

July 3, 1962

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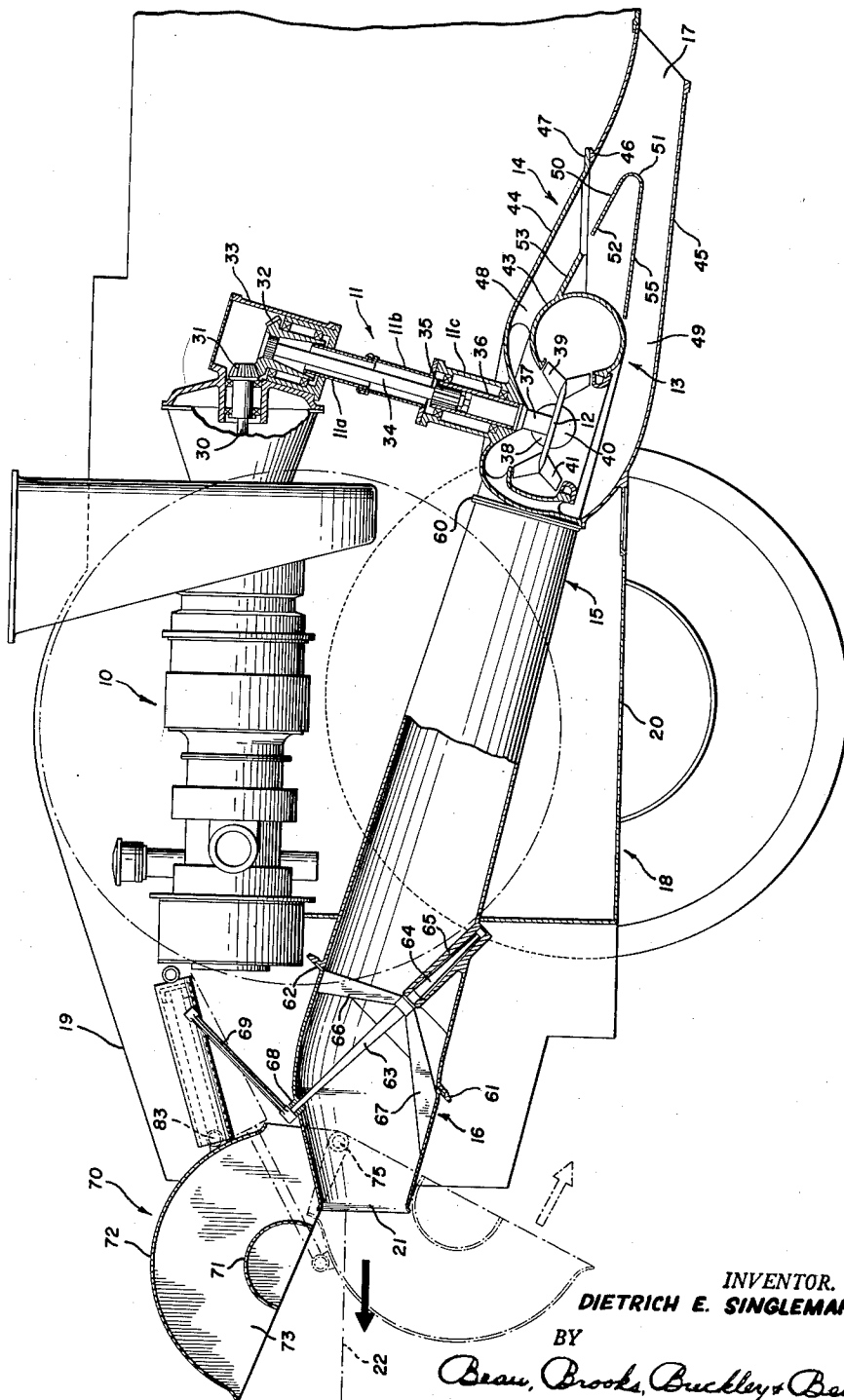
3,041,831

JET PROPELLED AQUATIC VEHICLE

Filed Sept. 12, 1960

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FIG. 1



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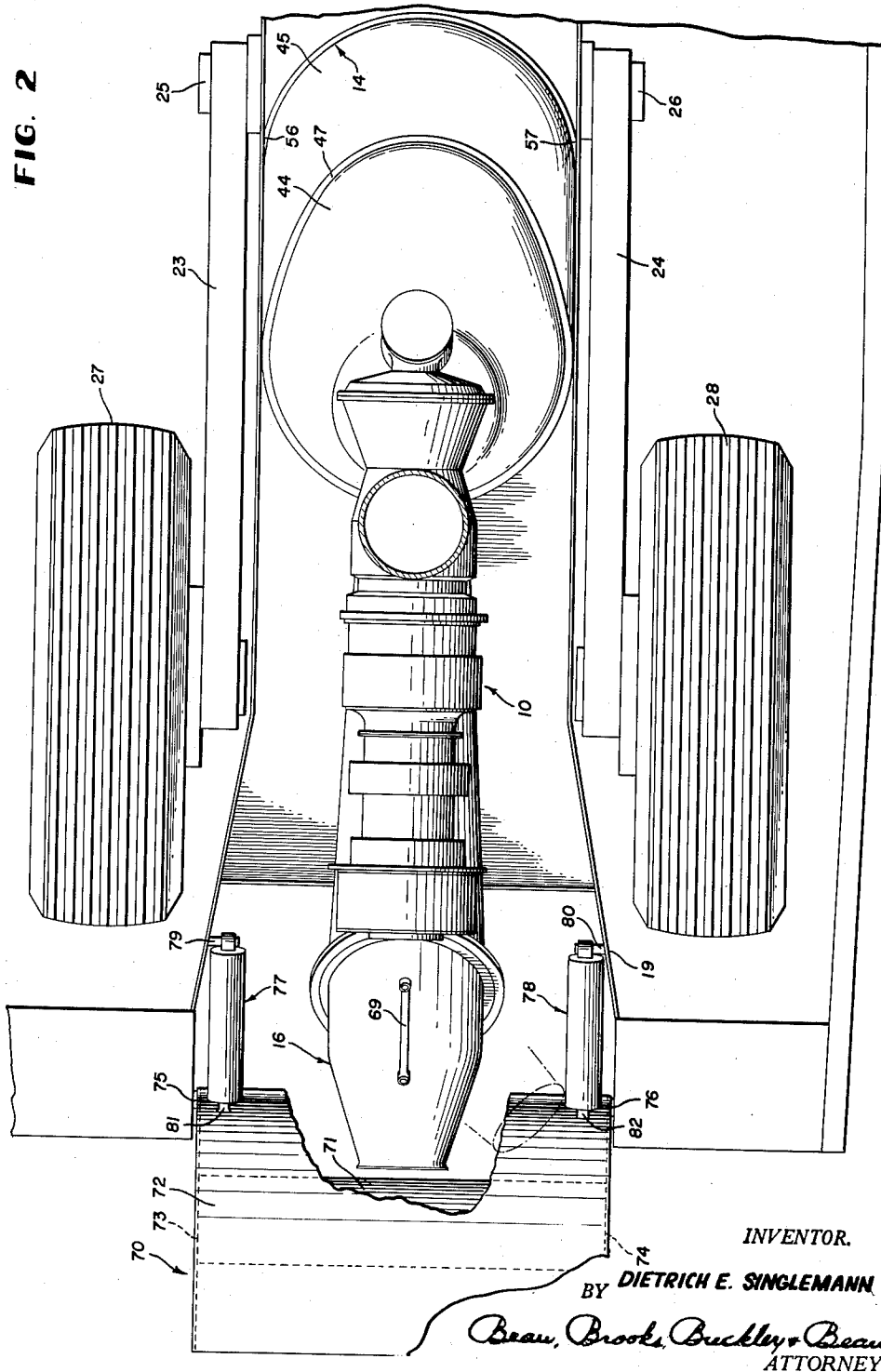
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FIG. 2



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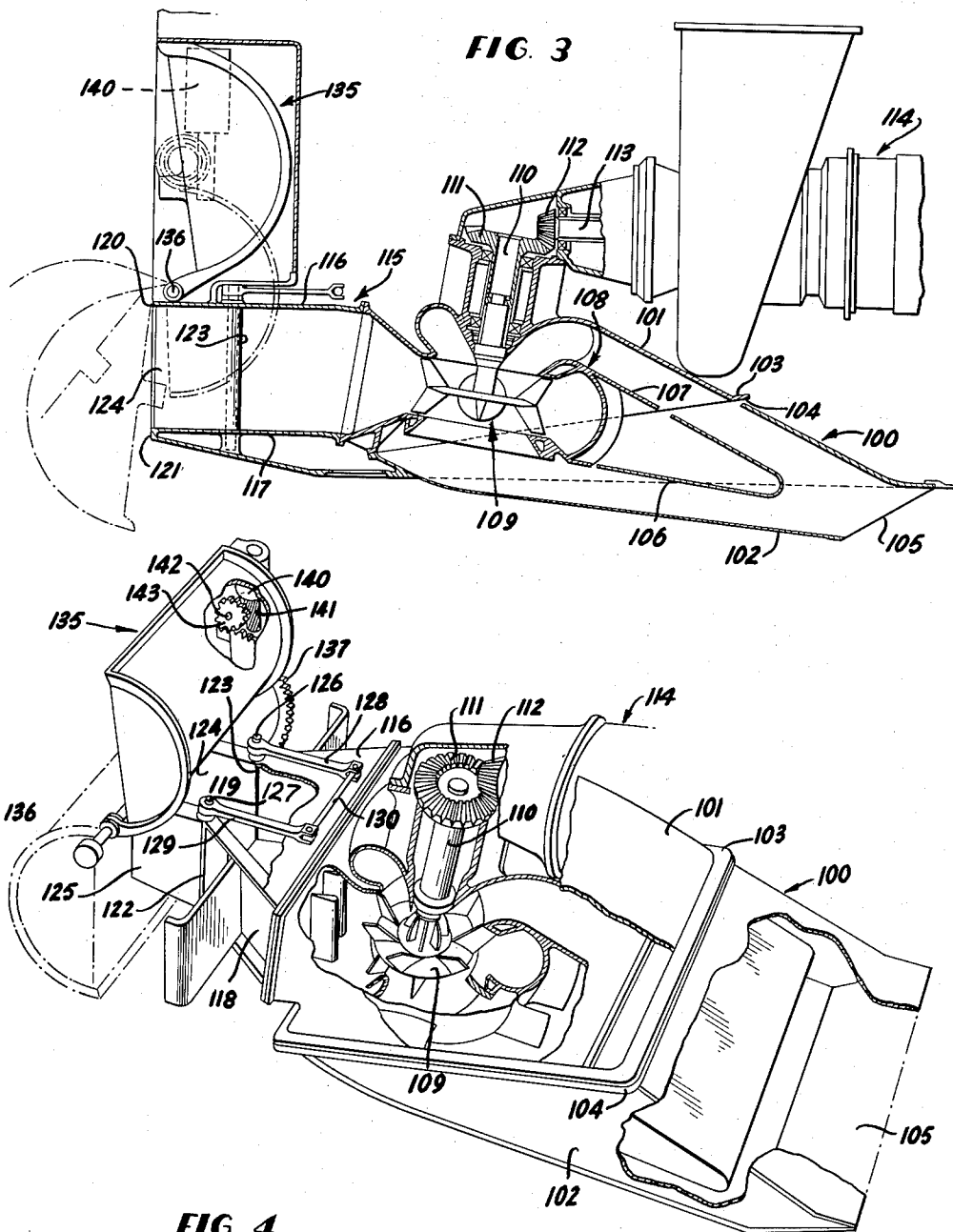


FIG. 4

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JET PROPELLED AQUATIC VEHICLE

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5 Claims. (Cl. 60—35.55)

This invention relates to propulsion means for water craft and, more particularly, to the utilization of a high speed, high capacity pump in conjunction with a novel ducting system for propelling a boat or the like by means of a directed stream of water.

The primary object of the present invention is the provision of a novel system for propelling boats, amphibious craft, or the like, in which the system includes an intake scoop for inducting water, which scoop is so constructed and arranged as to permit the craft to operate in very shallow water. The scoop is integrally related with a high capacity, high speed pump, preferably turbine driven, which discharges water to a swivelled nozzle located substantially at the water line of the craft and which is functional not only to provide the propelling force, but also to effect the steering of the craft.

A further object of the present invention is to provide a system in accordance with the preceding object wherein a reversing hood or shovel is operable to reverse the direction of flow of the water discharged from the nozzle.

Another object of this invention is to provide a novel propulsion system which has most of its components carried inboard of the boat and is characterized by occupying a minimum of space in relation to the power developed.

With the above, and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a vertical section taken through an amphibious craft utilizing a propulsion system of the present invention portions of such system being shown in elevation while others are shown in section;

FIG. 2 is a top plan view of the assembly shown in FIG. 1 illustrating in more detail the arrangement of the reversing hood and with portions of the same broken away to indicate its relationship with the swivelable nozzle;

FIG. 3 is a section similar to FIG. 1 but showing a modified form of system; and

FIG. 4 is a perspective view, partly broken away, further illustrating the modification of FIG. 3.

Referring now to FIGS. 1 and 2, the reference numeral 10 indicates in general a turbine unit, the specific structural details of which form no part of the present invention, such unit being illustrated only for the purpose that a turbine drive for the system is preferred inasmuch as the pump utilized in conjunction therewith is a high capacity, high speed pump of the type which would normally be driven at or near the rotational speed of presently available turbines. Reference numeral 11 indicates in general a power train extending from the turbine unit 10 down to the impeller 12 of a high speed, high capacity pump indicated generally by the reference character 13. The specific details of construction of the pump assembly 13 in themselves form no part of the present invention other than the fact that the propulsion system in accordance with the invention necessitates the use of a high capacity pump. The pump itself, as to its constructional details, may be similar to that disclosed in copending application, Serial No. 25,254 filed April 28, 1960.

The pump unit 13 operates in conjunction with an intake scoop, indicated generally by the reference character

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14 connected through ducting indicated generally by the reference character 15 to a swivelled nozzle assembly indicated generally by the reference character 16, the details of which will be presently described. Basically speaking, the pump 13 is operative to induct a large volume of water through the open inlet mouth 17 of the intake scoop assembly 14 and force it back through the ducting 15 and outwardly through the nozzle assembly 16.

The craft with which the propulsion unit in accordance with the present invention is illustrated is not to be considered as limiting with relation to the invention, the craft actually shown, as indicated generally by the reference character 18, being of the amphibious type having a hull 19 or body provided with a bottom 20 with which the intake scoop 14 is associated, as presently described. The nozzle 16 is situated at the rear of the hull or body 19, and has its discharge mouth 21 disposed in the region of the level of the water line 22 of the craft, substantially as shown. Referring now more particularly to FIGURE 2, it will be seen that the craft specifically shown in conjunction with the propulsion unit in accordance with this invention is provided with a pair of trailing arms 23 and 24, respectively pivoted, as at 25 and 26, to the body or hull 19 and extending rearwardly from such pivot points and mounting thereon, rotatably, wheel members 27 and 28. These wheel members may be driven in accordance with well-known practices, preferably from an independent power plant, not shown, and it is to be understood that the craft will also be provided with dirigible front wheels, also not shown, by means of which the craft can be manipulated while on land.

Referring back to FIGURE 1, the turbine unit 10 is provided with an output shaft 30 having a gear 31 thereon meshing with a further gear 32 disposed within the housing 33 which is fixed to a generally vertical shaft 34 extending downwardly from the output end of the turbine unit, and having a sliding, splined connection, as at 35, to the hollow hub portion 36 of the impeller shaft 37 for the pump 13. The pump itself is provided with two sets of inner and outer vanes 38 and 39, and 40 and 41, respectively, the details of which need not be specifically considered here other than the fact that such an arrangement permits the pump to be operated at extremely high speeds without cavitation and in such fashion as to be characterized by extremely high capacity. The pump further comprises a generally annular manifold or body portion 43 which directs the water carried by the pump to the ducting 15 previously described.

The intake scoop 14 includes a body preferably formed of an upper section 44 and a lower section 45, joined together along the parting face defined between the two flange portions 46 and 47 thereof and which body portions are suitably spaced from the pump body 43 so as to define intake passages 48 and 49 to either side of the impeller unit 12. To assure a smooth flow of water to the pump, the lower body section 45 is provided with a generally V-shaped baffle 50 having a rounded nose portion 51, the upper leg 52 being so disposed as to cooperate with the flange 53 on the pump body 43 to effect a smooth entrance channel 48 as previously described and the lower leg 55 of which is directed towards the lower side of the pump body 43 to provide a smooth passage 49, as previously described.

As can be seen best in FIGURE 2, the lower section 45 of the intake scoop 14 is of generally elliptical shape, whereas the upper section 44 thereof is generally egg-shaped. The previously mentioned mouth 17 for the intake scoop 14 extends between the opposite sides of the lower body section 45 substantially between points designated by the reference characters 56 and 57 in FIGURE 2 so as to present a substantially flattened, relatively wide intake mouth permitting of easy ingress of water to the

pump unit 13 while at the same time permitting of operation in shallow water.

The previously mentioned duct 15 is preferably constructed substantially as shown, that is, as a gradually divergent tube of circular cross-section detachably connected, as at 60, to the upper section 44 of the intake scoop assembly 14 and having a circumferentially extending flange 61 at its rearward end. This flange 61 is disposed substantially at 45 degrees relative to the vertical, and serves as a retaining means for a flange 62 on the nozzle assembly 16 tending to maintain the units 15 and 16 in proper alignment. The nozzle 16 converges slightly towards the aforementioned mouth 21 thereof and for the purpose of controlling the angular disposition of this nozzle 16, a steering shaft 63 is provided. This steering shaft has one end 64 rotatably received in a boss portion 65 formed integrally with the duct 15, substantially in the manner shown in FIGURE 1, and the shaft has radially projecting therefrom a pair or a series of vanes or legs 66 and 67 extending to the inner surface of the nozzle 16 and rigidly affixed thereto. The opposite end of the steering shaft 63 projects outwardly through the boss 68 on the nozzle 16 and has rigidly affixed thereto a steering arm 69. Obviously, then, movement of the steering arm 69 will cause a swivelling action of the nozzle 16.

FIGURE 1 further illustrates the extreme compactness of the unit. In this respect, it is to be noted that the power plant 10 is disposed above the duct 15 so that the unit as a whole forms a substantially U-shaped system in vertically stacked relationship with the bight of the U being formed by the power transmission arrangement 11 as previously described. The previously mentioned gear housing 33 preferably forms journaling means for both of the gears 31 and 32 and carries a tube 11a surrounding the upper portion of the shaft 34. A mating tube 11b is telescopically engaged with the tube 11a, the latter tube 11b being rigidly carried by a housing portion 11c integral with the upper section 44 of the intake scoop assembly 14. The gear housing 33 is provided with suitable bearings journaling both the gears 31 and 32, and the pump impeller shaft 37 is preferably journaled by suitable bearing means located in the section 11c.

A hood or shovel assembly, indicated generally by the reference character 70, is provided in close proximity to the nozzle assembly 16 for the purpose of effecting reverse movement of the craft. The shovel includes inner and outer arcuate walls 71, 72 extending between opposite side wall portions 73 and 74 so as to cooperate with the inner and outer wall to provide a channel for reversing the direction of flow of the water emanating from the nozzle 16 when the shovel is in the dot and dash line position as is shown in FIGURE 1. The side walls 73 and 74 are pivotally attached to the hull by suitable bearing members 75 and 76, see particularly FIGURE 2, and hydraulic motors 77 and 78 are provided for the purpose of moving the shovel assembly 70 between the two extreme positions illustrated in FIGURE 1. Each such hydraulic motor is in the form of a piston and cylinder with the cylinder in each case being pivotally anchored to pins 79 and 80 respectively fixed to the hull and the outer wall 72 is provided with ears 81 and 82 to which the respective pistons of the units 77 and 78 are pivotally attached, as at 83, as shown in FIGURE 1. Suitable fluid connections are made to the cylinder, not shown, for effecting extension and retraction of the piston to operate the shovel 70 between the two positions as illustrated. When the shovel is in the full line position as shown in FIG. 1, the water issuing from the nozzle assembly 16 is unimpeded by the shovel, but when the shovel is in the position of dotted lines as shown in FIG. 1, the direction of flow in any position of the nozzles 16 is reversed, thus imparting a reverse thrust.

It will be noted that the use of a substantially vertical drive shaft for the pump tends to stabilize the craft as

compared with the use of a horizontal shaft alone. With a horizontal shaft, strong roll forces are produced whereas with the present arrangement, the gyroscopic action of the vertical shaft and pump impeller opposes roll forces produced by the prime mover.

Referring now more particularly to FIGS. 3 and 4, a somewhat modified construction will be described. In these figures, it will be seen that the system employs a ducting system 100 including an intake scoop having upper and lower sections 101 and 102 joined along the flanged portions 103 and 104 and with the lower section defining an intake opening 105. The lower section 102 carries a baffle or shroud 106 cooperable with the shrouding 107 on the pump body 108 to define smooth inlets to the upper and lower sides of the pump. The pump itself may be identical to that used in the modification of FIG. 1 or of similar design.

The pump impeller 109 is mounted on the lower end of the substantially vertical pump drive shaft 110 which carries gear 111 at its upper end engaged with gear 112 on the drive shaft 113 of prime mover 114.

Downstream of the pump and connected to the manifold thereof is ducting 115 defined by top and bottom walls 116 and 117 and sides walls 118 and 119. As can be seen best in FIG. 3, top and bottom walls 116 and 117 terminate at the rear edge portions 120 and 121 thereof whereas the side walls 118 and 119 terminate along their rear edge portions 122 and 123, see particularly FIG. 4, forwardly of edges 120 and 121. Deflector vanes 124 and 125 are mounted on vertical shafts 126 and 127 along the edges 122 and 123 and each such shaft carries an arm such as those indicated by reference characters 128 and 129 in FIG. 4. These two arms are joined by a link 130 pivotally connected at its ends to the arms and any conventional motion-transmitting mechanism may be connected to this link and arm system to effect angular movement of the deflector vanes 124 and 125 for steering purposes.

A shovel or hood 135 is carried by the transverse shaft 136 and on one side, the hood carries a gear sector 137. Separate from the hood or shovel there is mounted an electric motor 140 or the like provided with a worm drive shaft 141 for rotating the cross shaft 142 carrying the gear 143 in mesh with sector 137. In this fashion, the hood or shovel may be operated to the upper position shown in full lines in FIGS. 3 and 4 or to the lower or reversing position shown in dot and dash lines in these figures or to intermediate positions such as the intermediate dot and dash line position shown in FIG. 3.

This intermediate position as shown in FIG. 3 will permit full power operation of the prime mover and pump without causing motion of the associated craft, since the intermediate position of the hood or shovel is such as to produce cancelling forward and reverse thrust forces.

From the foregoing, it will be seen that novel and advantageous construction has been disclosed for attaining the desired ends. However, it is to be understood that numerous variations may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. In an aquatic vehicle having a hull, a ducting system located in the aft portion of said hull and including upper and lower walls, said ducting system being inclined generally upwardly in the aft direction and having, forwardly thereof, an intake mouth opening through the bottom of the hull just forwardly of the rear of the hull and having, rearwardly thereof, a discharge mouth projecting rearwardly of the hull and above the level of said hull bottom,
- a generally annular manifold disposed within said ducting system downstream of said inlet mouth spaced from both the upper and lower walls of said ducting system and being open at its inner side to

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provide both top and bottom water inlets into the manifold, and having an outlet portion discharging downstream to said discharge mouth of the ducting system,

a high rotational speed pump impeller disposed within said manifold for inducting water thereinto, pump shaft means projecting vertically from said impeller upwardly from said ducting system, and a substantially horizontal turbine having an output shaft,

the pump shaft means projecting above the ducting system into directly driven connection with said output shaft,

said turbine and ducting system being disposed in vertically stacked relation.

2. In an aquatic vehicle having a hull,

a propulsion assembly disposed in the aft section of said hull,

said assembly including a ducting system for inducting water at the hull bottom just forwardly of its rearward extremity and discharging such water at the rear of the hull,

said ducting system including a rearwardly and upwardly inclined intake portion having upper and lower sections defining an intake mouth at their forward end and the upper section being connected to a discharge portion of the ducting system,

a generally annular manifold mounted in said upper section downstream of said intake mouth and leading into said discharge portion of the ducting system,

said manifold being open around its inner side and having vertical clearance with both the upper and lower sections of the intake portion to define top and bottom intake into the manifold,

pump impeller means mounted within said manifold, shaft means connected at its lower end to said impeller means and projecting above said ducting system,

and prime mover means drivingly connected to said shaft means.

3. In the vehicle as defined in claim 2, said lower section of the intake portion of the ducting system being separable from the upper section to exposed said manifold and pump impeller means,

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said lower section being bellied below the hull bottom to scoop in water at said intake mouth.

4. In an aquatic vehicle having a hull,

a ducting system at the rear of said hull and extending axially thereof,

said ducting system including a forward intake portion having an intake mouth at its forward end opening through the hull bottom,

said ducting system also including a discharge portion joined to the intake portion and having a discharge mouth at the rear of the hull,

a manifold disposed in said intake portion rearwardly of said intake mouth and leading into said discharge portion at the juncture between the intake and discharge portions of the ducting system,

said manifold being provided with a generally central opening and being spaced within said intake portion of the ducting system to provide both top and bottom intake openings into the manifold,

shaft means extending vertically downwardly into said intake portion of the ducting system,

pump impeller means fixed to the lower end of said shaft means and within the confines of said manifold,

and means for driving said shaft means.

5. The assembly as defined in claim 4 wherein said intake portion of the ducting system is defined by separable upper and lower sections, said discharge portion of the ducting system being joined to said upper section and said manifold being mounted to said upper section whereby removal of the lower section exposes both the manifold and the pump impeller means.

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