July 27, 1954 H. E. WINKELMAN ET AL 2,684,635

CENTRIFUGAL PUMP

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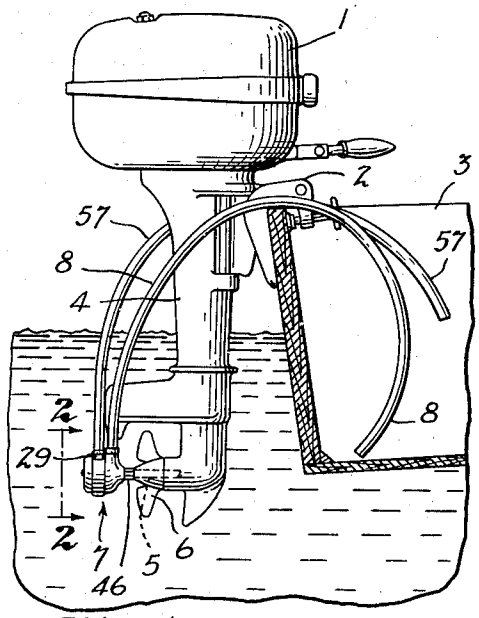

Fig. 1

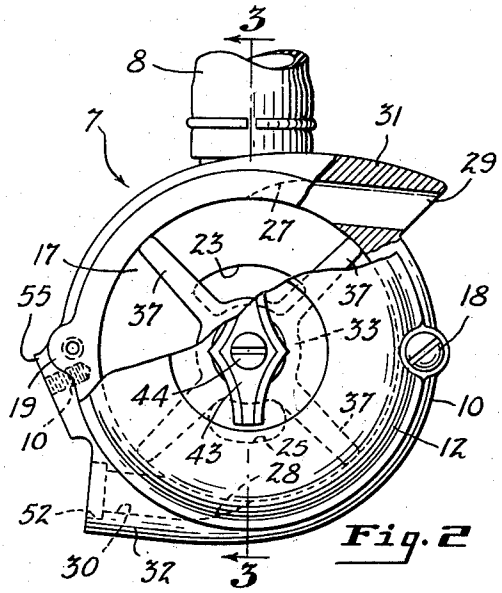

Fig. 2

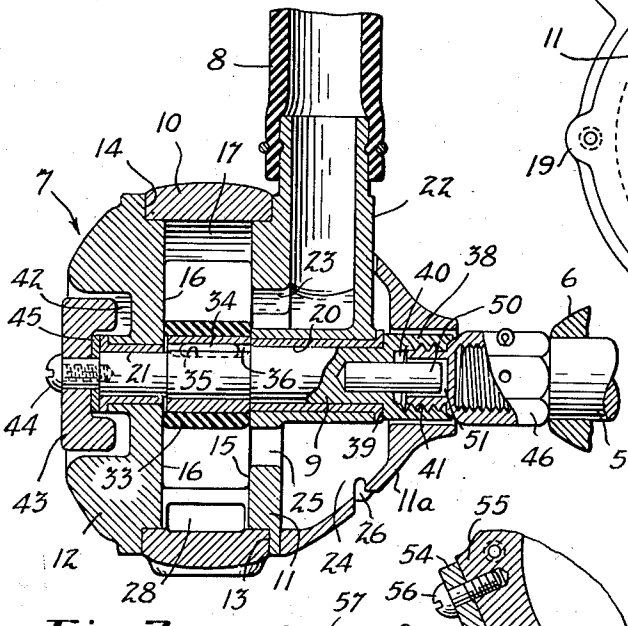

Fig. 3

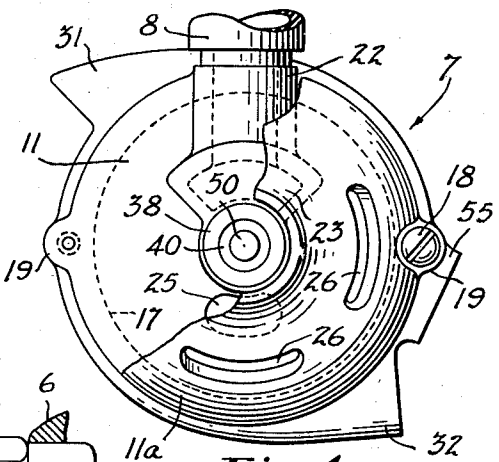

Fig. 4

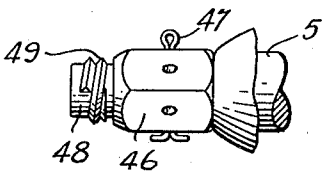

Fig. 5

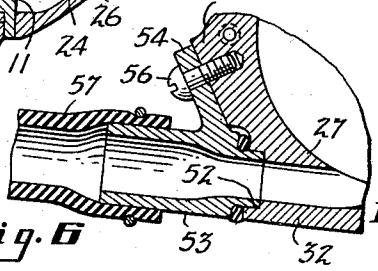

Fig. 6

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CENTRIFUGAL PUMP

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10 Claims. (Cl. 103—113)

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This invention relates to centrifugal pumps and particularly to a pump of simple construction and designed to operate efficiently when submerged in liquid.

One object of the invention is to provide a rotary pump that is continuously primed by liquid that passes into the pump chamber through an auxiliary inlet and out of the pump chamber through an outlet associated with said inlet.

A further object is to provide a self-priming pump that is adapted to be mounted on a boat propeller shaft and that is operated when the propeller shaft is driven with its priming inlet in communication with the body of liquid in which the pump is submerged.

An additional object of the invention is to provide a coupling member which may serve as a propeller retaining unit, that is adapted to be secured to a propeller shaft and a pump rotor that may be manually manipulated to attach it to the coupling member and to detach it therefrom.

A further object is to provide a pump so constructed that the torsional thrust exerted on the pump housing by the propeller shaft is substantially balanced by an opposed torsional thrust exerted by liquid discharging through one or more tangentially disposed outlets.

It is a further object of the invention to provide a pump housing so constructed that it can be readily adjusted to properly dispose its outlets to counterbalance the torsional thrust of a propeller shaft that rotates clockwise or to counterbalance the torsional thrust of a propeller shaft that rotates counterclockwise.

An important object of the invention is to provide a pump that is adapted to be attached to an outboard motor propeller shaft and that has a main inlet to which a suction conduit may be attached and an outlet through which air or water or a mixture of air and water drawn through said inlet may be discharged into the body of water in which the pump is submerged, the pump also having an auxiliary priming inlet opening to said body of water and an outlet through which water drawn into the priming inlet is discharged, the latter outlet being provided with means for attachment of a delivery conduit through which water may be discharged under pressure, the pump being operable with either or both of said conduits attached, whereby the pump may be used to suck water from a boat or to deliver a stream of water under pressure and may also be used to simultaneously deliver a stream of water under pressure to wash

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the boat and to suck the dirty water from the bottom of the boat.

With the above and other objects in view, the invention may be said to comprise the pump as illustrated in the accompanying drawings and hereinafter described, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention pertains.

Reference should be had to the accompanying drawings forming a part of this specification in which:

Figure 1 shows the pump of the present invention attached to the propeller shaft of an outboard motor and having a suction hose extending into the boat;

Fig. 2 is a rear elevation of the pump viewed as indicated by the arrows at 2—2 in Fig. 1;

Fig. 3 is a vertical section through the pump taken on the line indicated at 3—3 in Fig. 2;

Fig. 4 is a front elevation of the pump;

Fig. 5 is a fragmentary elevational view showing the coupling member employed for attaching a pump to the propeller shaft; and

Fig. 6 is a fragmentary sectional view showing the hose attachment detachably connected to one of the pump outlets.

In Fig. 1 of the drawings there is shown an outboard motor 1 of a conventional type that is pivotally supported upon a bracket 2 that is clamped to the rear end of a boat 3. The motor has an elongated housing extension 4 in the lower end of which is a horizontal propeller shaft 5 which projects rearwardly from the housing and carries a propeller 6, suitable driving connections from the motor to the propeller shaft being provided in the housing 4.

The pump of the present invention which is indicated generally by the numeral 7 is shown in Fig. 1 attached to the outer end of the propeller shaft 5. A hose 8 is attached to the pump 7 and extends into the boat 3 so that it may be used to suck water from the boat. The pump of the present invention has a rotor shaft 9 that is adapted to be attached to and to be driven by the propeller shaft 5.

The housing of the pump comprises a central internally cylindrical ring 10 and inner and outer side members 11 and 12 that are secured to opposite sides of the ring. The members 11 and 12 are provided with marginal recesses 13 and 14 in which opposite side edges of the ring 10 fit. The portions of the members 11 and 12 that fit within the ring 10 have flat inner faces 15 and 16 which form the side walls of a cylindrical

rotor chamber 17. The side members 11 and 12 may be fastened together and to the ring 10 by suitable means such as bolts 13 that extend through marginal portions of the side members and through bosses 19 formed in the ring 10.

The rotor shaft 9 is journaled in bearings 20 and 21 mounted in the side members 11 and 12 and positioned at opposite sides of the rotor chamber 17 centrally thereof. The inner side member 11 is provided with a radial tubular extension 22 to which the suction hose 8 may be attached, the extension 22 being connected to the rotor chamber 17 through an inlet port 23 outwardly of the rotor shaft but adjacent thereto.

A cover member 11*a* of streamlined form is attached to the inner side member 11 and faces the propeller when the pump is attached to the propeller shaft. The cover member 11*a* is cup-shaped and provides a priming chamber 24 that communicates with the rotor chamber 17 through an inlet 25 that is near the rotor shaft on the side of the rotor shaft opposite the inlet 23. Elongated openings 26 may be provided in the wall of the member 11*a* to permit free flow of water into the priming chamber, the openings 26 being made narrow so that solid objects of sufficient size to clog the pump are not drawn into the pump. The ring 10 forming the periphery of the pump chamber is provided with diametrically opposite discharge ports 27 and 28, the port 27 being spaced radially outwardly and in substantial radial alinement with the main inlet port 23 and the port 28 being spaced outwardly from the priming port 25 and substantially in radial alinement therewith. Tangential passages 29 and 30 are formed in the ring 10 and extend outwardly from the ports 27 and 28 through integral projecting portions 31 and 32 carried by the ring 10.

A rotor 33 has a running fit in the chamber 17 and is keyed to the shaft 9. The rotor 33 is preferably so connected to the shaft 9 that the shaft 9 can be withdrawn endwise from the hub of the rotor. A key 34 which may be in the form of a cylindrical pin fits in grooves 35 and 36 formed in the shaft 9 and upon the interior of the rotor hub. The rotor 33 is so constructed that it causes water drawn into the chamber 17 to travel circumferentially and develop a pressure due to centrifugal force which causes an outward flow through the tangential outlets.

Various forms of rotors may be employed which have one or more pockets of radial and circumferential dimensions such that communication is established between each of the inlets and its alined outlet intermittently during operation, the inlets being brought into communication with their alined outlets successively during each revolution of the rotor. As herein shown the rotor has radial vanes 37 that have a running fit within the cylindrical interior of the ring 10 and between the inner faces 15 and 16 of the side members 11 and 12. The vanes 37 provide a series of circumferentially spaced pockets in the rotor each adapted to register successively with the inlets 23 and 25 and each communicating simultaneously with each inlet and its associated outlet. The rotor at all times seals the space between the inlets 23 and 25 so that the pumping action of the rotor passing one of the inlets is independent of its pumping action at the other inlet.

During the passage of a rotor pocket past the priming inlet and its associated outlet, the pocket is first substantially filled with water entering through the inlet 25 and then substantially emptied by discharge through the outlet passage

30 before registering with the inlet 23. The discharge of water by centrifugal force through the outlet passage 30 establishes a subatmospheric pressure in the rotor pocket which creates suction in the conduit 8 when the pocket registers with the inlet 23. In order to more completely discharge the liquid from the rotor pockets and thereby increase the suction, the cross sectional area of the passage 30 is preferably substantially greater than the cross sectional area of the inlet 25. It is also desirable to completely discharge water drawn through the inlet 23 and the outlet passage 29 is also preferably of a cross sectional area greater than that of its associated inlet 23.

Since the pump 7 is mounted rearwardly and downstream with respect to the propeller 6 and the openings 26 in the side member 11*a* of the pump casing face the propeller 6, water is forced by the propeller through the openings 26 and chamber 24 to the priming inlet 25. The delivery of priming liquid under pressure to the inlet 25 increases the volume of water entering the pump through the priming inlet with the result that air in the rotor pockets is more completely displaced by the priming water and the suction in the boat bailing hose 8 is increased.

The tangential arrangement of the discharge passages 29 and 30 causes a torsional thrust to be exerted upon the pump housing during operation of the pump. As shown in the accompanying drawings, the rotor turns in a clockwise direction as viewed in Fig. 2, and the thrust on the housing due to flow of water through the discharge passages 29 and 30 is counterclockwise. The passages 29 and 30 are of such length and at an angle to a radii intersecting their inner ends that the torsional thrust on the housing exerted by the propeller shaft during operation is substantially balanced and little if any force is required to hold the pump housing against turning movement about its axis.

Some makes of outboard motors have propeller shafts that are driven clockwise as viewed at 2—2 in Fig. 1, and other makes are driven counterclockwise. In order to enable the pump to be used with either type of outboard motor, the central ring 10 in which the outlet passages 29 and 30 are formed is reversible between the side members 11 and 12, so that each outlet passage may extend in the direction opposite that shown in Fig. 2 for a counterclockwise driven propeller shaft.

A quick detachable attaching and driving connection is provided between the rotor shaft 9 and the propeller shaft 5 and this connection preferably comprises parts which telescope, which have interengaging portions that are interlocked by the driving thrust of the propeller shaft and that can be disengaged by a relative turning movement in the direction of the driving thrust. The rotor shaft 9 has an enlarged inner end 38 which provides a shoulder 39 that bears against the inner bearing member 20 and the enlarged end portion 38 of the shaft 9 is provided with a socket 40 which forms part of a coupling and driving connection between the shafts 5 and 9, the socket 40 having internal torque transmitting and retaining means such as a screw thread 41.

The outer face of the side member 12 is provided with a central recess 42 which receives a member 43 attached to the outer end of the shaft 9. The member 43 is shaped to provide a finger grip for turning the shaft 9 manually and is secured to the outer end of the shaft 9 by means of a screw 44. During operation the member 43

turns with the shaft 9 within the recess 42 and in attaching the shaft 9 to a propeller or other driving mechanism the member 43 provides a convenient means for turning the shaft 9 manually. A suitable washer 45 may be interposed between the member 43 and the outer end of the bearing member 20.

For attaching the rotor shaft 9 to a propeller shaft a coupling member 46 is provided which may serve as the propeller retaining nut which, as herein shown, has a hexagonal body and is internally screw threaded so that it may be screwed onto the propeller shaft and serve as the propeller retaining nut. A cotter pin 47 may be provided for securing the combined propeller retaining nut and coupling member against rotation on the propeller shaft. The member 46 has a reduced outer end 48 adapted to enter the socket 40 and provided with an external thread 49 adapted to engage with the thread 41 in the socket 40. The threads 41 and 49 are preferably coarse pitch threads so that only a small turning movement is required to fasten the shaft 9 to the coupling member. The inclination of the threads 41 and 49 is such that the torsion applied to the shaft 9 during operation of the pump 10 will tighten the threaded connection between the shaft and coupling member. To facilitate the connection of the rotor shaft 9 to the coupling member 46 a pilot pin 50 is provided in the socket 40 centrally thereof, and the reduced end 48 of the coupling member is provided with a bore 51 forming a socket to receive the pin 50. The thread 49 of the coupling member preferably terminates short of the outer end of the reduced portion 48 so that the coupling member can engage with the pilot 50 before the threads 49 come into engagement with the threads 41, thereby insuring the correct registry of the mating threads of the coupling member and shaft.

The pump of the present invention is adapted to deliver liquid under pressure as well as to create a suction. By connecting a suitable delivery conduit to the outlet passage 29 water may be pumped from the body of water in which the pump is submerged.

The projecting portion 32 of the housing is provided with a recessed end 52 to receive a hose attaching member 53 that has a flange 54 which is secured to a boss 55 on the periphery of the pump housing by means of a screw 56, as shown in Fig. 6. The member 53 has interfitting engagement with the recessed end 52 and forms a continuation of pump outlet 30 providing means for attaching a delivery conduit such as a flexible hose 57.

Since the flow of liquid through the inlet 25 and the outlet passage 30 is independent of the flow of fluid through the inlet 23 and outlet passage 29, water may be drawn from the body of water in which the pump is submerged and discharged under pressure through the hose 57 while air, water or air and water is being drawn into the pump through the hose 8 and discharged into the body of water in which the pump is submerged. The pump is intended to be used primarily for bailing water from a boat, but when it is desired to wash the boat, clean water may be discharged through the hose 57 and dirty water accumulating in the bottom of the boat may at the same time be sucked out through the hose 8. Because of the fact that the openings 26 are in the side of the pump casing that faces the propeller 6 so that water is forced under pressure to the inlet 25, there is a greater discharge pressure in the hose 57 than would otherwise be obtained.

It is to be understood that in accordance with the provisions of the patent statutes, variations and modifications of the specific devices herein shown and described may be made without departing from the spirit of the invention.

What we claim is:

1. A self-priming submersible pump comprising a housing having a body portion forming the periphery of a cylindrical chamber and provided with tangentially disposed outlets and side walls detachably and interchangeably secured to opposite sides of said body portion, a rotor having a running fit in said chamber, said housing having a main inlet and a priming inlet opening to said chamber outwardly of the rotor axis and spaced apart circumferentially and spaced radially inwardly from each of said outlets, said rotor being formed to provide a pocket of a size to register with said inlets successively and with an outlet during registry with each inlet, said rotor having a shaft journaled in said side walls of said housing and having a coupling portion at one end and said shaft being reversible with said side walls to position the tangential outlets for a clockwise or a counterclockwise driven rotor.

2. A self-priming pump comprising a housing having a cylindrical chamber provided with diametrically opposite outlet ports and two lateral inlet ports, one substantially in radial alinement with each outlet port, said inlet ports being connected to two different sources of fluid, said housing having a tangential discharge passage leading from each outlet port and a projecting hose attaching portion having a passage leading to one of said inlet ports only, and a rotor having a running and sealing fit in said chamber and having radial vanes forming a pocket in each quadrant thereof between two adjacent vanes adapted to register successively with said inlets and simultaneously with each inlet and its radially alined outlet said cylindrical chamber and said rotor vanes providing means to cut off communication between said inlets and between said outlets in all positions of the rotor.

3. A self-priming submersible pump comprising a housing having a body portion forming the periphery of a cylindrical chamber and provided with diametrically opposite tangentially disposed outlet ports and detachable and interchangeable side walls in which there is provided a lateral inlet port substantially in radial alinement with each outlet port, said housing having a tangential discharge passage leading from each outlet port and a projecting hose attaching portion having a passage leading to one of said inlet ports, and a rotor having a running fit in said chamber and having radial vanes forming a pocket in each quadrant thereof adapted to register successively with said inlets and simultaneously with each inlet and its radially alined outlet, said rotor having a shaft journaled in said side walls of said housing and having a coupling portion at one end said shaft being reversible with said side walls to position the tangential outlets for a clockwise or a counterclockwise driven rotor.

4. A self-priming pump comprising a housing having a cylindrical chamber provided with diametrically opposite outlet ports and two lateral inlet ports, one substantially in radial alinement with each outlet port, said housing having a tangential discharge passage leading from each outlet port and a projecting hose attaching portion having a passage leading to one of said inlet ports only, said housing having a priming

chamber to which the other inlet port opens and openings through an outer wall to said priming chamber, said inlet ports receiving fluid from two separate sources outside the housing, and a rotor in said cylindrical chamber and provided with an unobstructed pocket having walls formed by portions of the rotor that registers successively with said inlet ports and that registers with each inlet and its radially alined outlet simultaneously to create flow from each inlet to its alined outlet, said rotor having a running fit with the portions of said chamber between the two pairs of radially alined ports to cut off communication between the ports of one pair and the ports of the other in all positions of the rotor.

5. A self-priming pump comprising a housing having a cylindrical chamber and a rotor in said chamber, said housing having a main inlet connected to one source of fluid to be pumped and a priming inlet connected to a different source of fluid for priming, said inlets opening to said chamber outwardly of the rotor axis and spaced apart circumferentially, and two outlets, one spaced radially outwardly from each of said inlets, said outlets discharging separate streams of fluid from said housing, said rotor being formed to provide a pocket of a size to register with said inlets successively and with an outlet during registry with each inlet, said pocket having walls formed by portions of the rotor means providing an unobstructed passage for the flow of fluid, the circumferential dimension of the portion of the pocket that registers with the inlets being less than the circumferential spacing of the inlets and the rotor having a running fit with the portions of the housing between the inlets whereby the rotor cuts off communication between said inlets in all of its positions within said chamber each outlet being of a cross sectional size greater than its associated inlet.

6. A self-priming pump comprising a housing having a cylindrical chamber and a rotor having a running and sealing fit in said chamber, said housing having a main inlet connected to one source of fluid and a priming inlet connected to a different source of priming fluid opening to said chamber outwardly of the rotor axis and spaced apart circumferentially, and two outlets, one spaced radially outwardly from each of said inlets, said outlets discharging separate fluid streams from the housing, said rotor being formed to provide an unobstructed pocket of a size to register with said inlets successively and with an outlet during registry with each inlet, said pocket having walls formed by portions of the rotor, the circumferential dimension of the portion of the pocket that registers with the inlets being less than the circumferential spacing of the inlets whereby the rotor cuts off communication between said inlets, a suction conduit connected to said main inlet only, and a delivery conduit attached to only the outlet spaced radially outwardly from said priming inlet.

7. A boat bailing attachment for propeller shafts comprising a self-priming submersible pump that has a housing provided with a central annular body portion and side walls detachably and interchangeably secured to opposite sides of said body portion, said body portion and side walls forming a pump chamber and providing circumferentially spaced tangential and peripheral outlets and circumferentially spaced inlets radially inward of the outlets, one of said inlets being a priming inlet opening to the exterior of the housing through a side wall thereof, a flexible boat bailing suction conduit connected to the other of said inlets, and a rotor having a running fit within said pump chamber and provided with a pocket of a size to communicate with said inlets and outlets successively and intermittently to discharge liquid through said outlets, said rotor having a shaft that has a coupling portion that extends through one side wall of the housing and that is reversible with the side walls to reverse the tangential outlets with respect to the coupling portion of the rotor shaft whereby the pump can be accommodated to a clockwise or counterclockwise driven rotor.

8. A self-priming pump comprising a housing having a rotor chamber a main suction inlet connected to a source of fluid to be pumped and a priming inlet connected to a different source of fluid for priming, said inlets opening to said chamber outwardly of its axis and spaced apart circumferentially, said housing having two outlets, one associated with each of said inlets and spaced radially outwardly therefrom, said outlets discharging separate streams of fluid from said housing, a rotor means in said chamber provided with a pocket having walls formed by portions of the rotor means that opens to said chamber and that is of a radial depth to register simultaneously with each inlet and its associated outlet and to provide an unobstructed passage from an inlet to its associated outlet during portions of each revolution of the rotor to create by centrifugal force a flow of fluid from each inlet to its associated outlet through the pocket while it is in communication with an inlet and an outlet, the portion of the pocket that registers with said inlets being of a circumferential width less than the circumferential spacing of the inlets and the portion of the pocket that registers with said outlets being of a circumferential width less than the circumferential spacing of said oulets whereby the pocket registers successively with the inlets and the outlets, said rotor means having a running and sealing fit with the portions of said chamber to which said pocket opens intermediate said inlets and intermediate said outlets to cut off communication between said inlets and between said outlets in all positions of the rotor means.

9. A self-priming pump comprising a housing having a rotor chamber a main suction inlet and a priming inlet opening to said chamber outwardly of its axis and spaced apart circumferentially, said inlets being connected to separate sources of fluid outside of the housing, said housing having two outlets, one associated with each of said inlets and spaced radially outwardly therefrom, said outlets discharging separate streams of fluid from the housing, a rotor in said chamber provided with circumferentially spaced pockets having walls formed by portions of the rotor that open to said chamber and that are of a radial depth to register simultaneously with each inlet and its associated outlet and to provide an unobstructed passage from an inlet to its associated outlet during portions of each revolution of the rotor to create by centrifugal force a flow of fluid from each inlet to its associated outlet through each pocket while it is in communication with an inlet and an outlet, the portion of each pocket that registers with said inlets being of a circumferential width less than the circumferential spacing of said inlets and the portion of each pocket that registers with said inlets being of a circumferential width less than the circumferential spacing of said outlets whereby each

pocket registers successively with the inlets and the outlets, portions of the rotor intermediate said pockets having a running and sealing fit with the portions of said chamber to which the pocket opens intermediate said inlets and intermediate said outlets to cut off communication between said inlets and between said outlets in all positions of the rotor.

10. A self-priming pump comprising a housing having a rotor chamber a main suction inlet connected to a source of fluid to be pumped and a priming inlet connected to a different source of fluid for priming, said inlets opening to said chamber outwardly of its axis and spaced apart circumferentially, said housing having two outlets, one associated with each of said inlets and spaced radially outwardly therefrom, a rotor in said chamber having angularly spaced vanes forming a series of pockets open to said chamber, each of which registers simultaneously with each inlet and its associated outlet and provides an unobstructed passage from an inlet to its associated outlet during portions of each revolution of the rotor to create by centrifugal force a flow of liquid from each inlet to its associated outlet through each pocket while it is in communication with an inlet and an outlet, the portion of each pocket that registers with said inlets being of a circumferential width less than the circumferential spacing of said inlets and the portion of each pocket that registers with the

outlets being of a circumferential width less than the circumferential spacing of said outlets whereby each pocket registers successively with the inlets and the outlets, said vanes having a running and sealing fit in said rotor chamber to cut off communication between said inlets and between said outlets in all positions of said rotor.

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