July 13, 1965 J. R. MATTSON ETAL 3,194,205

PROPULSION SYSTEM FOR SMALL BOATS

Filed Jan. 31, 1963 5 Sheets-Sheet 1

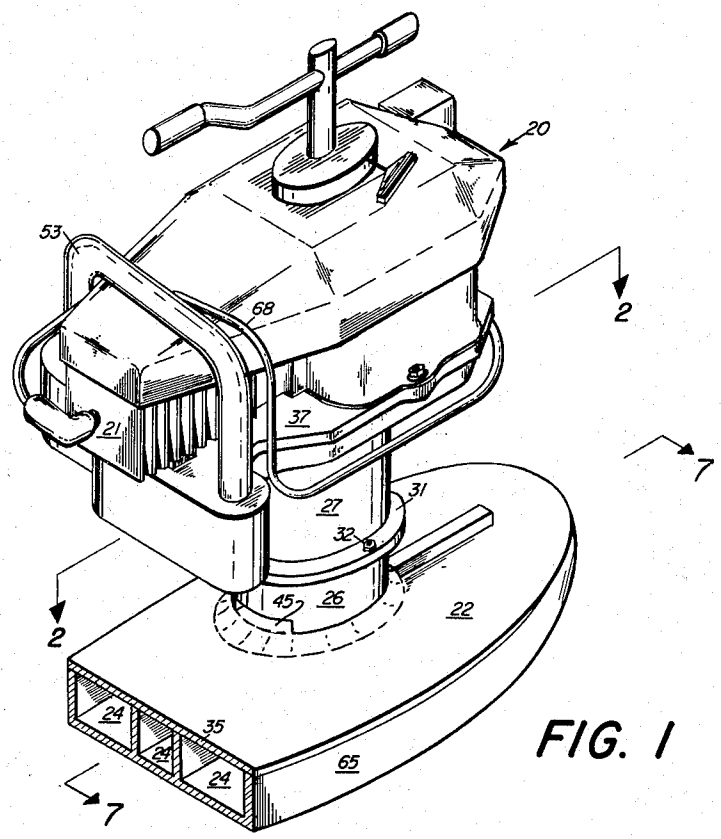


FIG. 1

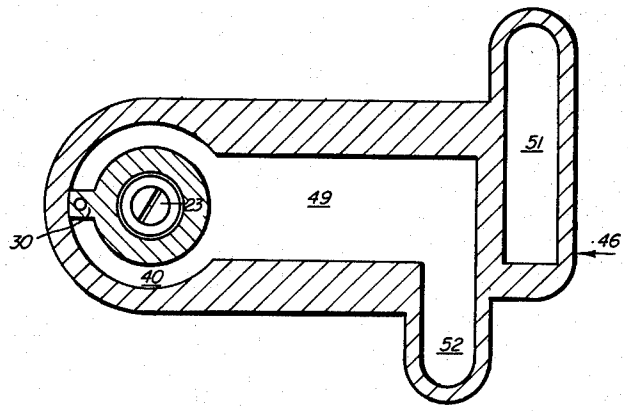


FIG. 2

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PROPULSION SYSTEM FOR SMALL BOATS

Filed Jan. 31, 1963 5 Sheets-Sheet 2

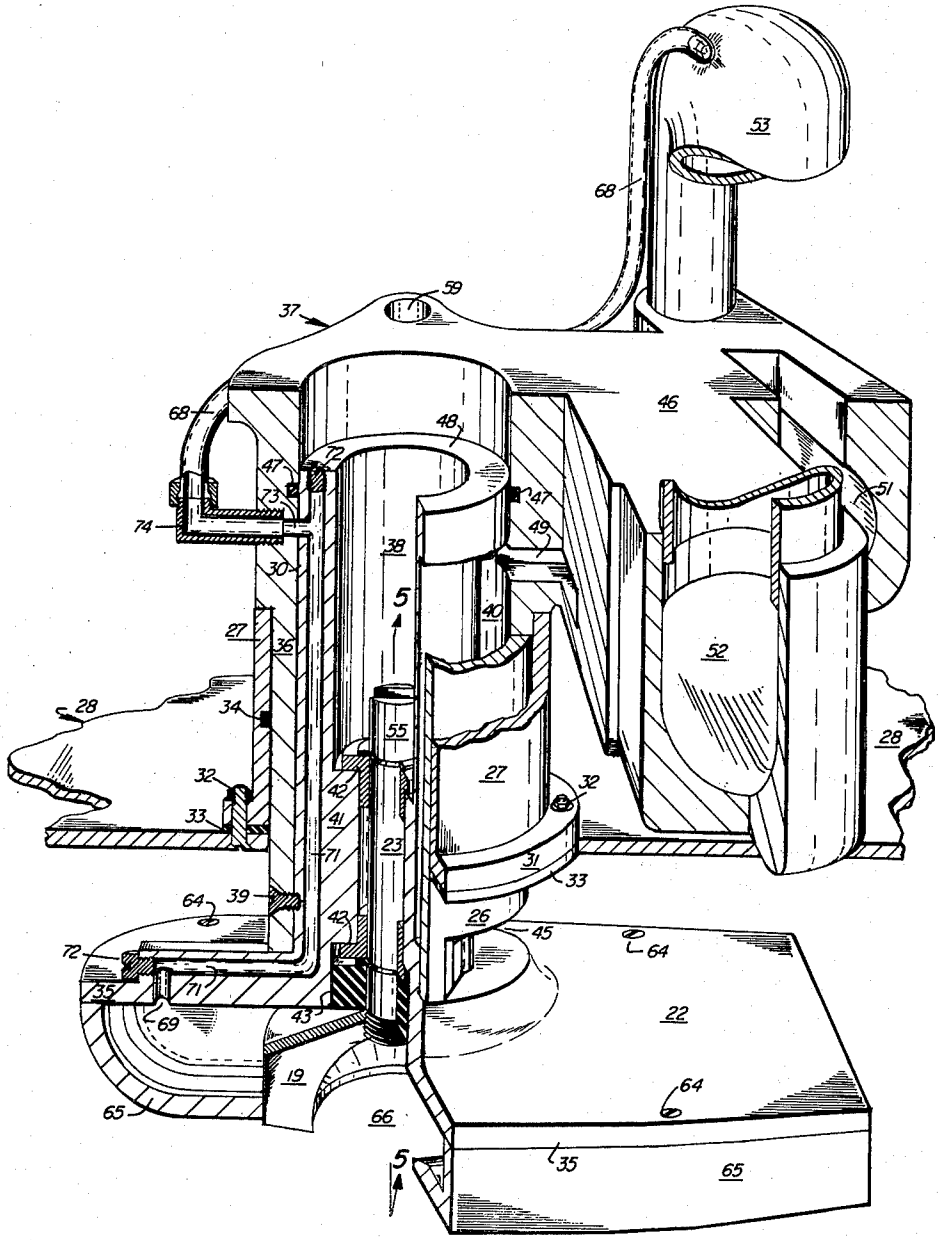


FIG. 3

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PROPULSION SYSTEM FOR SMALL BOATS

Filed Jan. 31, 1963 5 Sheets-Sheet 3

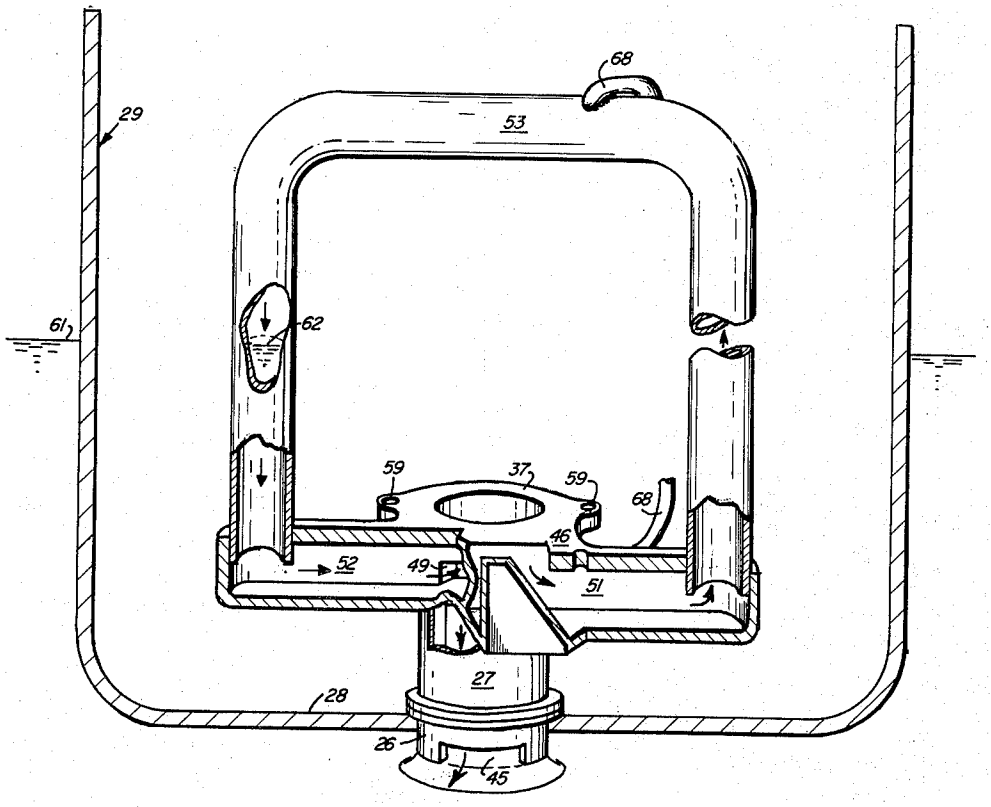


FIG. 4

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PROPULSION SYSTEM FOR SMALL BOATS

Filed Jan. 31, 1963 5 Sheets-Sheet 4

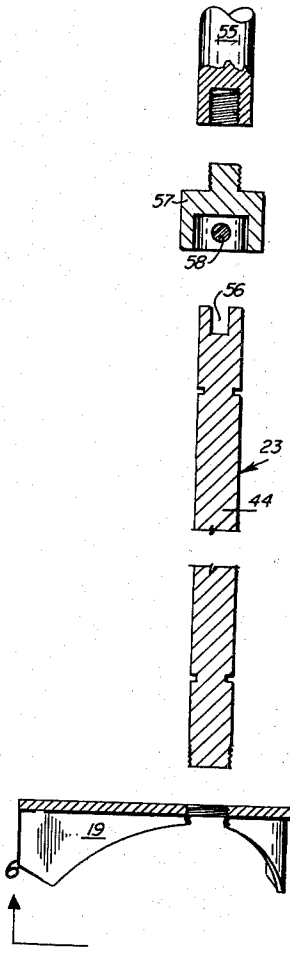


FIG. 5

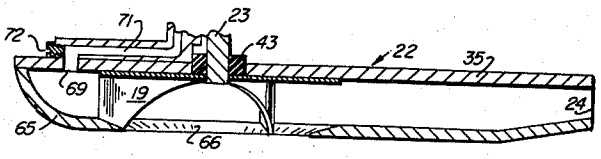


FIG. 7

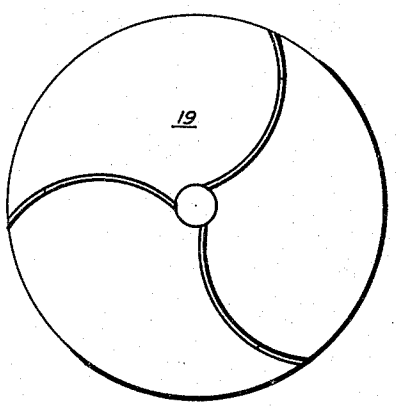


FIG. 6

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PROPULSION SYSTEM FOR SMALL BOATS

Filed Jan. 31, 1963 5 Sheets-Sheet 5

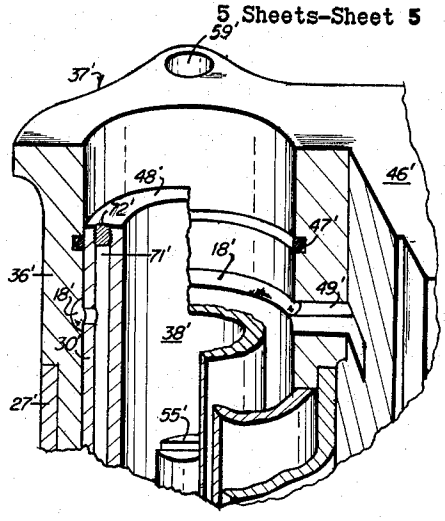


FIG. 8

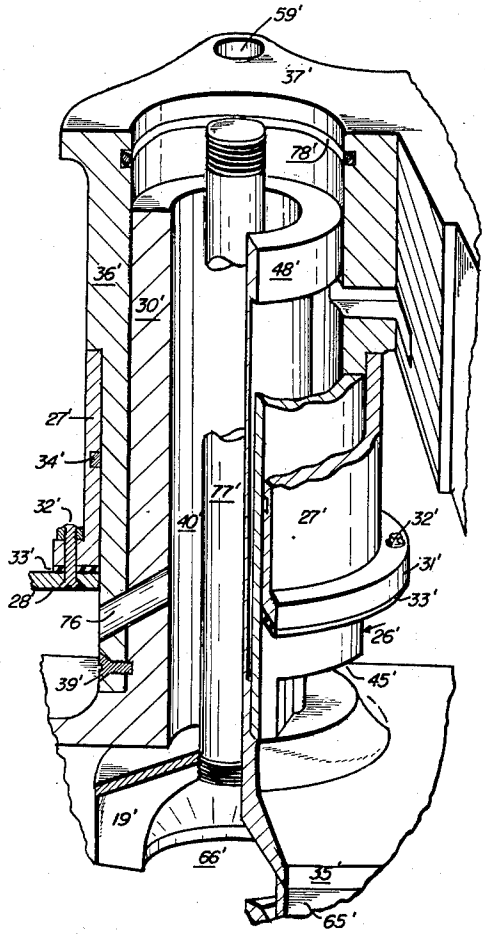


FIG. 9

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United States Patent Office 3,194,205 Patented July 13, 1965

3,194,205

PROPULSION SYSTEM FOR SMALL BOATS

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Filed Jan. 31, 1963, Ser. No. 255,262
4 Claims. (Cl. 115—12)

This invention relates to a new and very useful hydraulic propulsion system for small open boats, especially shallow-draft boats such as canoes.

Propeller-type, deep-draft, high center of gravity, outboard motors when attached to outrigger-type or stern-located motor mounts on lightweight, shallow-draft water craft, such as canoes, create a hydrodynamically unstable condition owing to the associated rise in the center of gravity in the assembled combination. In addition, such combination displays a marked tendency to roll in the direction of applied torque to the rotating propeller. Also, the overall draft of such combination is usually much greater than that of the vessel by itself and so the combination does not permit boat operation in water only deep enough to float the shallow-draft vessel without the motor-driven propeller. Furthermore, such combination displays a dangerous tendency to bank and roll, even overturn the boat, when the boat is horizontally turned, as in steering, unless very gradual turns are made. For all of these reasons, conventional propulsion systems for small boats such as speed boats and the like have generally not been adaptable to canoes, duck boats, and similar shallow-draft, portageable, light weight, commonly outrigger-equipped open boats.

In the present invention there is provided a novel, compact, hydraulic propulsion system which utilizes a centrifugal pump and which, in combination with a lightweight, shallow-draft boat, requires only a few more inches of draft than does the boat by itself without the propulsion system.

It is an object of this invention to provide a compact, lightweight, hydraulic propulsion system for small open boats utilizing a centrifugal pump.

Another object of this invention to provide a hydraulic propulsion system which is adapted to have a center of gravity when in combination with a boat that is not above the normal water line of the boat as well as being not above the center of gravity of the boat itself, thus effectively, actually increasing the overall stability of the combination of boat plus propulsion system.

Another object of this invention is to provide a hydraulic propulsion system for small, lightweight, shallow-draft boats which eliminates the tendency of such boats to roll when equipped with conventional, high center of gravity propeller-driven propulsion systems.

It is another object of this invention to provide a propulsion system for boats which enables one to steer a boat equipped with this system without the aid of a rudder, tiller or similar device.

It is another object of this invention to provide a hydraulic propulsion system for boats which allows boats equipped with this system excellent maneuverability characteristics in all horizontal directions.

It is another object of this invention to provide a hydraulic propulsion system for small open boats which permits boats so equipped with this system to navigate in water too shallow for the same boats equipped with conventional propeller-type outboard or inboard propulsion means.

It is another object of this invention to provide an inboard hydraulic propulsion system utilizing a centrifugal pump in which the power source may be moved from the system while leaving the centrifugal pump and associated mechanism without affecting adversely the capacity of the

vessel to function and operate as an unpowered watercraft.

It is another object of this invention to provide a hydraulic propulsion system in which a centrifugal pump is driven by an internal combustion engine and in which, when the system is mounted inboard, exhaust from the internal combustion engine is vented into water beneath the boat and not into the atmosphere within and about the boat.

It is a further object of this invention to provide a hydraulic system which can be mounted inboard within a boat and which system can be rotated from within the vessel so as to provide means for steering and maneuvering the boat and at the same time allow exhaust gases from an internal combustion engine used at the power source for the system to be expelled into the water below the waterline of the vessel.

It is a further object of this invention to provide in a hydraulic propulsion system of the class just described means for preventing entrance of water into the power source through the exhaust line when such power source is located below the normal water line of the boat.

It is a further object of this invention to provide in a hydraulic propulsion system of the class just described an exhaust cooling means which prevents possible overheating of mechanical water seals utilized in the rotatable power source and associated mountings and propulsion means.

The above, and still further highly important objects and advantages of our invention will become apparent from the following detailed specification, appended claims, and attached drawings.

Referring to the drawings, which illustrate the invention, and in which like reference characters indicate like parts throughout the several views:

FIG. 1 is a perspective view of an embodiment of a hydraulic propulsion system of the invention;

FIG. 2 is a horizontal section taken along the line 2—2 of FIG. 1;

FIG. 3 is a view in perspective showing the casting mounting the power head, the impeller housing and the supporting column structure thereof of the embodiment of FIG. 1, some parts broken away and some parts shown in section;

FIG. 4 is a view in perspective of the casting mounting the power head and the exhaust manifold assembly associated therewith, as seen from left to right of FIG. 3, some parts broken away and some parts shown in section;

FIG. 5 is an exploded view in axial section of the impeller shaft and means for coupling said shaft to the power head of the embodiment of FIG. 1;

FIG. 6 is a bottom plan view of the impeller blade of the embodiment of FIG. 1;

FIG. 7 is a vertical sectional view taken along the line 7—7 of FIG. 1, some portions thereof broken away;

FIG. 8 is an enlarged fragmentary view in perspective of a portion of a modified form of the embodiment shown in FIG. 3, some parts thereof broken away and some parts being shown in section; and

FIG. 9 is a fragmentary view in perspective similar to that shown in FIG. 8 showing a still further modified form of the embodiment shown in FIG. 3, some parts broken away and some parts shown in section.

Turning to the drawings, there is seen in FIG. 1 a hydraulic propulsion system of the invention herein designated in its entirety by the numeral 20. The system comprises a power head 21 and a centrifugal pump 22. When the impeller 19 in centrifugal pump 22 is rotated by the power head 21, water is ejected from ports 24 of pump 22.

The entire propulsion system 20 is, in effect, supported

upon a cylindrically shaped column 26 which, as will be explained, is actually composed of a plurality of separate elements. Journalling the exterior of this column 26 is a sleeve 27 which is flanged at its lower end. This flange 31 on sleeve 27 rests on the bottom portion 28 of boat 29 when the column 26 is positioned in a normally vertical axis with the column 26 extending downwardly through the bottom 28 of boat 29 through the latter's keel region. The flange 31 contains a plurality of circumferentially spaced holes whose respective axes are parellel to that of shaft 23 and which are designed to receive mounting bolts and nuts 32 which extend through the bottom 28 of boat 29 and serve to securely mount the sleeve 27 against the boat bottom 28. Conveniently, a gasket 33 is positioned between the flange 31 and the boat bottom 28 so as to make a water-tight seal between the boat bottom 28 and the sleeve 27. Another gasket member 34 is positioned in an appropriately formed groove on the inner wall of sleeve 27 so as to keep the sleeve 27 in water-tight engagement with the column 26.

In the region of the sleeve 27 the column 26 is actually formed by two concentrically arranged members, to wit, the pedestal portion 36 of the motor mounting block 37 and the anchoring post 38 of centrifugal pump 22. Pedestal 36 is generally cylindrically shaped as is post 38 except that a ridge 30 is formed as a longitudinally extending projection on the outside wall of post 38. Ridge 30 is in general sliding engagement with the inside wall of pedestal 36 and is so oriented as to be facing forward as respects the direction of movement through water in the assembled hydraulic propulsion system 20. A radially outwardly extending collar 48 is integrally formed in the top region of post 38 so as to telescopically engage the inside walls of pedestal 36. In an appropriately formed slot in pedestal 36 is positioned a gasket 47 which serves to keep the collar 48 in water-tight engagement with the adjacent inner wall of pedestal 36. There is, thus, a void space or passageway formed in column 26 between the inside wall of pedestal 36 and the outside wall of post 38. Pedestal 36 and anchoring post 38 are ganged together for common axial rotational movements within sleeve 27 as by means of a set screw 39 mounted in the forward wall of pedestal 36 and extending therethrough into an aligned recess in the forward edge of ridge 30 of post 38. An exit port 45 is formed in the bottom of column 26 below the bottom 28 of boat 29 extending in a rearward direction. Exit port 45 is formed by slotting the rear wall of pedestal 36 and post 38, as in the manner shown, for example, in FIG. 3.

A radially inwardly projecting shoulder 41 is formed on the inside walls of post 38 near its bottom or base region and it is in the axially extending cylindrical region of this shoulder 41 that the lower portion 25 of shaft 23 is journalled as by means of a pair of bearings 42 positioned one at each end of the shoulder 41. A rubberized seal 43 at the inside bottom region of the post 38 makes a water-tight seal between shaft 23 and the inside wall of post 38.

Conveniently, the pedestal 36 is integrally formed with the block 37 as, for example, by casting aluminum metal. Conveniently formed within block 37 is a depending lobe 46. Within lobe 46 are conveniently formed a pair of passageways 51 and 52 which are vertically stacked with respect to one another, as respects pedestal 36. The passageway 52 communicates with a channel 49 which interconnects passageway 52 with passageway 40.

Passageway 51 receives exhaust gases directly from the cylinder head of the power head, here an internal combustion engine 21. These gases are conducted from passageway 51 to passageway 52 by means of an exhaust manifold pipe 53. The height of the pipe 53 in relation to the deck or top of block 37 is determined by the height of water on the outside of the boat 29 in which the hydraulic propulsion system 20 of the invention is to be used. The pipe 53 height should always be chosen so as to be above the high-water level 60 on the side of the boat 29. The relationship is illustrated in FIG. 4, where the water level 61 outside the boat limits the water level 62 inside pipe 53 when the system 20 in a boat 29 is not operating and the boat is at rest in the water. The arrows in FIG. 4 indicate direction of exhaust gas flow when the system 20 is in operation. There is thus provided a continuous passage from the cylinder head of internal combustion engine 21 to exit port 45, as follows. After entering the passageway 51, exhaust gases pass through pipe 53 and into passageway 52. From passageway 52 the gases enter channel 49 and pass into passageway 40 and thence out through exit port 45 into the water beneath the boat 29. It will be observed that by having the height of pipe 53 so chosen as to always be above the high-water mark or line, no water can enter into the cylinder head region of the internal combustion engine 21. Thus, when the boat is idle in the water, water will enter exhaust port 45 and rise, perhaps, even high enough to fill passageway 52, but will not rise high enough to pass through pipe 53 and down into the cylinder head region of internal combustion engine 21.

The crankshaft 55 of internal combustion engine 21 is connected to the upper portion 44 of shaft 23 so that when the internal combustion engine 21 is in position atop block 37, the lower portion of shaft 55 and the upper portion 44 of shaft 23 unite to form a continuous drive shaft. While any conventional method of uniting the two shaft portions 23 and 55 can be employed, one which is useful here is to form a slot 56 diametrically across the upper end of upper portion 44 and then to form a cup-shaped adapter element 57 on the lower end of threaded shank which screws into a bore in the lower end of crankshaft 55. This cup-shaped adapter element 57 has diametrically extending therethrough a shear pin 58, the diameter of such shear pin 58 being so chosen as to permit the shear pin 58 to lie in slot 56 when crankshaft 55 is engaged with shaft 23. The shear strength of the shear pin 58 is so chosen that should the impeller 19 become jammed in any way during operation of the propulsion system 20, the shear pin 58 will give way or rupture, thereby avoiding damage to the centrifugal pump 22.

Conveniently, block 37 is provided with a bolt hole or holes 59 for fastening the internal combustion engine 21 thereto. As engine 21 is conventional, it is not described in detail herein.

The centrifugal pump 22 is composed of a head plate 35 and a casing 65. Casing 65 is fastened to the head plate 35 conveniently by means of flathead machine screws 64 arranged in spaced intervals around the perimeter of the head plate 35. The casing 65 has an input port 66 axially positioned beneath the shaft 23 and below the impeller 19. As the impeller 19 rotates within casing 65 in the area between casing 65 and head plate 35, water is drawn in through port 66 and forcibly ejected through ports 24 positioned across the rear of casing 65 beneath the head plate 35. Taken together, the combination of the impeller 19 and the head plate 35 and casing 65 comprise what is conveniently termed a centrifugal pump, and those skilled in the art will appreciate that any conventional design or arrangement of parts that functions for the purpose intended is suitable for use in this invention.

It is desirable to cool exhaust gases from internal combustion engine 21 so as to cause the manifold or crossover pipe 53 to be cool in operation and also so as to avoid any heating or overheating of the column 26 and associated bearings, gaskets, etc. For this purpose water is injected into the crossover pipe 53 in its apex region through a delivery tube 68. Delivery tube 68, then, conveniently enters crossover pipe 53 through the apex region in the latter. Water is supplied to tube 68 from the body

of water in which the hydraulic propulsion system 20 is operating as follows. Near the prow end of head plate 35 is formed a small port 69. This port 69 enters a channel 71 which is formed in the head plate 35 and it is integrally connected to upstanding anchoring post 38 as by suitable casting and drilling operations. Conveniently, if the channel 71 is formed by drilling, each end thereof is stoppered by means of a plug 72. Near the uppermost end of the channel 71 a short exit channel 73 is provided which extends laterally from the channel 71 through the side of pedestal 36. Channel 73 is joined with tube 68 by means of a suitable elbow fitting 74. Now, when the impeller 19 is rotating, sufficient hydraulic pressure is developed in the prow region to force water in the chamber defined by head plate 35 and casing 65 upwardly into port 69 and through channels 71 and 73 and so through the tube 68 into the crossover pipe 53. Thus, when the impeller 19 is rotating, water is injected into the crossover pipe 53. It will be appreciated that the faster the impeller 19 turns the more water is pumped into the crossover pipe 53 which is a desirable condition for, in general, the higher the r.p.m., the greater the temperature and volume of exhaust gases passing through crossover pipe 53 from internal combustion engine 21. Therefore, at such times, a higher volume of water is needed for cooling purposes than when the impeller 19 is turning at engine idling speeds.

In FIGS. 8 and 9 are shown modified forms of that shown in FIGS. 1–7. It should be noted that the alternative embodiments of our invention shown in FIGS. 8–9 and hereinafter described corresponds in all respects not specifically hereinafter mentioned to the above described embodiment of our invention shown in FIGS. 1–7, and the parts or elements of said alternative embodiment which correspond to like parts or elements in FIGS. 1–7 are denoted by the use of the same reference characters with prime marks added thereto. In the embodiment of FIG. 8, a modified form of cooling is used for the exhaust gases. Instead of conducting the water pumped up into channel 71′ into a pipe, the water is led around through an annular groove 18 from ridge 36′ to the mouth of channel 49′. Exhaust gases porting through channel 49′ into passageway 40′ are cooled by the water by a splash action set up by the exhaust gas stream.

In FIG. 9 is shown another modification of the invention which differs from that shown in FIGS. 1–7 in two respects, to wit, in water cooling and in impeller shaft construction. In this embodiment, water enters through a port 76 on the leading edge of column 26′. In this embodiment the faster the boat is propelled through the water the more water enters channel 76. Then when the water enters into the region 40′ motion of the impeller shaft 77 serves to splash the water around within the region 40′ and produce the desired cooling action so that the post 38′ and the pedestal 36′ do not become overheated. Also note in this embodiment that the shaft 77 consists of a single bar threaded at each end and is held to axial alignment within post 38′ by the connection with the internal combustion engine on top of the block 37′. No other bearing or guide means need be employed since the shaft itself in this embodiment is made rigid enough to insure that the impeller 19′ will rotate as desired during operation within the space defined between head plate 35′ and casing 65′. In this embodiment only the single O-ring 78 is used in addition to 34′ and this seal 78 is fitted into the upper inside of pedestal 36′. O-ring seal 78 is the only means provided in this embodiment for keeping water out of the boat. Thus, here the power head (not shown) cannot be removed while the boat is in the water as is the case with the embodiment shown in FIGS. 1–7 and that shown in FIG. 8. Observe that the impeller

shaft 77 threads directly into the engine crankshaft and that there is no seal at the bottom inside of the post 38′ between the shaft 77 and the inside wall of the post 38′. Water entering through the channel 76 leaves the space 40′ through the exit port 45′.

Our invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the above objects, and while we have shown and described a preferred embodiment, we wish it to be specifically understood that the same is capable of modification without departure from the spirit and scope of the appended claims.

What is claimed is:

1. A hydraulic propulsion system for small open boats comprising:
   (a) a cylindrically shaped mounting column,
   (b) means adapted to be secured to the interior bottom portion of a boat at the keel region of the boat and journalling said column for steering rotation on a normally vertical axis with said column extending downwardly through the bottom below the keel of said boat,
   (c) a drive shaft axially extending through, and journalled for rotary movement in said column,
   (d) an impeller mounted on the bottom end of said shaft,
   (e) a housing for said impeller having water intake and exhaust port means and being adapted to convert horizontal rotational movements of said impeller into laterally exerted hydraulic thrust,
   (f) said housing being rigidly secured to the bottom of said column for common rotation therewith,
   (g) an internal combustion engine mounted on the top of said column below the high water line on the exterior of said boat,
   (h) exhaust passage means communicating with said internal combustion engine and a port defined by said column below the bottom of said boat,
   (i) and means positively preventing passage of water through said exhaust passage means to said engine when said engine is in disuse or removed and when said boat is resting in said water under said high water line condition.

2. The structure defined in claim 1 in which said last mentioned means comprises an inverted U-shaped pipe element, the uppermost portion of which projects above said high water line.

3. The structure defined in claim 2 in further combination with means for introducing water under pressure into said pipe element whereby to cool same.

4. The structure defined in claim 3 in which said last mentioned means comprises a conduit means communicating with said impeller housing intermediate the water intake and exhaust port means thereof and the uppermost portion of said U-shaped pipe.

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