 are fitted together. The center of this shaft 205 is eccentric with the center of the outer edge of the eccentric housings 203, 204 which rotate in openings 206 formed in the first half section 101 and the second half section 102. This rotation causes the idler sprocket 201 and bearing 202 to move in and out to tension the chain 110. The rotation of the eccentric housings 203, 204 is locked in position by placing a pin 206 between a groove 207 in the eccentric housings 203, 204 and the corresponding groove 208 in both the first half section 101 and the second half section 102. The three grooves 206 in the housings in the first half section 101 and a second half section 102 are placed to allow incremental rotations of the eccentric idler 111 of 2.5 degrees. The eccentric idler 111 is sealed to the first half section 101 and the second half section 102 by two o-rings 209, 210 fitted into grooves 208 molded into the eccentric housings 203, 204.

[0042] An schematic view of the operation of the eccentric idler is displayed in FIGS. 11a-11c. As the kayak is peddled by the user, eccentric idler 111 causes tension on the chain 110 as the sprocket 201 moves to the position shown in FIG. 11a inside the race bearing 202 and eccentric housings 203, 204. As illustrated in FIG. 11b, the sprocket and bearing have moved to a slightly slackened position resting on the opposite side of the eccentric housings 203, 204. As the sprocket and bearing move to the position shown in 11c tension is once again placed on the chain 110 and drive assembly 13.

[0043] The drive assembly 13 is mounted to the hull 12 of the boat 10 by two pairs of drive collars 230-232 firmly clamped around the housing bearing surfaces of the drive. The drive collars 230-232 are held together with bolts 234 and spacers 236. The lower drive collars 230, 231 are attached to the hull firmly anchoring the entire drive assembly 13 to the hull 12. An additional clamping force is provided by o-rings 237, 238 fitted into a groove in the drive collars 230-232. These large o-rings 237, 238 also act as a friction ring between the drive assembly 13 and the drive collars 230-232. Each friction ring 237, 238 holds the drive assembly 13 in the retracted (up) position.

[0044] With the drive collars 230-232 anchored to the hull 12, the drive assembly 13 can be rotated about the bearing surfaces 240 on the drive assembly and the collars 230-232 by the use of a handle 250 with a non-slip grip 251. The drive handle 250 is held in a drive bracket 252 by a removable clevis pin 253 and lock ring 254. The drive bracket 252 is mounted to the drive assembly 13 by three machine screws 255 and nuts 256 passing through two holes 257 in the first half section 101 and the second half section 102 and one hole 258 through the eccentric idler 111. This allows the drive assembly 13 to be retracted into a trunk 260 (formed in the hull) for shallow water, beaching, or transporting. The entire drive assembly 13 can also be removed from the hull by removing the four bolts and spacers 234, 235 and the upper drive collars 233(3). The drive assembly 13 will now lift out of the lower drive collars 230, 231 cradling it.

[0045] A pedal powered boat having a drive assembly including an eccentric idler provides a tension and adjustment during operation of the pedal drive. A crankshaft assembly and a bevel gear assembly are uniquely combine to produce a smooth pedaling operation for the user. The bevel gear assembly is operable to change the direction of rotation 90 degrees and increasing the speed three times for a net overdrive of six times for creating the speed necessary for a propeller drive.

[0046] While the invention has been taught with specific reference to the above-described embodiments, those skilled in the art will recognize that changes can be made in form and detail without departing from the spirit and the scope of the invention. For example, in each of the above embodiments one or more of the foot pedals can be replaced with hand pedals for accommodating handicapped persons or for exercising the upper body.

[0047] Thus, the described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes that come within the meaning and range of equivalency of the claims are to be embraced within their scope.

1. A pedal powered boat having a drive assembly, said drive assembly comprising,
a crankshaft assembly, said crankshaft assembly having crank arms and crank pedals,
a chain, said chain connected to a bevel gear assembly and to said crankshaft assembly, said bevel gear assembly operable to change the direction of rotation 90 degrees and increasing the speed three times for a net overdrive of six times for creating the speed necessary for a propeller drive.

2. The drive assembly as recited in claim 1, said drive assembly further comprising an injection-molded glass reinforced urethane housing.

3. The drive assembly as recited in claim 1, said drive assembly further comprising a drive housing with a cover connected by a grooved glue joint entirely encircling said drive housing said glue joint having stand-off points around its perimeter for adjustments in size between said housings.

4. The drive assembly as recited in claim 1, said drive assembly further comprising three grooves in housings to allow incremental rotations of said eccentric idler of 2.5 degrees.

5. The drive assembly as recited in claim 1, said drive assembly further comprising a cassette assembly, said cassette assembly held in place in a prop shaft cassette by a prop-nut, said prop-nut threaded onto female threads in said prop-shaft cassette.

6. The drive assembly as recited in claim 1, said drive assembly further comprising a prop-shaft cassette, said prop-shaft cassette including a lip, said lip forcing said prop-shaft assembly inward to adjust a gear lash.

7. A pedal powered boat having a drive assembly, said drive assembly comprising,
a crankshaft assembly, said crankshaft assembly having crank arms and crank pedals,
a chain, said chain connected to a bevel gear assembly and to said crankshaft assembly, said bevel gear assembly connected to a cassette assembly, said bevel gear assembly-
bly operable to change the direction of rotation 90 degrees and increasing the speed three times for a net overdrive of six times for creating the speed necessary for a propeller drive, and eccentric means for tensioning said chain, said eccentric means including a chain idler sprocket and a bearing mounted between two eccentric housings, said idler and said bearing are mounted on a shaft said shaft having an center eccentric with a center of said eccentric housings which rotate in openings, said rotation causing said idler said bearing to move in and out to tension said chain.

8. The drive assembly as recited in claim 7, said drive assembly further comprising an injection-molded glass reinforced urethane housing.

9. The drive assembly as recited in claim 7, said drive assembly further comprising a drive housing with a cover connected by a grooved glue joint entirely encircling said drive housing said glue joint having standoff points around its perimeter for adjustments in size between said housings.

10. The drive assembly as recited in claim 7, said drive assembly further comprising three grooves in housings to allow incremental rotations of said eccentric idler of 2.5 degrees.

11. The drive assembly as recited in claim 7, said drive assembly further comprising a cassette assembly, said cassette assembly held in place in a prop shaft cassette by a prop-nut, said prop-nut threaded onto female threads in said prop-shaft cassette.

13. The drive assembly as recited in claim 7, said drive assembly further comprising a prop-shaft cassette, said prop-shaft cassette including a lip, said lip forcing said prop-shaft assembly inward to adjust a gear lash.

14. A pedal powered boat having a drive assembly, said drive assembly comprising, a crankshaft assembly, said crank shaft assembly having crank arms and crank pedals, a chain, said chain connected to a bevel gear assembly and to said crankshaft assembly, said bevel gear assembly connected to a cassette assembly, and a eccentric means for tensioning said chain, said eccentric means including a chain idler sprocket and a chain idler bearing mounted between two eccentric housings, said idler and said bearing are mounted on a shaft said shaft having an center eccentric with a center of said eccentric housings which rotate in openings, said rotation causing said idler said bearing to move in and out to tension said chain.

15. The drive assembly as recited in claim 14, said drive assembly further comprising an injection-molded glass reinforced urethane housing.

16. The drive assembly as recited in claim 14, said drive assembly further comprising a drive housing with a cover connected by a grooved glue joint entirely encircling said drive housing said glue joint having standoff points around its perimeter for adjustments in size between said housings.

17. The drive assembly as recited in claim 14, said drive assembly further comprising three grooves in housings to allow incremental rotations of said eccentric idler of 2.5 degrees.

18. The drive assembly as recited in claim 14, said drive assembly further comprising a cassette assembly, said cassette assembly held in place in a prop shaft cassette by a prop-nut, said prop-nut threaded onto female threads in said prop-shaft cassette.

19. The drive assembly as recited in claim 14, said drive assembly further comprising a prop-shaft cassette, said prop-shaft cassette including a lip, said lip forcing said prop-shaft assembly inward to adjust a gear lash.

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