ABSTRACT OF THE DISCLOSURE

An outboard pneumatic tire drive wheel having a peripheral portion exposed to the water. A housing secured to the boat and enclosing all but such peripheral portion of the pneumatic tire. A submerged propeller having an unenclosed annular rim in tight contact with the non-enclosed portion of the pneumatic tire, and radial blades which also serve as structural members or spokes. A propeller shaft including a forwardly directed ram water inlet passageway means leading rearwardly to water lubricated bearings. Additional water lubricated bearings in the enclosed portion of the drive train, lubricated by water thrown into the housing by the propeller.

POWER BOAT OUTDRIVE ASSEMBLY

The present invention relates to outdrive assemblies for power boats equipped with an inboard engine. More particularly, it relates to outdrive assemblies characterized by an outboard drive wheel and a rimmed propeller, the rim of which is contacted and frictionally driven by said drive wheel.

Know as outdrive assemblies, such as the type disclosed in my U.S. Patent No. 3,150,631, or in my U.S. Patent No. 2,977,923, for example, comprise a rimless screw propeller mounted for rotation on an end of a short, horizontal drive shaft carried at the lower end of a vertical drive train housing. A vertical drive shaft extends through said housing and is geared at its lower end to the horizontal drive shaft. Such assemblies are either provided with a rudder (e.g. Patent No. 2,977,923) for steering, or the gear train housing is mounted for pivotal movement about a vertical axis (e.g. Patent No. 2,977,923), so that steering is effected by moving the housing and the propeller carried thereby sideways.

It is old to construct screw propellers with an annular drive rim on which gear teeth are formed, and to drive such propellers by a pinion gear (e.g. U.S. Patent No. 2,083,282), or by a toothed belt (see U.S. Patent No. 2,722,193). It is also old to employ turbine blades on a drive rim in place of gear teeth (e.g. see U.S. Patent No. 2,083,282), to provide a fluid drive. Each of these types of rim driven propellers requires a shroud or casing about the rim, and in at least most cases a seal must be provided between the shroud and the rim. The addition of the shroud materially increases the drag of the propeller assembly (and this is rearwardly) and in addition, it is quite difficult, and complicated mechanisms are required, to mount the propeller so that it can be turned sideways about a vertical axis for steering the boat. A principal object of the present invention is to provide an outdrive assembly comprising a rubber tired drive wheel carried on the end of a drive shaft that extends rearwardly from the inboard engine and projects rearwardly through an opening in the transom or some other wall portion of the boat, and a rimmed propeller supported with its rim pressed against a peripheral portion of the drive wheel by means permitting turning of the propeller about a vertical axis passing substantially through the center of contact of the rim and drive wheel. Owing to this arrangement, drive contact is maintained between the wheel and rim during turning of the propeller, for purposes of steering the boat, as well as when the propeller is oriented for straight course travel of the boat. Another object of the present invention is to provide an outdrive assembly in which all the parts located outboard of the boat are, or at least may be, wetted by the water without destructive effects, and in which all rotating parts are located outboard of the boat are rotatably supported by water lubricated bearings. The rimmed propeller is substantially completely exposed to and wetted by the water in which it is submerged, and this is substantially supported by water lubricated bearings, such as phenolic sleeve bushings, for example. The drive wheel is preferably enclosed in a housing that is secured to the boat. Such housing is formed to include a bottom opening through which a peripheral portion of the drive wheel is exposed. The drive shaft on which the drive wheel is secured extends through, and is supported in the housing by a tubular support member. One or more water lubricated bearings are retained in the support member in surrounding relationship to the drive shaft, such bearings serving to rotatably support the drive shaft. An opening is provided in a side wall portion of the tubular support member, located inside said housing, to serve as an avenue through which some of the water that is splashed or thrown upwardly into the housing by the rotating propeller may enter into the region of the bearings, for lubricating the same. Further object of the present invention is to provide an outdrive assembly of the character described wherein the propeller assembly includes a propeller guard disposed forwardly of the propeller proper, and mounting means which permits the propeller assembly to swing rearwardly and upwardly along an arcuate path toward a retracted position whenever the guard is struck by a mainsail boom. In preferred form, the means supporting the rimmed propeller comprises a vertical propeller post disposed rearwardly of the drive wheel housing; a fixed propeller shaft carried by and projecting forwardly of the lower end portion of said propeller post; the said propeller guard, which preferably is in the form of a faired in end plate or vertical strut disposed forwardly of the propeller, in line with the lower portion of said propeller post; a means for mounting the propeller post and propeller carried thereby for pivotal movement about a generally vertical axis, said means comprising a relatively large diameter, horizontally disposed, circular, pivot pin interconnected between the upper end portion of the guard and an intermediate portion of the propeller post, said pivot pin including side wall means extending about the lower portion of the drive wheel housing, which is of complementary configuration, and a vertical pivot pin mounted for rotation in a bushing carried by an upper portion of the drive wheel housing; means securing the upper end portion of the propeller post with said pivot pin; and a tiller connected at one end of the pivot pin and project forwardly through an opening in the wall of the boat. Sideways movement of the tiller causes the pivot pin to rotate and this in turn causes sideways movement of the propeller post and the propeller carried thereby. According to the invention the vertical pivot pin is hollow and includes an annular side wall, and a compression spring is buttoned in the interior of such pin. A pair of longitudinal slots are formed at diametrically opposite locations in said side wall. The upper end portion of the propeller post includes a pair of apertured tines disposed on opposite sides of the pivot pin. A horizontal bolt or cross pin extends through the apertures in said tines, and through the slots in the side wall of said pivot pin, and such bolt is supported on top of the compression spring. The compression spring normally urges the propeller rim upwardly into drive engagement with the drive wheel. Rearward pivotal movement of the
drive assembly is normally prevented by virtue of the engagement of the lower end portion of the drive wheel housing by the pivot pan. However, the contacting parts of the pivot pan and the lower portion of the drive wheel housing both slope downwardly and inwardly from top to bottom. Thus, when the propeller guard is struck by a major obstacle the pivot pan tends to slide downwardly and rearwardly out of engagement with the lower end portion of the drive wheel housing, and such movement is permitted because the horizontal bolt mounting the upper end of the propeller post to the pivot pin is able to move downwardly by virtue of its spring and slot mounting.

A still further object of the present invention is to provide an outdrive assembly of the character described that further includes means for manually engaging the propeller rim into drive engagement by the drive wheel, and for manually disengaging such parts followed by manually swinging the propeller assembly into a retracted position.

The foregoing as well as other characteristic features, objects and advantages of outdrive mechanisms of the present invention will be apparent from the following description of a typical and therefore non-limitive embodiment thereof, together with the accompanying illustrations of such embodiment, wherein like numerals refer to like parts, and wherein:

FIG. 1 is a view in side elevation of the stern portion of a power boat equipped with an inboard engine and marine transmission, with the stern drive assembly of the present invention installed thereon and in its operating position;

FIG. 2 is a view in rear elevation of the boat and installed stern drive assembly shown in FIG. 1;

FIG. 3 is a view similar to FIG. 1, but showing the stern drive assembly in a partially retracted position;

FIG. 4 is a view in vertical section, taken substantially along line 4--4 of FIG. 2 and being presented on an enlarged scale, with certain parts being shown in elevation, and with the annular propeller rim shown urged upwardly into drive engagement by the tire of the drive wheel;

FIG. 5 is a view similar to FIG. 4, but showing the annular propeller rim urged downwardly out of drive engagement by the tire of the drive wheel, by action of a manually operable mechanism, with the tire and the propeller rim pictured in elevation;

FIG. 6 is a view in horizontal section, taken substantially along line 6--6 of FIG. 4, with a straight show of position of the tiller bar and the rudder post being shown in full line, and a left turn position of such bar and post being shown in broken line; and

FIG. 7 is a view in horizontal section, taken substantially along line 7--7 of FIG. 4, with the drive wheel shown in reference, with a straight ahead position of the rimmed propeller and the lower portion of the propeller post being shown in full line, and with an extreme left turn position of such parts being shown in broken lines.

Referring more specifically to the several figures of the drawings, the outdrive assembly of the present invention is shown to be mounted at the stern of the power boat B, on its transom T. The boat B is equipped with an inboard power plant (not shown) including an engine and a marine reversing transmission, each conventional per se. An opening is provided in the transom T for passage therethrough of a short drive shaft 10 and a portion of a support structure therefor, hereinafter to be described in detail. The inner end of the drive shaft 10 is shown in FIGS. 4 and 5 to be coupled at 12 to the output shaft 14 of the reversing transmission.

An outboard drive wheel 16, shown by way of example in the form of a pneumatic tired vehicle wheel, such as may be used on light aircraft, for example, is secured to the rear end of the output shaft 14. The drive shaft 10 includes a generally disk-shaped end piece 18. Drive wheel
through a small diameter axial bore 72 formed in nose block 74 is of bore 76 and is threaded into a threaded bore 74 formed in the forward end portion of propeller shaft 52. A longitudinal bore 73 may be formed axially through bolt 68 and shaft 52, and provided with radial ports, to serve as an avenue for ram water to enter into the region of bearings 56, 58, for lubricating same.

The nose block 66 is in integral part of a propeller guard 60, shown in the form of a vertical strut or fairing, having a rounded lead edge 78.

A shallow, upwardly opening, pan-like element 80, hereinafter termed a "pivot pin," is interconnected (and provides a rigid structural intertie) between the upper end of propeller guard 76 and an intermediate portion of the propeller post 48. Propeller post 48, propeller shaft 52, propeller 40, propeller guard 76, and pivot pin 80 together comprise what may be termed the "propeller assembly."

The propeller assembly is mounted onto the drive wheel housing 26 for sideways pivotal movement about a vertical axis that passes substantially through the center of contact of rim 46 and tire 23. The means mounting the propeller assembly for such pivotal movement includes the pivot pin 80 and a vertical pivot pin 82 journalled for rotation in an upper portion 84 of the housing 26, such a water lubricated bearing 86.

Pivot pin 82 possesses a hollow interior formed by an annular wall. A pair of axially elongated slots are formed at diametrically opposed locations in the annular wall. A relatively stiff compression spring 88 is bottomed at 90 inside of pivot pin 82. The upper end portion of propeller post 48 is forked, and the times 94, 96 thereof are disposed on opposite sides of the pivot pin 82. A transverse bolt or cross pin 92 extends horizontally through the said slots in pivot pin 82, above the spring 88, and through apertures in the times 94, 96. One end of cross pin 92 may include a head 98, and the other may be provided with a nut 100. As will be apparent, cross pin 92 will transmit any rotational movement of pin 82 to the propeller post 48. Downward movement of the propeller assembly is permitted if a downward force of sufficient magnitude to overcome the force of compression spring 88 is exerted on it. Unless some restraining force is applied to the propeller assembly, it is free to pivot about the axis of cross pin 92. Such a restraining force is normally provided by the pivot pin 80, as will now be described.

The housing 26, is shown (FIGS. 3-6) to be somewhat in the form of a "truncated sphere." That is to say, it is essentially spherical except where modified at the front, back, top and bottom. The axis of drive shaft 10 is co-extensive with a horizontal axis of the sphere, and the rim of bottom opening 38 lies in a horizontal plane that is parallel to the axis of drive shaft 10. Of particular importance, the lower portion of housing 26, forwardly of the rear wall 102 of such housing 26, has spherical characteristics.

The vertical or zenith axis of the sphere of which the spherical portions of housing 26 are a part is coextensive with the axis of rotation of pivot pin 82. The pivot pin 80 includes an annular side wall 104 that is substantially a segment of a sphere. It is sized so that the lower portion of the housing 26 is somewhat snugly received in it. As will be apparent, the vertical axis of the sphere of which side wall 104 is a part also coincides with the center of rotation of pivot pin 82.

Accordingly, pivot pin 82 constitutes a means for mounting such assembly onto the upper portion 84 of the housing 26. The pivot pin 80 constitutes a means for pivotal mounting the propeller assembly onto the lower portion of housing 26. In addition, when the propeller assembly is in its normal position of use (FIG. 4, for example), the pivot pin 80 prevents the propeller assembly from pivoting about the axis of cross pin 92 by virtue of the fact that the side wall 104 thereof surrounds the lower end portion of the housing 26.

Referring to FIG. 7, the central portion 106 of rear wall 102 is a segment of a cylinder (about a 60-70° arc), the center of which cylinder also coincides with the vertical axis Z about which the propeller assembly pivots. The portions of wall 102 situated outboard of the central portion 106 may be planar, as illustrated.

A recess 108 is formed in the leading edge of propeller post 48, closely above the pivot pin 80, and a roller 110 is journaled for rotation about a vertical axis in the recess 108. The roller 110 is positioned so that it projects a slight distance forwardly of the leading edge of propeller post 48 and contacts the rear surface of the central portion 106 of rear wall 102. A forward pair of rollers 112, 114 are inset in recesses 116, 118, and rest upon lower end portion of housing 26. Such rollers 112, 114 are spaced about 90° apart and about 45° on opposite sides of a vertical plane passing through axis Z and the axis of rotation of roller 110. Rollers 112, 114 are positioned so that they project a slight distance beyond the lower surface of housing 26 and contact the inner surface of wall 104 of pivot pin 80. As will be apparent, the rollers 110, 112, 114 take the side thrust of the propeller assembly. Since roller 110 rides across a cylindrical surface, it may be cylindrical in form itself. Rollers 112, 114 contact a spherical surface so they should be somewhat barrel shaped, i.e. they should have a somewhat spherical roller surface.

Referring particularly to FIGS. 4, 6 and 7, the upper end portion 84 of housing 26 is formed to include a forwardly opening cavity 120 bounded on its sides by forwardly diverging side walls. The lower end portion of pivot pin 82 depends downwardly into a rearward apical portion of such cavity 120. The rear end portion of a tiller 122 is secured to such lower portion of the pivot pin 82, and such tiller extends thence forwardly through the cavity 120, through an elongated slot 124 cut in the transom T, and projects into the interior of the boat B.

The tiller 122 may be moved sideways for effecting steering of the boat by any suitable type of control mechanism.

In FIGS. 4-6 the rear end portion 126 of a control mechanism is shown to be drivenly attached to the forward end portion of the tiller 122.

In FIGS. 6 and 7 the tiller 122 and the propeller assembly are shown in a straight travel position. The direction of travel may be either ahead or to the rear depending upon the direction of rotation of the propeller 40. The full left turn and full right turn positions of the tiller 122 and the propeller assembly are indicated by broken lines labeled LT, RT, respectively, and in the full left turn positions, by a reference or broken line showing of such components. In FIG. 7 the position of drive wheel 16 (which is fixed) is shown in reference. Such view clearly shows that contact is maintained between the tire portion 23 of drive wheel 16 and the propeller rim 48 throughout the turning operation of the propeller 40.

Owing to the sloped surface-to-surface contact made between the rollers 112, 114 and the side wall 104 of pivot pin 80, and to the slot and spring mounting of the cross pin 98, the propeller assembly is able to "kick-up" rearwardly upon the propeller guard 76 striking a major obstruction. A minor movable obstruction would probably be deflected to one side or the other by guard 76, or the propeller assembly might ride merely over it. However, when the propeller guard 76 moves against a major obstruction, such as an immovable underwater limb, for example, the tendency is for the wall 104 of pivot pin 80 to want to slide downwardly and rearwardly along its line of contact with the upturned 110. The compression spring 88 is designed so that the force which it exerts will be overcome by the force exerted by the major obstruction on the propeller guard tending to move the propeller assembly downwardly. Hence, the cross pin 98 moves downwardly into the slots in pivot pin 82, and the entire propeller assembly moves downwardly at the same time wall 104 slides downwardly and
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As soon as the wall 104 clears the lower end portion of housing 26 the propeller assembly is "kick-up" rearwardly, i.e. pivoted rearwardly about the center of cross-pin 98, and will remain in a relatively "up" position until the obstruction is cleared.

A manually operable mechanism 128 is provided for use in returning the propeller assembly to its proper position of use, and for manually retracting the propeller assembly when it is desired to do so. The mechanism 128 comprises a pair of cam plates 130, 132 disposed on opposite sides of the upper portion of pivot pin 82, and mounted thereon for pivotal movement about a horizontal axis by a cross-pin 134. The mechanism 128 also includes a handle 136 and a pair of thumb-like projections 138 stemming from the cam plates. As clearly shown by FIG. 4, the mechanism 128 is normally held in a position of rest against the rear edge of propeller post 48 by virtue of the fact that when the propeller assembly is in its normal position of use (FIG. 4) the cross-pin 92 is located in the quirk formed between the thumbs 138 and their cam plates 130.

As will be apparent, the edges of the cam plates 130, 132 depress the cross-pin 92 as the cam plates are rotated by an operator pulling upwardly on the handle 136, using finger grip 140. This is because the distance between the center of pin 134 and the edge portion of the cam plates 130, 132 in contact with pin 92 (i.e. the radius) increases as the handle 136 is raised. Movement of the mechanism 128 to the position shown by FIG. 5 will result in the propeller assembly being pushed downwardly to a position wherein a gap exists between the tire 23 and the propeller rim 40, and a larger gap exists between the bearing surfaces of the rollers 112, 114 and the inner surface of wall 104.

It is to be noted that when the mechanism 128 is in the position shown by FIG. 5 the thumb projections 138 each contact a boss 142 formed on the inner surfaces of the tines 94, 96. When the mechanism 128 is moved upwardly an additional amount from the position shown by FIG. 5, the thumb projections 138 push against the boss 142 and raise the propeller assembly with them.

In operation, the outboard drive wheel 16 is rotatably driven by the inboard power plant, and such wheel 16 in turn frictionally drives the propeller 40 by virtue of the surface-to-surface contact of the two. When it is desired to turn the boat, the tiller 122 is moved sideways in the direction opposite to the direction of turn. For example, if it is desired to turn the boat to the left, or counter clockwise, the tiller 122 is moved to the right or clockwise. The tiller in turn rotates or turns the pivot pin 82, and since the propeller assembly is connected to the pivot pin 82, it is carried along therewith. As earlier explained, the pivotal movement of the propeller assembly occurs about a vertical line that substantially passes through the center of contact between tire 23 and rim 46, and which is the zenith of the sphere of which the spherical surfaces of housing 26 are a part, the zenith of the sphere of which the spherical surfaces of wall 104 are a part, is the rotational center of both pivot pin 82 and pivot pan 80, and is the center of the cylinder of which the cylindrical segment 106 of wall 102 is a part.

As the propeller assembly is turned sideways, the propeller guard 76 is moved from a position wherein its leading edge 78 is directed straight into the stream of water flowing relatively past it to a succession of positions in which it is disposed at an angle of attack relative to such stream. During a turn the water that moves relatively over the leading surface of propeller guard 76 is turned thereby, and this produces a reaction force tending to rotate the propeller assembly a further amount in the direction in which it is turned. According to the present invention, this rotational tendency is substantially counterbalanced by virtue of the fact that the lower portion 144 of propeller post 48 is also turned. Since the lower portion 144 of post 48 is located rearwardly of the center of rotation 134 of propeller 48 the turning moment due to an external force or movement by water reaction that opposes the movement produced by propeller guard 76. Like propeller guard 76, the lower portion 144 of propeller post 48 is a fairing, and it is aligned with the propeller guard 76 axially of the propeller shaft 22.

The propeller housing 26 may be constructed in two parts, as illustrated. The forward part, which is shown to be secured to the transom T by bolts 146, may be termed a mounting bracket or the bracket portion. The rear part may be termed the cover plate or rear pan. It is shown to be secured to the fulcrum post of a ring of bolts, some of which are designated 148. In FIG. 4, a boss 150 is shown to be formed on the inner side of the cylindrical segment 106, directly rearwardly of and in line with the drive shaft 10. A bearing block 152 of a water lubricated material (e.g. phenolic resin) is shown to be secured to the boss 10 by a bolt 154. The bearing block 152 assumes the end thrust of the drive shaft 10.

Preferably, propeller 48, from the tines 94, 96 at its upper end down to the tail block 59 at its lower end, is a piece casting. As clearly shown by FIGS. 4–6, in particular, a pair of streamlined bosses 156, 158 are used on the blades to reduce the resistance to the movement of water and the rear end portions 160, 162 (FIG. 7) of a pair of cheek plates, which together form the pivot pan 80, are connected to such bosses 156, 158. The cheek plates 46 and the propeller guard 76, including the nose block 72, may all be one casting.

A particularly important feature of the present invention is that all of the parts that are situated outboardly of the transom T may be wetted by the water without water damage occurring. As previously described, the bearings 32, 34, 56, 58, 86 and 152 are all of the water lubricated type. Also, rollers 110, 112, 114 are preferably made of a non-corrosive material, such as hard rubber, nylon, Teflon, a phenolic resin, or the like.

The housing 26 encloses that portion of the drive train means located above the propeller 40. The opening 38 in the housing 26 faces downwardly and is positioned directly above the propeller 40, enabling propeller throw water to enter the housing 26 and wettingly engage the various water lubricated portions of the drive train means therein.

The propeller rim 46 is shown to have a relatively thin lenticular cross-sectional configuration. Owing to the type of drive involved, it needs no shroud, and none is provided. This is in contrast to the type of drive in which in its submerged. Owing to its thin streamlined shape, and the absence of a shroud, it possesses low drag characteristics.

Although the drive wheel is shown to be equipped with a pneumatic tire 23, it is within the contemplation of the present invention that a solid rubber tire be employed instead. The outer surface of propeller rim 46 may be a relatively smooth or even surface, or it may be knurled or otherwise scored or patterned for the purpose of increasing its coefficient of friction and hence the traction between it and the tire. In some installation it might be desirable to bond or otherwise secure a shoe of a material having a high coefficient of friction to the outer surface of propeller rim 46, and then use either a rubber tire drive wheel or a metal drive wheel (e.g. an aluminum alloy drum formed to include a knurled peripheral surface) for driving the same.

Further modifications contemplated by the present invention include mounting the rollers 112, 114 onto the side wall 104 of pivot pan 80, rather than onto the bottom portion of the housing 26. Or, the inner surface of wall 104 may be divided to mate and rotatably slide around the outer surface of the lower portion of housing 26. Additionally, a shoe of Teflon or a phenolic resin may be bonded to both of such surfaces, so that the sliding
contact is made between surfaces having anti-friction characteristics. Although desirable, it is not essential that the housing and the wall have spherical characteristics. It is only essential that the surface-to-surface contact between the pivot pan and the lower portion of housing occur along downwardly and inwardly sloping lines or surfaces.

Although the friction drive feature of the present invention is shown and described in connection with an outer drive assembly, in which the drive wheel is situated outwardly of the boat and most of the parts are mounted onto the transom of the boat, it is to be realized that such feature has applications in other installations. For example, the drive wheel may be mounted in a well formed in a lower portion of the boat forwardly of the transom, and arranged to project downwardly a slight distance below the bottom surface of the boat into contact with the rim of a propeller of the type disclosed that is mounted directly below it.

From the foregoing, various further features, advantages, objectives, modifications, adaptations and rearrangements of the assemblage and components thereof will be apparent to those skilled in the art within the scope of the following claims.

What is claimed is:

1. In combination with a power boat equipped with an inboard drive means including a drive shaft protruding through an opening in a wall of the boat, an outdrive assembly comprising:
   (a) a drive wheel secured to said drive shaft;
   (b) a housing secured to the boat and at least partially enclosing said drive wheel, said housing including an opening through which a peripheral portion of the wheel is exposed, and a tubular support member concentrically surrounding said drive shaft, with a portion of said support member projecting through the said opening in the wall portion of the boat into the interior of the boat, said support member including at least one side wall opening, communicating its interior with the interior of said housing;
   (c) a water lubricated bearing means in said tubular support member, rotatably supporting the drive shaft;
   (d) seal means at the inboard end of said tubular mounting member, for preventing water leakage out from the interior of said support member at said inboard end;
   (e) a propeller including an annular rim; and
   (f) means mounting said propeller for rotation with its rim pressed tightly against the exposed portion of said drive wheel, as so to be frictionally driven thereby, whereby the propeller picks up water and throws it into the interior of the housing and a portion of some water enters into said tubular support member through the opening therein and lubricates the bearings.

2. In combination with a power boat equipped with an inboard drive means including a drive shaft protruding through an opening in a wall portion of the boat, an outdrive assembly comprising:
   (a) a drive wheel secured to said drive shaft;
   (b) a housing mounted on said boat and substantially enclosing the entire drive wheel except for a bottom opening through which a peripheral portion of the drive wheel is exposed;
   (c) a propeller including an annular rim at least the greater portion of which is exposed to, and wetted by, the water in which the propeller is submerged;
   (d) means mounting said propeller for rotation below said housing with its rim pressed tightly against the exposed peripheral portion of said drive wheel, said means comprising a substantially vertical propeller post disposed rearwardly of said housing and including a forwardly projecting shaft at its lower end on which the propeller is journaled for free rotation, and means mounting said propeller post onto said housing for rotation about a vertical axis that passes substantially through the center of contact of said drive wheel with said rim.

3. A marine propulsion assembly comprising:
   (a) a drive wheel mounted at the end of a substantially horizontal drive shaft;
   (b) a housing substantially enclosing the drive wheel except for a bottom opening through which a peripheral portion of said drive wheel is exposed;
   (c) a propeller including an annular rim, at least the greater portion of which is exposed to, and wetted by, the water in which the propeller is submerged;
   (d) means mounting said propeller below said housing for rotation about a center axis, and for sideways pivotal movement about a generally vertical axis, with its rim pressed tightly against the exposed peripheral portion of said drive wheel, said means comprising a substantially vertical propeller post disposed rearwardly of said housing and including a forwardly projecting shaft at its lower end on which the propeller is journaled for free rotation, and means mounting said propeller post onto said housing for rotation about a vertical axis that passes substantially through the center of contact of said drive wheel with said rim; and
   (e) steering means for effecting sideways movement of the propeller post and the propeller carried thereby.

4. A marine propulsion assembly according to claim 3, wherein the means mounting the propeller post onto the housing comprises a pivot pin journaled in an upper portion of the housing for rotation about a vertical axis, means connecting the upper end portion of the propeller post to said pivot pin, and means mounting said propeller post onto the lower portion of the housing for rotation about a said vertical axis.

5. A marine propulsion assembly according to claim 3, wherein the lower portion of the housing is formed by wall means of circular curvature about a generally vertical line, and wherein the means mounting the propeller post onto the housing comprises a pivot pin journaled in an upper portion of the housing for rotation about a vertical axis that coincides with the center of curvature of said wall means, means connecting the upper end portion of the propeller post to said pivot pin, and a pivot pan connected to, and projecting forwardly from, an intermediate portion of the propeller post, said pivot pan including wall means surroundingly engaging the said lower portion of the housing.

6. A marine propulsion assembly according to claim 3, wherein the means mounting the propeller post onto the housing comprises a hollow pivot pin journaled for rotation in an upper portion of the housing for rotation about a vertical axis, said pin being formed in part by an annular side wall, and including a pair of vertically elongated slots formed at diametrically opposed locations in said annular side wall, a compression spring bottomed in the hollow interior of said pin, a cross-pin extending through both slots above the spring and having outwardly projecting end portions, means connecting the upper end portion of the propeller post to the end portions of the cross-pin, and means mounting the propeller post onto the lower portion of the housing for pivotal movement about the said vertical axis, through the intermediacy of the propeller post, to bias the propeller upwardly and maintain its rim in drive contact with the exposed peripheral portion of the drive wheel.

7. A marine propulsion assembly according to claim 3, wherein the lower portion of the housing is at least in part transversely circular, with the center of curvature coinciding with the said vertical axis, and wherein the means mounting the propeller post onto the lower portion of the housing, for pivotal movement about the said vertical axis, comprises an upwardly opening pivot pan hav-
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11 ing side walls means surroundingly engaging the lower portion of the housing.

8. A marine propulsion assembly according to claim

7, further including a propeller guard located forwardly of said propeller, wherein surface-to-surface contact is made between the pivot pin and the lower portion of the housing along downwardly and inwardly sloping surfaces, and wherein the slots in the said annular side wall of the pivot pin are long enough to permit the cross-pin to move downwardly, along with the propeller post and the propeller carried thereby, to allow the said pivot pin to slip off from, and out of engagement with, the lower portion of the housing whenever the said propeller guard is struck by major obstacles, so that the propeller post and propeller are free to swing up rearwardly clear of the obstacle.

9. A marine propulsion assembly according to claim

8, further including manually operable means for depressing the propeller post downwardly in opposition to the force of the compression spring, and for manually lifting it up along an arcuate path into a retracted position.

10. In combination with a power boat having a transom and equipped with an inboard drive means, an outdrive assembly comprising:

(a) a short drive shaft coupled at its forward end to the inboard drive means and extending rearwardly therefrom through an opening in said transom;
(b) a drive wheel secured to said drive shaft outwardly of said transom;
(c) a housing mounted on said transom and substantially enclosing the entire drive wheel except for a bottom opening through which a peripheral portion of the drive wheel is exposed;
(d) a propeller including an annular rim at least the greater portion of which is exposed to, and wetted by, the water in which the propeller is submerged; and
(e) means mounting said propeller below said housing for rotation about a center axis, and for sideways pivotal movement about a generally vertical axis, with its rim pressed tightly against the exposed peripheral portion of the drive wheel.

11. The combination of claim 10, wherein the latter mentioned means include a substantially vertical propeller post disposed rearwardly of said housing, and carrying a forwardly projecting fixed shaft at its lower end, on which the propeller is journaled for free rotation, (2) a substantially vertical pivot pin journaled for rotation in an upper portion of the housing for rotation about a vertical axis that substantially passes through the center of contact of said along wheel with said rim,

(3) means connecting the upper end portion of said propeller post with said pivot pin,

(4) a generally vertical strut disposed forwardly of the propeller and including a socket opening therein for receiving the forward end portion of said propeller post, and

(5) means providing a rigid structural intertie between the upper end of said vertical strut and an intermediate portion of said propeller post on about the same level therewith, said means also serving to mount the propeller post, and in turn the propeller shaft, the propeller, the said vertical strut, and the said means itself, all of which are carried by the propeller post, onto the lower portion of the housing for pivotal movement about the said vertical axis.

13. The combination of claim 12, wherein the lower portion of the propeller post, which carries the said propeller shaft, constitutes a tail block portion of a propeller shaft nacelle, wherein the portion of the vertical strut in which the forward end portion of the propeller shaft is received constitutes a nose block portion of the propeller shaft nacelle, and wherein the propeller includes a tubular hub that constitutes an intermediate portion of said nacelle, with said nacelle being generally circular in cross-section and tapering both forwardly and rearwardly towards its ends.

14. A marine propulsion assembly comprising:

(a) a resilient drive wheel;

(b) a propeller including a hub, an annular rim spaced outwardly from and surrounding said hub, and blades interconnected between said hub and said rim, with said rim being exposed to, and wetted by, the water in which the propeller is submerged;

(c) means mounting said propeller for rotation with its rim pressed tightly against said drive wheel, said means including a support shaft on which said hub is journaled, with said blades and said hub serving to structurally support said rim and to transmit the radial loading imposed on it by said drive wheel inwardly to said support shaft; and

(d) engine means for rotating said drive wheel, with it in turn frictionally driving the propeller.

15. A marine propulsion and steering assembly comprising:

(a) a fixed position drive wheel having a fixed axis of rotation and a resilient tire;

(b) a propeller including an annular rim;

(c) means mounting said propeller for rotation about a center axis in a plane that is spaced from and generally parallel to said fixed axis, and for pivotal movement relative to said drive wheel about a fixed axis that is substantially perpendicular to, and intersects both, the center axis of said propeller and the fixed axis of said drive wheel, and with said annular rim pressed tightly against said tire;

(d) engine means for rotating said drive wheel, with it in turn frictionally driving the propeller; and

(e) steering means for pivotally moving said propeller about said perpendicular axis and relative to said fixed position drive wheel.

16. A marine propulsion assembly comprising:

(a) a resilient drive wheel, at least a peripheral portion of which runs exposed to the water;

(b) a submerged propeller including an unenclosed annular rim that is fully exposed to, and completely wetted by, the water;

(c) means mounting said propeller for rotation with
its rim pressed tightly against said peripheral portion of said drive wheel, with the contact of said rim pressed against said peripheral portion of said drive wheel occurring in a water exposed region; and
(d) engine means for rotating said drive wheel, so that it in turn frictionally drives the propeller.

17. In combination with a power boat equipped with an inboard drive means including a drive shaft protruding through an opening in a wall of the boat, an outdrive assembly comprising:
(a) a drive wheel secured to said drive shaft;
(b) a housing at least partially enclosing said drive wheel, and including an opening through which a peripheral portion of the wheel projects, with said peripheral portion being exposed to and normally wetted by the water;
(c) a fully submerged propeller including an unenclosed annular rim that is completely exposed to, and completely wetted by, the water; and
(d) means mounting said propeller for rotation with its rim pressed tightly against said peripheral portion of said drive wheel, so as to be frictionally driven thereby.

18. A marine propulsion assembly comprising:
(a) a fixed position drive wheel having a resilient tire, at least a portion of which is wetted by the water;
(b) a changeable position propeller including an unenclosed, substantially fully submerged, annular rim;
(c) means mounting said propeller for movement in position relative to said fixed position drive wheel, and for rotation with its rim pressed tightly against said tire; and
(d) engine means for rotating said drive wheel, with it in turn frictionally driving the propeller.

19. A marine propulsion assembly according to claim 18, wherein said propeller mounting means permits pivotal movement of said propeller between a use position in which the annular rim contacts said tire and a retracted position situated rearwardly and above said use position.

20. A marine propulsion assembly according to claim 18, wherein said propeller mounting means includes a resilient means normally urging said propeller towards said drive wheel, and said rim into contact with said tire, but permitting movement of said propeller radially away from said drive wheel when subjected to a force in that direction.

21. A marine propulsion assembly comprising:
(a) a fixed propeller shaft including forwardly opening passageway means therein for the reception of ram water, and including generally radial outlet openings intermediate its length;
(b) water lubricated bearing means concentrically surrounding the shaft in the region of the outlet openings; and
(c) a propeller having a hub concentrically surrounding and supported by the water lubricated bearing means.

22. The combination of claim 21, wherein the water lubricated bearing means constitute both thrust and radial bearings.

23. The combination of claim 21, wherein the propeller shaft is supported at its front end by a first generally vertical member, is supported at its rear end by a second generally vertical member, and wherein the two vertical members are rigidly connected together above the propeller by a rigid support member that bridges between and is rigidly secured to both.

24. A marine propulsion assembly comprising:
(a) an elongated propeller post carrying a propeller shaft at its lower end projecting forwardly from said post;
(b) a propeller including blade means and an annular drive rim surrounding said blade means;
(c) means mounting said propeller onto said shaft, entirely forwardly of said post, for rotation about said shaft;
(d) means for mounting said propeller post onto a boat such that it is substantially vertically oriented; and
(e) drive wheel means situated entirely forwardly of said post, and directly contacting and driving the said drive rim of the propeller.

25. The combination of claim 24, further including means supporting said drive means on said boat independently of said post.

26. The combination of claim 25, further including means mounting said propeller and the propeller carried thereby for sideways pivotal movement about a generally vertical axis.

27. In combination with a power boat equipped with a wall and an inboard drive means, an outdrive assembly comprising:
(a) a drive shaft coupled at its forward end to said inboard drive means and projecting outwardly through an opening in said wall;
(b) an outboard propeller;
(c) means sealing the region where the drive shaft extends through said wall;
(d) means mounting said propeller for rotation about a center axis, said means including an elongated propeller shaft, and water lubricated thrust and radial bearing means concentrically surrounding said shaft and supporting the propeller, said bearing means being exposed to water;
(e) water lubricated, outboard drive train means drivingly connecting said drive shaft to said propeller, said drive train means including engaged water wetted surfaces; and
(f) a housing upwardly and laterally enclosing the portion of said drive train means above said propeller, said housing having a downwardly facing opening directly above said propeller, enabling propeller thrown water to enter the housing and wettingly engage the portion of the drive train means therein.

28. The combination of claim 27, wherein said wall of the power boat is the transom thereof, and said housing is stationarily affixed to said transom.

29. The combination of claim 27, wherein the propeller mounting means is arranged to permit decoupling of the propeller from the portion of the drive train means within the housing substantially at the downwardly facing opening of the housing.

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