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(54) **ELECTRIC MARINE SURFACE DRIVE**

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ABSTRACT

A marine articulated surface drive propulsion system is provided with a housing construction that allows the direct application of an electric motor for power onto the drive structure. Alternatively, it can include a power transmitting element for reducing the rate of rotation or the position of the motor shaft with respect to the propeller shaft. The drive can be retrofitted to existing boat hulls and does not require a dedicated hull. The electric motor can be fitted to the surface drive housing on the inside of the transom. It is contemplated that an electric motor with very small dimensions can be mounted in the drive thrust tube and ball socket, eliminating the need for U joints. Notably, if the propeller is left free wheeling it becomes the propulsor for the electric motor to become a generator and recharge the batteries.

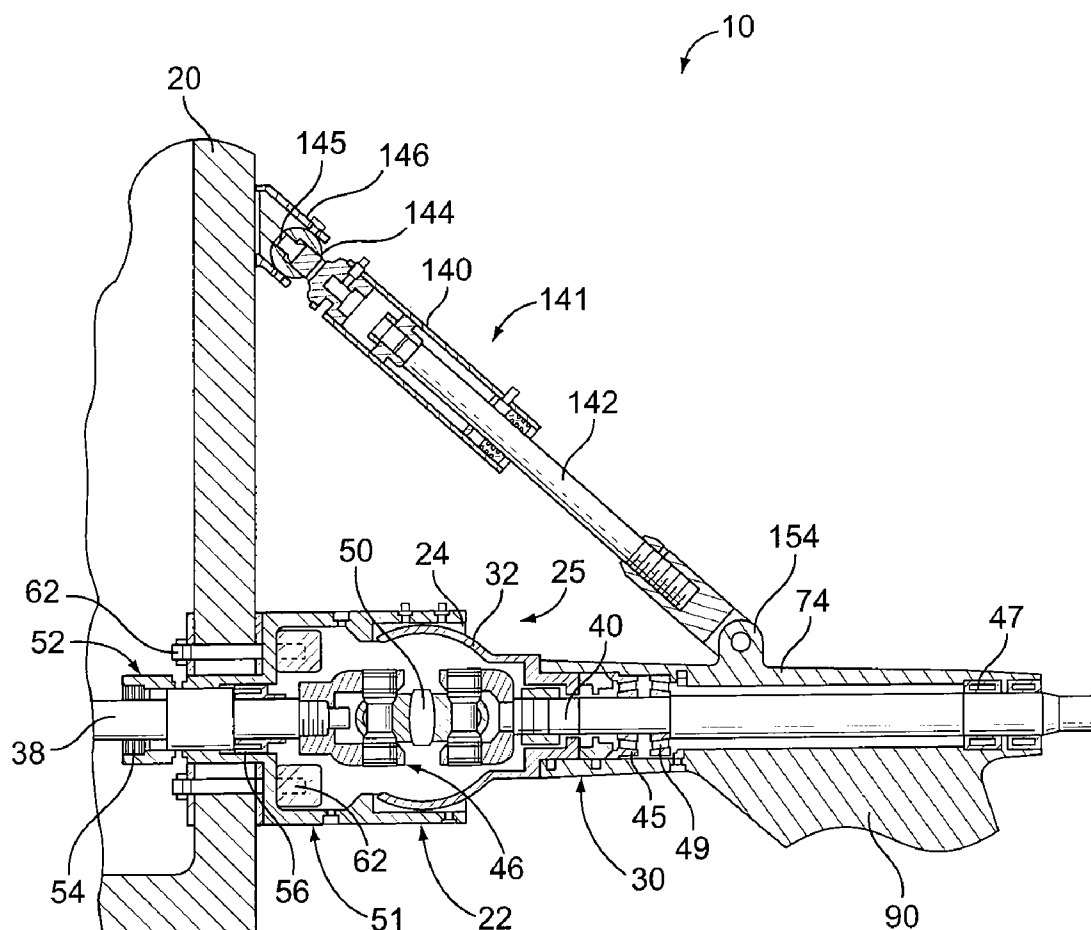


FIG. 1

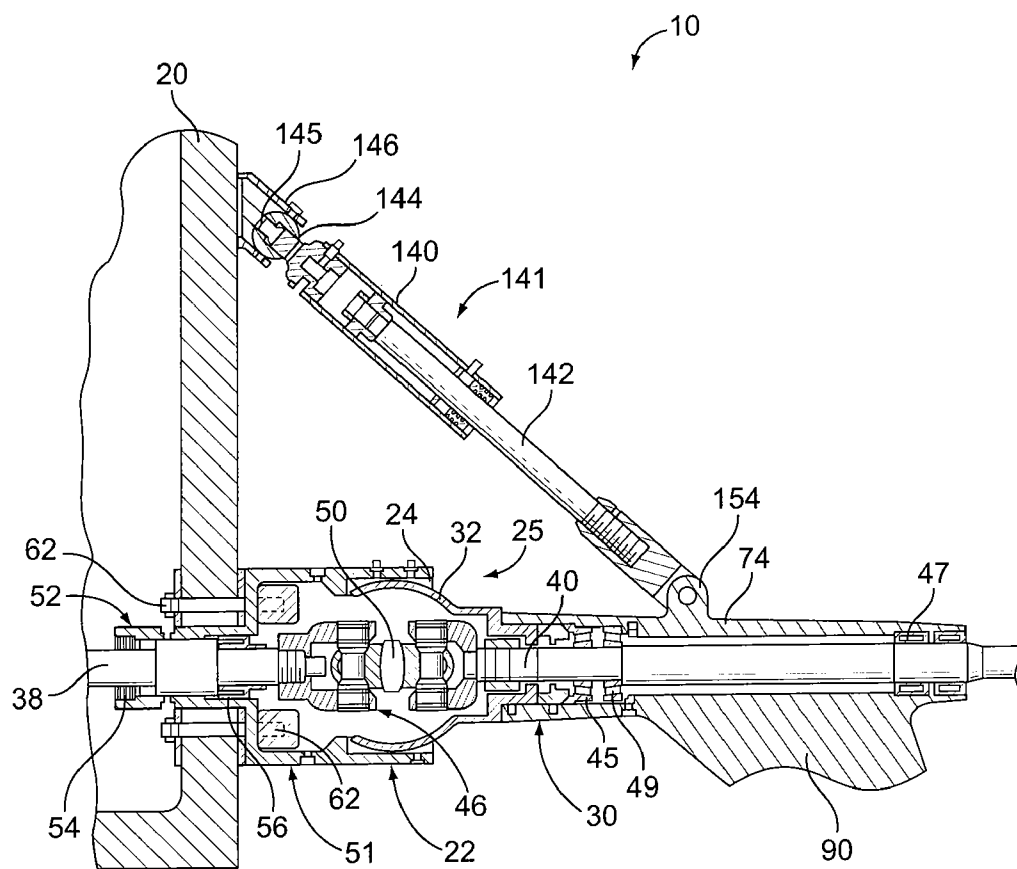


FIG. 2

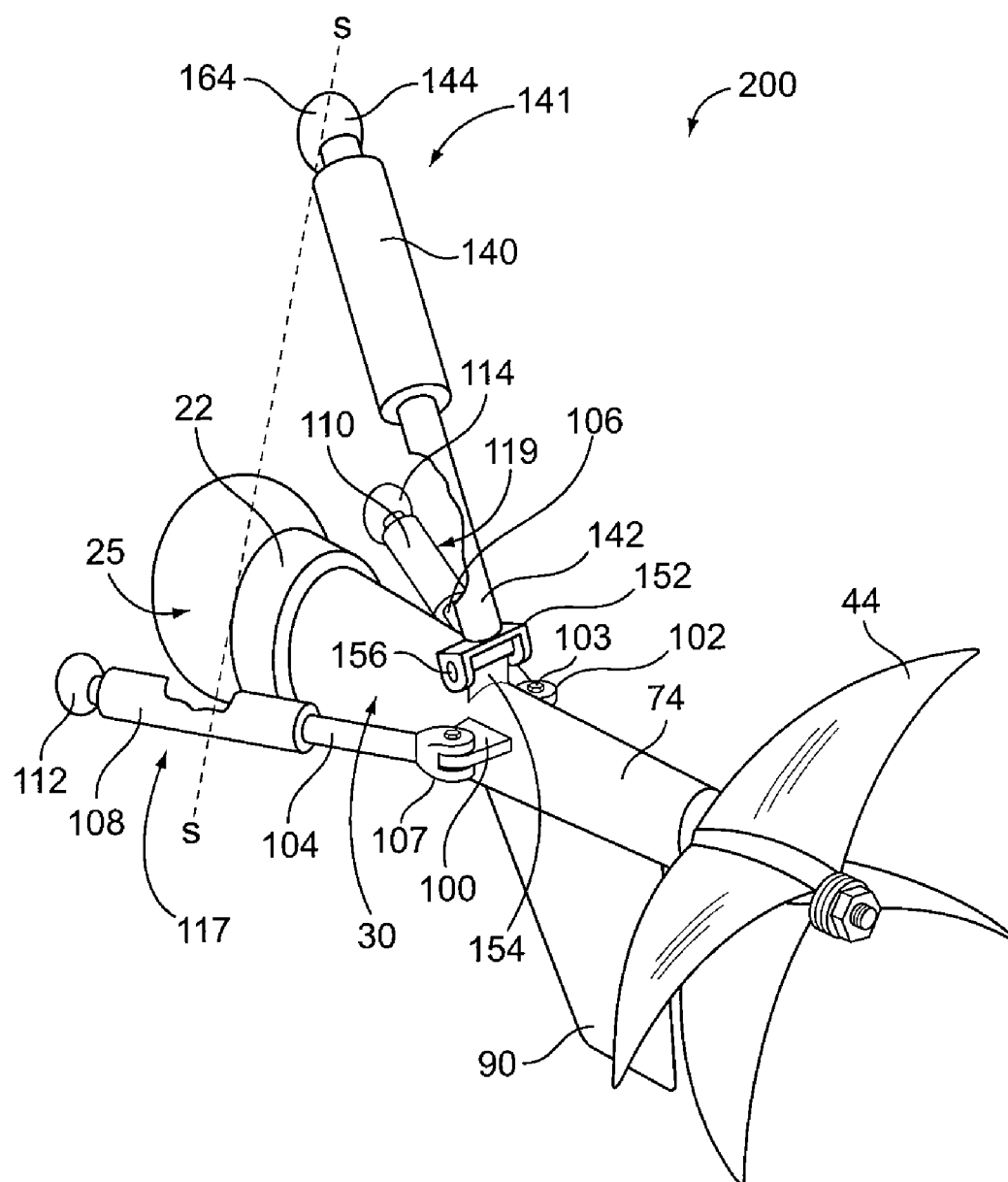


FIG. 3

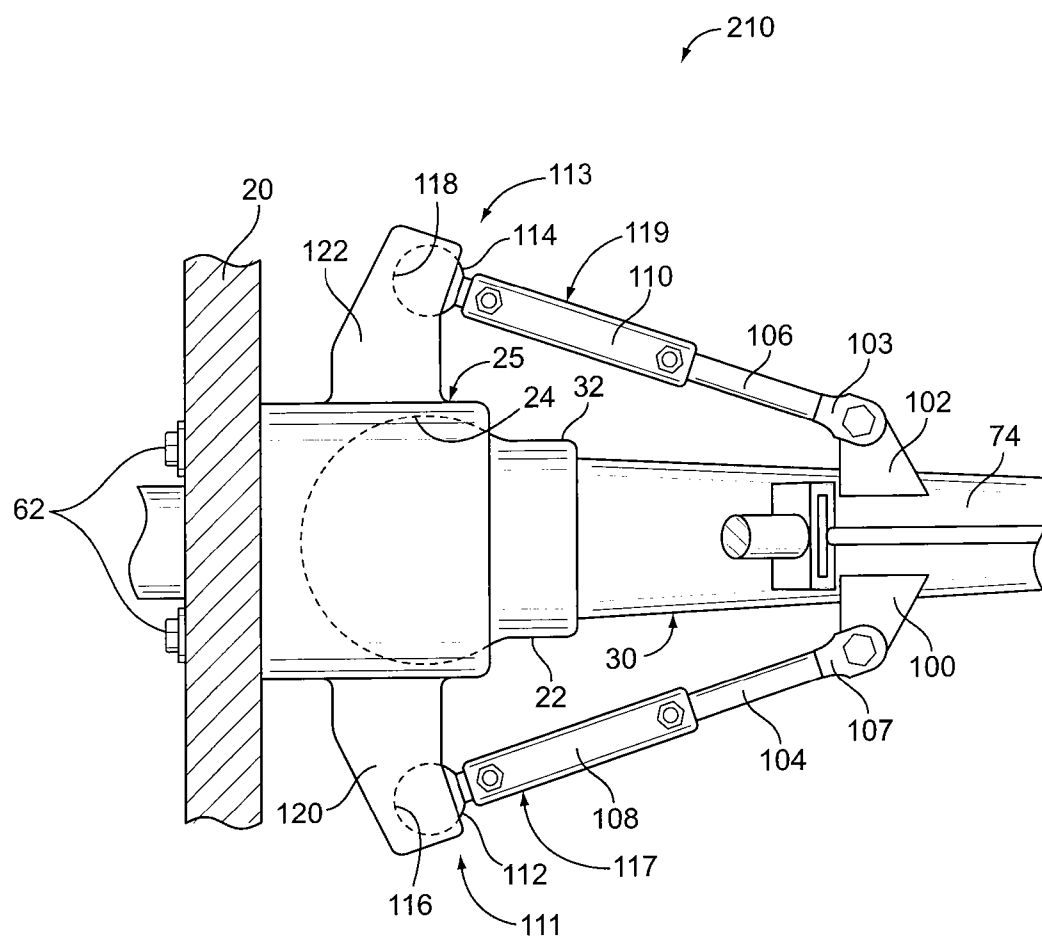


FIG. 4

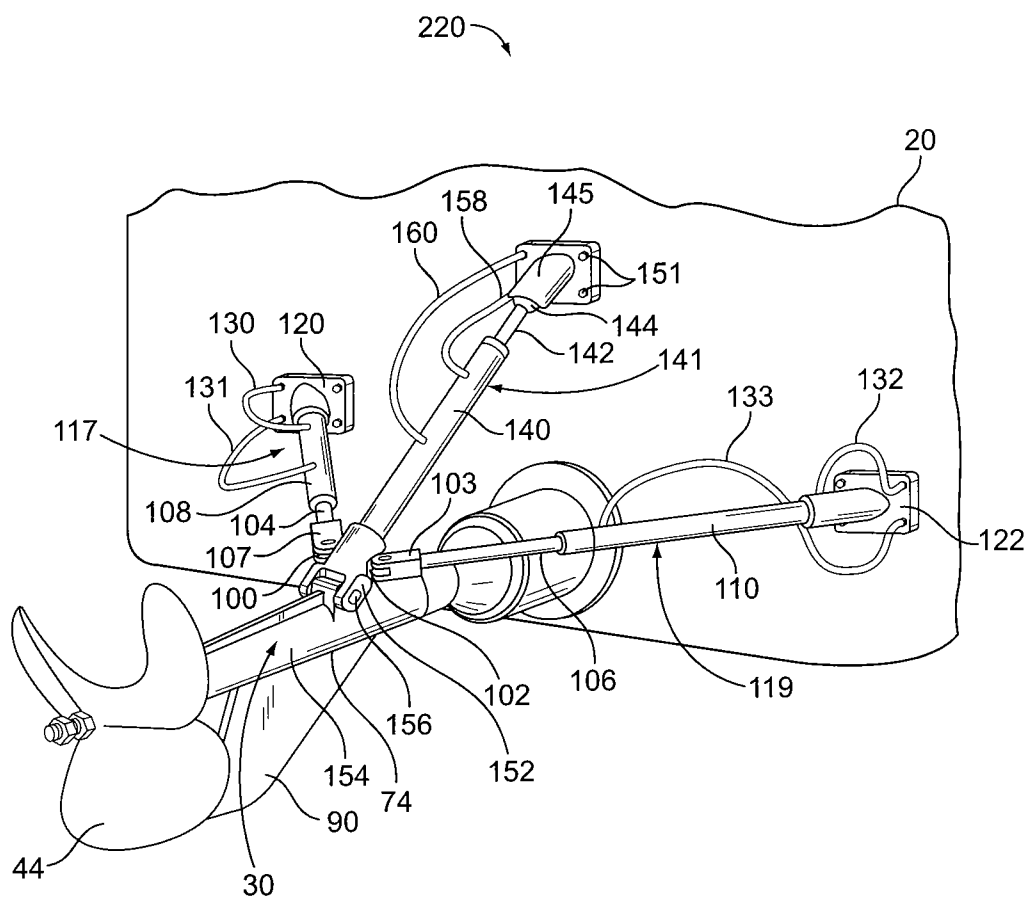


FIG. 5

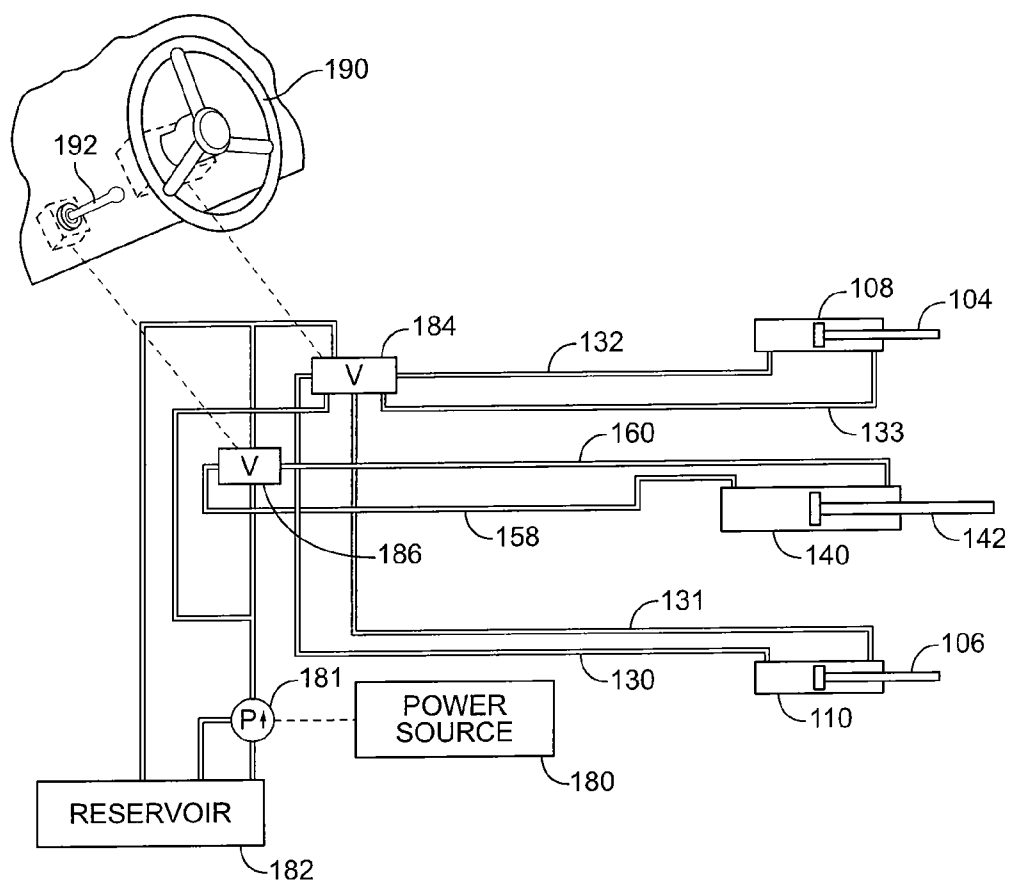


FIG. 6

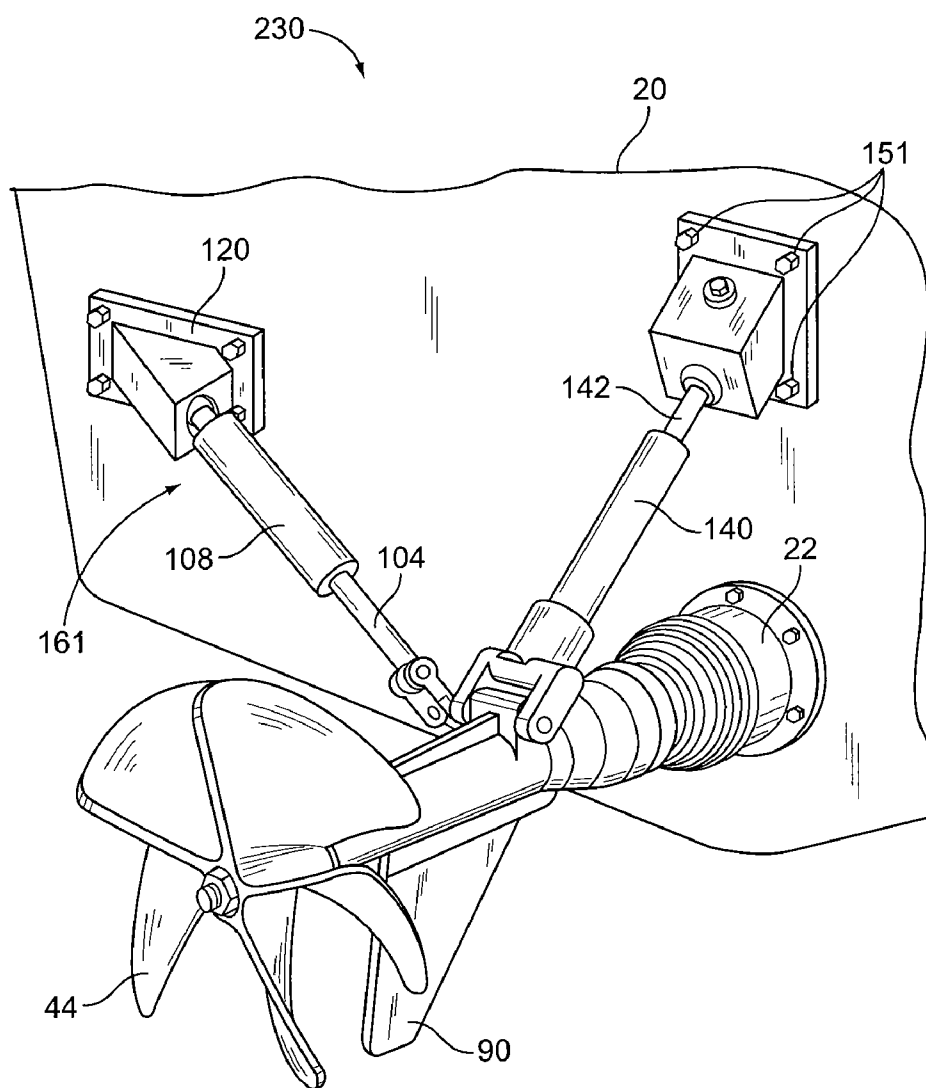


FIG. 7

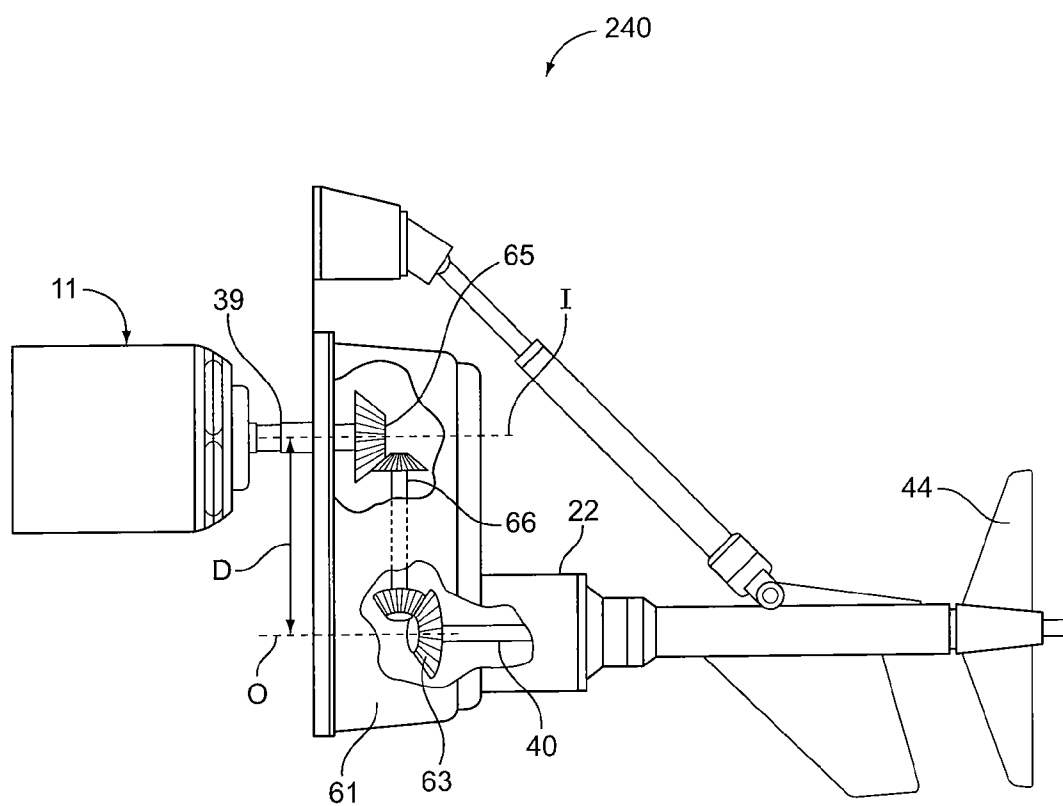


FIG. 8

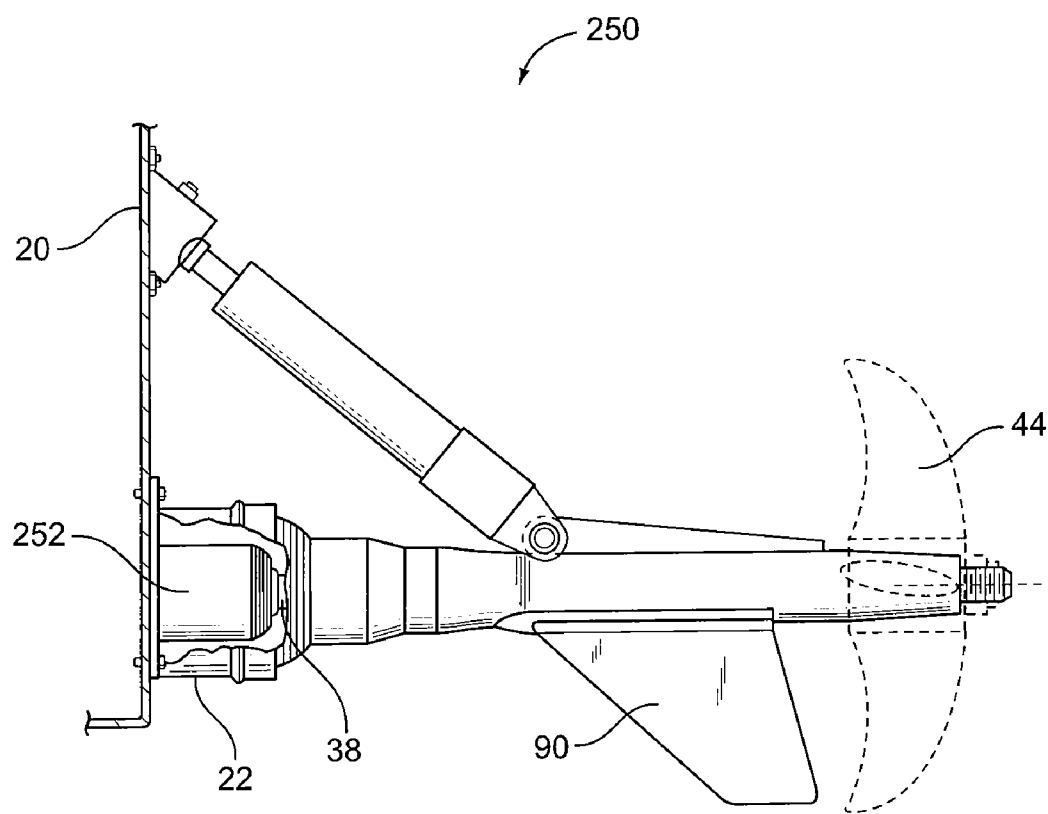


FIG. 9

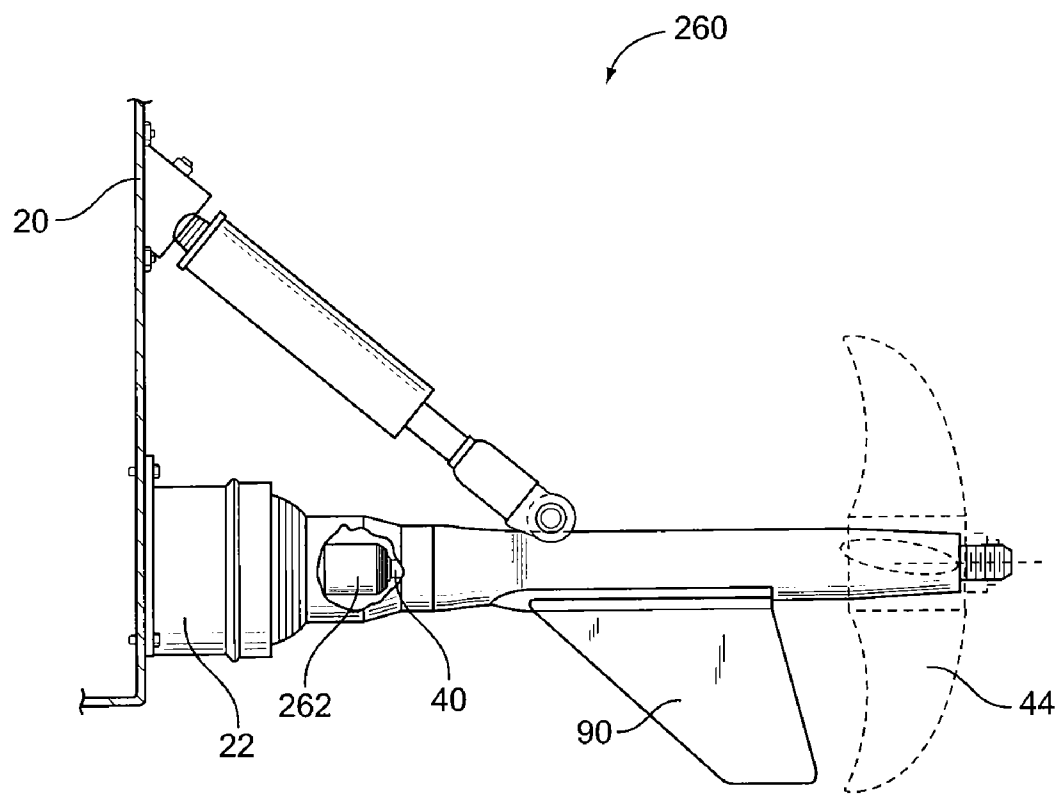


FIG. 10

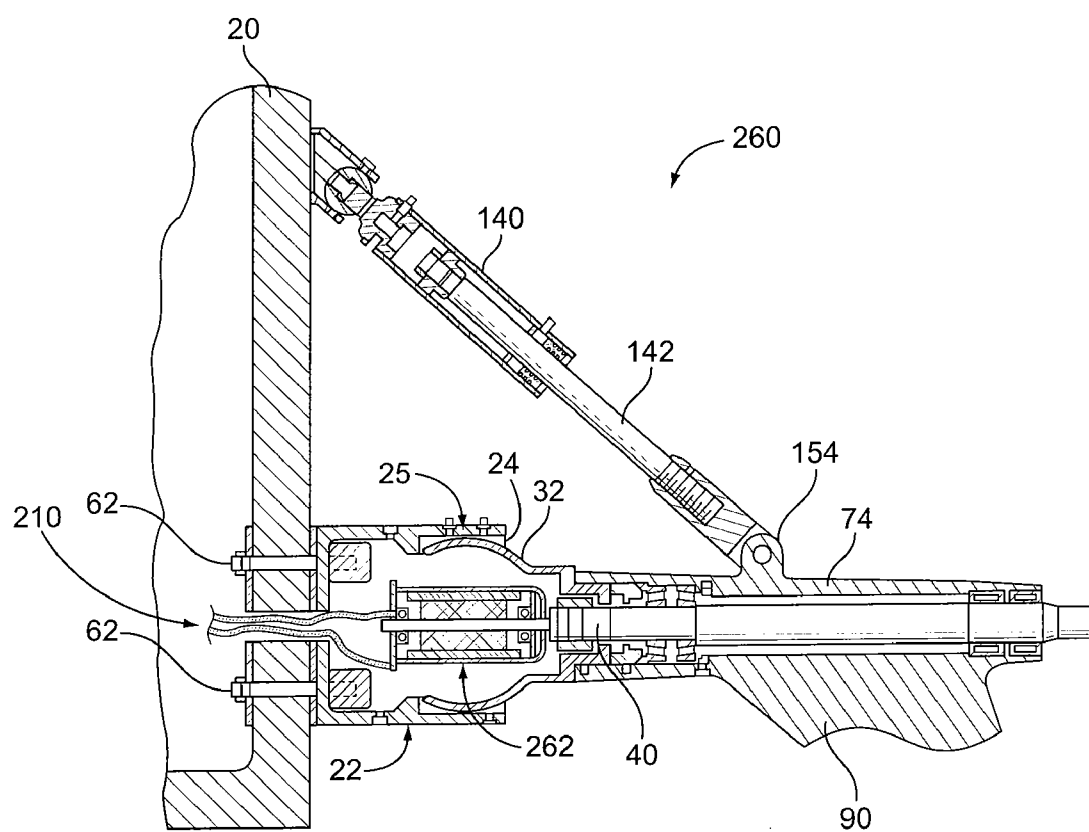


FIG. 11

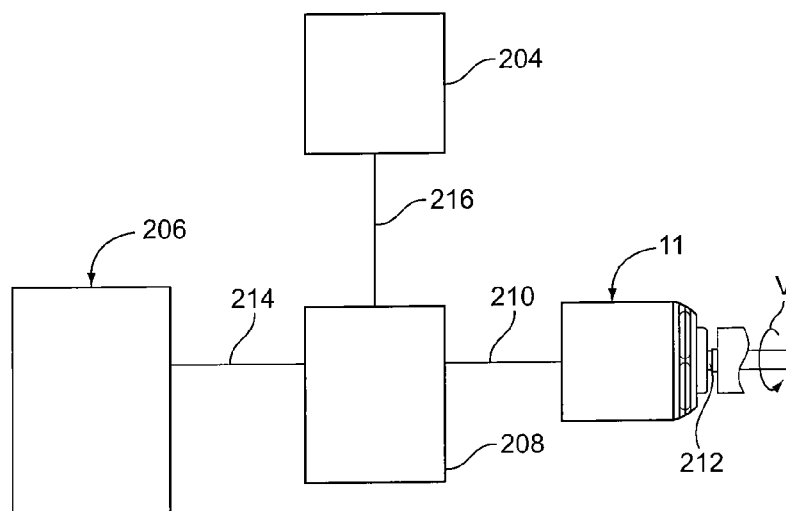


FIG. 12

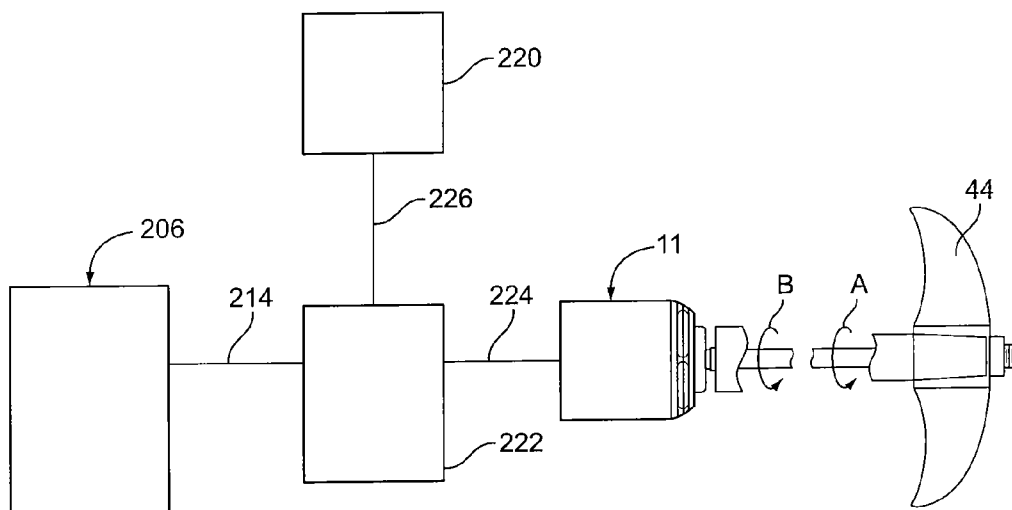


FIG. 13

ELECTRIC MARINE SURFACE DRIVE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention pertains to a marine propulsion system, and more particularly the present invention pertains to improvements to an environmentally friendly surface drive marine propulsion system.

[0003] 2. Discussion of the Related Art

[0004] In light of numerous environmental concerns, vehicles that can be powered with electrical power instead of relying on internal combustion engines are becoming increasingly popular. To date, the most prevalent commercialized examples of this trend are found in the automobile industry.

[0005] Some efforts have been made to utilize electric power drive technologies in the marine industry, but none that incorporate surface drives. Surface drives of all configurations have existed for some time, see, e.g., U.S. Pat. No. 4,645,463 to Arneson, which is expressly incorporated by reference herein.

[0006] The use of an electrical motor as the power source to the propeller has also existed, especially in naval vessels. However, the most prevalent marine examples of electric motor usage have been implemented in hybrid electric-combustion systems in the largest of marine vessels and in electric trolling motors for small vessels, but none of these marine vehicles incorporate an electric motor powering a surface drive.

[0007] Large pleasure boats or other boats may operate at lower speeds to avoid wakes and noise when at or near marinas, other mooring locations, or when traversing a no-wake designated portion of a waterway. Importantly, electric motors are more fuel efficient than combustion engines at lower speeds and benefit from reduced noise and non-existent exhaust emission when compared to combustion engines as well.

[0008] It is further noted that in various jurisdictions, anti-idling rules and regulations are being proposed and implemented for boats and other watercraft. Some jurisdictions are proposing and implementing rules and regulations that prohibit the use of internal combustion engines, or establish maximum horsepower ratings for internal combustion engines, for certain portions of the waterways in these jurisdictions.

[0009] The current surface drive systems fail to provide a solution to the problem of fuel overconsumption by and emissions from internal combustion engine powered boats. Known surface drives are driven by internal combustion engines which are both heavy and noisy.

[0010] A green solution was desired that would create less environmental pollution in the form of decreased noise and exhaust emission and improved fuel efficiency.

SUMMARY OF THE INVENTION

[0011] The present invention provides a marine surface drive system that yields reduced noise and air pollution emissions utilizing an engine that is an electric motor. In some embodiments the electric motor can be configured as a generator.

[0012] In recent years battery technology has developed rapidly to the point where the stored energy densities of some batteries make electric propulsion of marine vessels possible. Further, advances in semiconductor switching technology

enable numerous electric motor improvements, such as reduced size, that would not have been possible in the past. The propulsion power of the present invention is provided by an electric motor that can be mounted directly and integrally to the inside housing of the surface drive system. Alternatively, there could be reduction gearing between the electric motor and the surface drive input shaft. It is contemplated that when technology will allow significantly reduced electric motor dimensions, the electric motor can be mounted in the socket ball of the surface drive thrust tube eliminating the coupling having universal joints.

[0013] The electric motor may be inboard or outboard. The electric motor may directly turn the propeller at the same rate of revolutions per minute as the shaft of the electric motor. In another preferred embodiment, the electric motor may be connected to a transmission wherein the revolutions per minute of the motor are reduced such that the propeller turns at a slower RPM than the shaft of the electric motor.

[0014] Accordingly, it is an object of the present invention to provide an electric marine surface drive system that can propel a boat with an electric motor, preferably for an extended period of time. Preferably, the marine propulsion system will take advantage of new battery and electric motor technology, as well as the anticipated introduction of cost effective fuel cells as energy sources for marine propulsion systems. Another object of this invention is to provide a marine propulsion system that is highly compact, flexible as to where it is mounted and still highly efficient and quiet. Thus, to the preferred embodiments provide an electric marine surface drive system that can be installed in an engine compartment which is smaller or substantially the same size as a typical engine compartment that houses a conventional internal combustion engine power train system. It is also an object of this invention to offer an integral electric propulsion system which may act as a generator and recharge its batteries.

[0015] According to a preferred embodiment, a surface drive for a marine vehicle includes a support housing and at least one propeller wherein a portion of the propeller is above a water surface thereby substantially reducing underwater drag. In addition, the surface drive has at least one electric motor coupled to at least one propeller, the motor including a motor control device for actuating the electric motor and selecting a electric motor speed and a rotation direction. Further, at least one shaft that couples the electric motor to the propeller, and a shaft carrier are provided, wherein at least a portion of the at least one shaft extends through the shaft carrier.

[0016] In another embodiment, at least one electric motor is mounted within the support housing.

[0017] According to a further aspect of this embodiment, at least one shaft includes a drive shaft and a propeller shaft, and the electric motor is attached to the drive shaft that is coupled to the propeller shaft. Moreover, at least one propeller is coupled to the propeller shaft.

[0018] In another aspect of this embodiment, the drive further includes an articulated trimming arm having an adjustable length and at least one movable joint at an arm end with an arm forward end connecting to the marine vehicle and an arm rear end connected to about the top of the shaft carrier such that the arm is substantially parallel to and above a shaft long axis. The articulated trimming arm may be lengthened or shortened thereby rotating the ball joint substantially down-

wards and upwards, respectively, thereby controlling a portion of the propeller that is submerged and a depth of submersion.

[0019] In yet another aspect of this embodiment, the drive further includes at least one articulated steering arm having an adjustable length and at least one movable joint at an arm end with an arm rear end connecting to about the side of the shaft carrier and an arm forward end connected forward of a pivot point of the ball joint so that the arm forward end is at least substantially horizontally displaced from the shaft long axis. In this case, the articulated steering arm may be lengthened or shortened thereby rotating the ball joint to either side controlling the horizontal angle of the propeller shaft relative to the marine vehicle for steering.

[0020] According to another aspect of this embodiment, the shaft includes at least a forward drive shaft and a propeller shaft with a power transmission unit there between. The power transmission transmits rotational movement from the forward drive shaft to the propeller shaft with at least one of the following: a reduced rotational speed of the propeller shaft or a displacement between the rotational axes of the forward drive shaft and the propeller shaft.

[0021] According to another preferred embodiment, a surface drive for a marine vehicle includes a support housing securably mounted to the marine vehicle. Additionally, the surface drive has at least one electric motor by which the at least one propeller is drivable. The motor having a control device for actuating the electric motor and selecting a electric motor speed and a rotation direction, and an electric power source. The drive also includes at least one propeller, wherein the position of the propeller with respect to the marine vehicle is vertically controllable such that a portion of the propeller may be above a water surface thereby substantially reducing underwater drag. In addition, the position of the propeller with respect to the marine vehicle is horizontally controllable to steer the direction of the marine vehicle. In addition, the drive has at least one shaft having a forward end connected to the electric motor, a rear end connected to the propeller, and a shaft carrier.

[0022] In another aspect of this embodiment, the drive of the electric motor is securably mounted in one of a group including a support housing and the shaft carrier.

[0023] These and other aspects and objects of the present invention will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following description while indicating preferred embodiments of the present invention is given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Preferred exemplary embodiments of the invention are illustrated in the accompanying drawings in which like reference numerals represent like parts throughout, and in which:

[0025] FIG. 1 is a side elevational view of an embodiment of the marine surface drive apparatus of the present invention;

[0026] FIG. 2 is a sectional side view of a section of the embodiment of FIG. 1;

[0027] FIG. 3 is a perspective view of another embodiment of the marine surface drive apparatus of the current invention having steering cylinders;

[0028] FIG. 4 is a fragmentary top plan view of another embodiment of the marine surface drive apparatus of the current invention having steering cylinders mounted to the support casing;

[0029] FIG. 5 is a perspective view of another embodiment of the marine surface drive apparatus of the current invention having steering cylinders mounted to the transom of the marine vessel and showing hydraulic fluid conduits;

[0030] FIG. 6 is a schematic view of the steering and trim control system for the apparatus of the preferred embodiments;

[0031] FIG. 7 is a perspective view of another embodiment of the marine surface drive apparatus of the current invention having a single steering cylinder mounted to the transom of the marine vessel;

[0032] FIG. 8 is a side elevational view of another embodiment of the marine surface drive apparatus of the present invention having a power transmission apparatus;

[0033] FIG. 9 is a side elevational view of another embodiment of the marine surface drive apparatus of the present invention having an internal electric motor;

[0034] FIG. 10 is a side elevational view of another embodiment of the marine surface drive apparatus of the present invention having an integral electric motor within the housing ball joint;

[0035] FIG. 11 is a vertical sectional side view taken along the long axis of the apparatus of FIG. 9 showing the mounting of the electric motor with the housing ball joint;

[0036] FIG. 12 is a block diagram showing the electric motor control system according to a preferred embodiment; and

[0037] FIG. 13 is a block diagram showing the electric charging system according to a preferred embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] With reference to the drawings, and particularly to FIGS. 1 and 2, there is shown a first embodiment of the electric marine surface drive apparatus 10 adapted for use with a marine vehicle having a transom 20 upon which the apparatus 10 is mounted or integrated. Drive 10 includes a support housing, such as the tubular support casing 22 secured to transom 20, having at its rear end a ball socket 24 (FIG. 2) preferably formed of a synthetic plastic, such as nylon. A propeller shaft 40 is journaled by bearings 45, 47, 49 in propeller shaft carrier 30. The rear end of the propeller shaft 40 receives propeller 44, for example a conventional surface-piercing propeller. The propeller shaft carrier 30, for example a tubular propeller shaft carrier, comprises a ball 32 at its front end which is pivotally mounted in the ball socket 24 (collectively, a ball joint 25) as shown in FIG. 2, and a propeller shaft housing 74 connected to the ball socket 24 at the shaft carrier 30 rear end. The propeller shaft housing is preferably frusto-conical. Ball joint 25 allows the angle of the propeller 44 relative to the marine vehicle to be changed to either affect the marine vehicle speed or direction.

[0039] A forward drive shaft 38 is journaled by bearings 54, 56 in support casing 22. The forward drive shaft 38 comprises a front end connected to an inboard electric motor 11 as shown in FIG. 1, and a rear end connected to a universal joint 46, preferably a conventional double universal or constant

speed joint, as shown in FIG. 2. The electric engine 11 may be any conventional electric motor such as any appropriate horsepower AC or DC electric motor, or for example, an HTS technology super conductor motor.

[0040] The universal joint 46 couples the rear of the drive shaft 38 with the front of propeller shaft 40 such that the propeller shaft 40 rotates at the same rate as the forward drive shaft 38 while allowing an angular displacement of the propeller shaft long axis from the drive shaft long axis in one or more directions. This angular displacement occurs when the ball joint 25 rotates or pivots, which is to say that ball 32 pivots relative to ball socket 24 about pivot point 50. In other words, the center of universal joint 46 corresponds to the pivot point 50.

[0041] Support housing 22 has a rear main body 51 having an open rear end. The rear main body 51 is integral or connected to a front end body 52. Front end body 52 extends through transom 20 and has an open front end. Preferably both the rear main body 51 and the front end body 52 are substantially cylindrical as shown in FIGS. 1 and 2. Support casing 22 is rigidly affixed to the rear surface of transom 20 by a plurality of bolts 62. A stabilizing fin 90 is secured or integral to propeller shaft housing 74. The stabilizing fin 90 acts to help counter the lift of the propeller shaft while the boat is turning.

[0042] In addition, embodiment 10 of FIGS. 1 and 2 shows trim assembly 141 for vertical control (i.e. raising and lowering the drive) to control the portion of the propeller that is above the water thereby controlling drag and thrust. Trim assembly 141 is pivotally attached to housing 74 by vertical ear 154 and bracket 152, which is affixed to the end of piston rod 142 and shiftably coupled to of power-operated hydraulic trim cylinder 140. Trim assembly 141 has ball joint member 144 for insertion into ball receiving socket 145 contained within socket assembly 146 affixed to the transom 20 with bolts 151.

[0043] Referring to FIG. 3, another preferred embodiment 200 has steering assemblies 117, 119 which attach to ears 100, 102 extending laterally from the housing 74. The ears 100, 102 are pivotally connected to brackets 107, 103 affixed to the ends of piston rods 104, 106 shiftably coupled to power-operated hydraulic steering cylinder 108, 110, respectively. Steering assemblies 117, 119 have ball joint members 112, 114 for insertion into ball receiving sockets (not shown) affixed to the transom. In addition, embodiment 200 of FIG. 3 has a trim assembly such as trim assembly 141 first shown in FIGS. 1 and 2, for raising and lowering the drive. Trim assembly 141 is pivotally attached to housing 74 by vertical ear 154 and bracket 152, which is affixed to the end of piston rod 142 and shiftably coupled to power-operated hydraulic trim cylinder 140. Trim assembly 141 has ball joint member 144 for insertion into ball receiving socket affixed to the transom. The operation of the trim assembly 141 rotatably raises the drive when piston rod 142 is retracted into hydraulic cylinder 140 and rotatably lowers the drive when piston rod 142 is extended from hydraulic cylinder 140 with both movements primarily rotating the ball joint 25.

[0044] Referring to FIG. 4, preferred embodiment 210 has two articulated steering assemblies 117, 119 with adjustable length such as hydraulic steering cylinders 108, 110. The steering arms 117, 119 have respective movable ball and socket joints 111, 113. The forward ends of steering cylinders 108, 110 are provided with ball pivots 112 and 114, respectively, rotatably received within complimentary recesses 116

and 118 formed in a pair of mounts 120 and 122. Another aspect of this preferred embodiment is that the mounts 120, 122 may be attached or integral with support casing 22. With reference to FIG. 5, in another preferred embodiment 220 the mounts 120, 122 are secured to transom 20 rather than the support casing 22 to alleviate some stress from casing 22.

[0045] Continuing with FIG. 5, the embodiment 220 has a hydraulic system whereby the front and rear portions of steering cylinders 108 and 110 are provided with fluid conduits 130, 131 and 132, 133, respectively. The fluid conduits are in communication with conventional hydraulic steering system 190 shown in FIG. 6 described further below. Referring again to FIG. 5, an articulated trimming arm 141 has fluid conduits 158, 160 which are in communication with, for example, a conventional hydraulic trimming system 192 shown in FIG. 6.

[0046] Referring to FIG. 5, the front end of the trim cylinder 140 is provided with a ball pivot 144 pivotally received within a socket 145 of a mount secured to transom 20 by fasteners 151. The rear end of trim arm 141 is provided with a bifurcated bracket 152 which straddles an upwardly extending pad 154 rigidly affixed to the upper, intermediate portion of tube 74. A pivot pin 156 interconnects bracket 152 and pad 154. Hydraulic conduits 158 and 160 connect the front and rear ends of trim cylinder 140 with the hydraulic system shown in FIG. 6.

[0047] Referring now primarily to FIG. 6, the hydraulic system includes a conventional power source 180, coupled to a hydraulic pump 181. A reservoir 182, and conventional control valves 184 and 186 are coupled to pump 181. In one preferred embodiment, steering cylinders 108 and 110 and trim cylinder 140 are connected to valves 184 and 186, respectively, by conduits 130, 131, 132, 133, 158 and 160. Valve 184 is operatively connected to a steering wheel 190 of the boat in a conventional manner while valve 186 is operatively connected to an up-down trim lever 192 in a conventional manner. Rotation of steering wheel 190 will operate valve 184 so as to control the flow of pressurized hydraulic fluid from pump 181 to steering cylinders 108 and 110. In this manner, piston rods 104 and 106 of the steering cylinders will be concurrently extended and retracted, respectively. Referring to FIG. 3, the extension and retraction of steering cylinders 108 or 110 provide horizontal control of drive 200 by swinging propeller shaft carrier 30 laterally about a steering axis S-S which also pivots ball joint 25 laterally about axis S-S. In addition, pivot point 164 of ball pivot 144 lies on steering axis S-S such that the lateral movement about axis S-S pivots trim arm 141 laterally. In another preferred embodiment 230, there is only a single steering cylinder 161, for example, as shown in FIG. 7. In yet another preferred embodiment, valve 186 of FIG. 6 may be connected to an automated trim controller, which may be used rather than, or in addition to, the manual up-down trim lever 192 of FIG. 6.

[0048] Next, turning to FIG. 8, in another preferred embodiment, a drive 240 includes a drive shaft 38 that may be coupled to any conventional power transfer apparatus such as, for example, the power transmission unit 61 rather than coupled directly to the electric motor 11 as shown in FIG. 1. Power transmission 61 of drive 240 of FIG. 8 allows for displacement D between the input shaft 39 axis "I" and the output shaft 38 axis "O." Power transmission 61 may rotate the output shaft 38 at a reduced velocity from the input shaft 39. Still referring to FIG. 8, power transmission unit 61 of drive 240 has a gear 65 connected to the input shaft 39 and a

gear **63** connected to the rear shaft portion, wherein the gears could be spur gears, planetary gears, helical gears, herringbone gears, straight bevel gears, spiral bevel gears, hypoid gears, worm gears, and may alternatively include a chain or toothed belt drive. Electric motor **11** turns shaft **39** causing gear **65** to turn intermediate shaft **66**, which causes gear **63** to rotate output propeller shaft **40** and propeller **44**.

[0049] Electric motor **11** of the preferred embodiment may be inboard as shown in FIG. 1. In alternative embodiments, the electric motor may be outboard and contained within the support housing **22** in a position that is forward of the ball socket **24** as shown in FIG. 9. Drive **250** includes an electric motor **252** that is secured to transom **20**, either directly or indirectly.

[0050] In another alternative shown in FIGS. 10 and 11, a drive **260** includes an electric motor **262** that is positioned within support housing **22** and within ball socket **24**. In this case, electric motor **262** is free to move with respect to housing **22** as ball joint **25** is rotated, while staying rigidly affixed to propeller shaft **40**. This mounting position allows motor **262** to be connected directly or indirectly to propeller shaft **40** without an intervening universal joint **46** (FIG. 2).

[0051] Referring primarily now to FIG. 12, electric motor **11** requires an electrical power source **204**, which may comprise electrical storage devices such as batteries or capacitors; controls **206** for the speed and direction of the marine vessel; and a motor drive unit **208**. Motor drive unit **208** has connections **216** to a power source **204**, one or more control signals from motor control device **214**, and connections to the electric motor **210**. The connections to electric motor **210** comprise output motor control signals which power the electrical motor **11** to rotate electric motor shaft **212** at a commanded electric motor speed “v” having a rotational velocity and a clockwise or a counterclockwise rotation direction corresponding to forward and reverse directions commanded by speed and direction control signals from the motor control device **206**.

[0052] In another preferred embodiment the connections **210** from motor drive **208** to electric motor **11** may also include inputs indicating the velocity and direction of rotation of the electric motor **11**. Another preferred embodiment may also include one or more signals indicating the marine vessel speed and direction. Another embodiment includes a neutral setting of the motor control device **206** where no electric power is provided to the electric motor **11** thereby ceasing rotation.

[0053] Now turning to FIG. 13, in one preferred embodiment, rotation “A” of the propeller **44** by another source of power, such as water current, creates some rotation “B” in the electric motor **11**. This rotation causes the electric motor **11** to generate one or more electric currents **224** which inverter **222** utilizes to provide electric current **226** to charge the electrical power storage device **220**. In one preferred embodiment, the electric motor produces 3-phase AC currents **224**, and the inverter **222** produces a direct current **226** to charge a storage device, such as a lead-acid battery **220**. The electrical storage device **220** provides electrical power to motor **11** and, in another preferred embodiment, the power source **180** for hydraulic pump **181** (FIG. 6) has electrical power supplied by electrical storage device **220**.

[0054] It is noted that many changes and modifications may be made to the present invention without departing from the

spirit thereof. The scope of some of these changes is discussed above. The scope of others will become apparent from the appended claims.

We claim:

1. A surface drive for a marine vehicle comprising:
 - a support housing;
 - at least one propeller wherein a portion of the propeller is above a water surface thereby substantially reducing underwater drag;
 - at least one electric motor coupled to at least one propeller, the motor including a motor control device for actuating the electric motor and selecting a electric motor speed and a rotation direction; and
 - at least one shaft that couples the electric motor to the propeller, and a shaft carrier, wherein at least a portion of the at least one shaft extends through the shaft carrier.
2. The drive of claim 1, wherein at least one electric motor is mounted within the support housing.
3. The drive of claim 1, wherein at least one electric motor is mounted within the marine vehicle.
4. The drive of claim 1, wherein the at least one shaft includes the electric motor is securably attached to the propeller shaft.
5. The drive of claim 1, wherein the at least one shaft includes a drive shaft and a propeller shaft, and wherein the electric motor is attached to the drive shaft that is coupled to the propeller shaft, and wherein the at least one propeller is coupled to the propeller shaft.
6. The drive of claim 1, further comprising a ball joint within the support housing whereby an angle of the propeller with respect to the marine vehicle may be changed.
7. The drive of claim 6, wherein the electric motor is securably mounted within the ball joint.
8. The drive of claim 6, further comprising an articulated trimming arm having an adjustable length and at least one movable joint at an arm end with an arm forward end connecting to the marine vehicle and an arm rear end connected to about the top of the shaft carrier such that the arm is substantially parallel to and above a shaft long axis whereby the articulated trimming arm may be lengthened or shortened thereby rotating the ball joint substantially downwards and upwards, respectively, thereby controlling a portion of the propeller that is submerged and a depth of submersion.
9. The drive of claim 6, further comprising at least one articulated steering arm having an adjustable length and at least one movable joint at an arm end with an arm rear end connecting to about the side of the shaft carrier and an arm forward end connected forward of a pivot point of the ball joint so that the arm forward end is at least substantially horizontally displaced from the shaft long axis, whereby the articulated steering arm may be lengthened or shortened thereby rotating the ball joint to either side controlling the horizontal angle of the propeller shaft relative to the marine vehicle for steering.
10. The drive of claim 9, wherein a forward end of the articulated steering arm forward end is securably mounted to the marine vehicle.
11. The drive of claim 9, wherein the forward end of the articulated steering arm forward end is securably mounted to about the side of the support housing and forward of a ball joint pivot point.
12. The drive of claim 9, further comprising a second articulated steering arm.

13. The drive of claim **6**, wherein the shaft comprises at least a forward drive shaft and a propeller shaft with a coupling therebetween whereby rotational movement from the drive shaft portion is transmitted to the propeller shaft portion while allowing for at least some angular displacement between a long axis of the drive shaft and a long axis of the propeller shaft.

14. The drive of claim **13**, wherein the coupling is a universal joint.

15. The drive of claim **1**, wherein the shaft comprises at least a forward drive shaft and a propeller shaft with a power transmission unit therebetween wherein the power transmission transmits rotational movement from the forward drive shaft to the propeller shaft with at least one of the following: a reduced rotational speed of the propeller shaft or a displacement between the rotational axes of the forward drive shaft and the propeller shaft.

16. The drive of claim **15**, wherein the power transmission unit comprises at least one gear connected to the forward drive shaft and at least one gear connected to the propeller shaft, wherein the gears are selected from at least one of a group of spur gears, planetary gears, helical gears, herringbone gears, straight bevel gears, spiral bevel gears, hypoid gears, and worm gears.

17. The drive of claim **1**, further comprising a motor drive connected to the motor control device, an electric power source, and at least one electric motor wherein the motor drive provides power to the electric motor from the electric power source based on a speed control signal and a direction control signal from the motor control device.

18. The drive of claim **1**, further comprising an power conversion device connected to the motor control device, and an electric power storage device, wherein the inverter provides power to the electric power storage device from the electric motor when it is not being driven, but is generating an electric current.

19. A surface drive for a marine vehicle comprising:

a support housing securably mounted to the marine vehicle;

at least one electric motor by which the at least one propeller is drivable, the motor having a control device for actuating the electric motor and selecting a electric motor speed and a rotation direction; and

an electric power source;

at least one propeller wherein the position of the propeller with respect to the marine vehicle is vertically controllable such that a portion of the propeller may be above a water surface thereby substantially reducing underwater drag; and wherein the position of the propeller with respect to the marine vehicle is horizontally controllable to steer the direction of the marine vehicle; and

at least one shaft having a forward end connected to the electric motor, a rear end connected to the propeller, and a shaft carrier wherein the shaft extends therethrough.

20. The drive of claim **19**, wherein the electric motor is securably mounted in one of a group including a support housing and the shaft carrier.

* * * * *