ABSTRACT

An impeller for preventing air-lock in a pump, the impeller in its basic embodiment includes a top plate, the top plate having a center axis and a peripheral edge, a plurality of vanes, each vane attached to the top plate, at least one small protrusion projecting from the periphery of the top plate, and at least one ventilation channel having an outlet located near the protrusion, and an inlet located near the center axis of the top plate. The present invention also contemplates a centrifuge pump and an aerator device having the impeller of the present invention.
IMPELLER WITH ANTI-VAPOR LOCK MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention
The present invention is directed to an impeller, and more particularly, an impeller provided with an air-release mechanism to prevent air-lock of a pump.

2. Description of the Related Art
Rotary pumps are well known structures employed to pump fluids from one location to another. Rotary pumps have been developed for a number of different uses, ranging from fire engine apparatus to volumetric dosing of commercially important materials. Rotary pumps may be classified according to structural features of their material propelling elements. An example of the most commercially important types of rotary pump is the centrifugal pump.

Most centrifuge pumps comprise a generically cylindrical casing and an impeller, or a plurality of impellers mounted inside the casing to draw a fluid through the pump. The pumps typically operate by taking in a fluid and adding energy from the fluid by kinematics means; thus, the fluid pressure is increased, by the interaction of rotating blades or vanes with the fluid as it passes through. This energy, however, provides several undesired side effects such as air-locking of the pump.

The pressure of the fluid in a pump drops as it flows from the suction flange through the suction nozzle and into the impeller. The amount of pressure drop is a function of many factors, including pump geometry, rotational speed, frictional and hydraulic shock losses, and flow rate.

If the pressure at any point within the pump falls below the vapor pressure of the fluid being pumped, vaporization or cavitation will occur. Bubbles are formed as a result of this pressure drop. Lower pressures in the impeller center axis are caused by variations in velocity of the fluid and friction losses as the fluid enters the impeller.

The bubbles are caught up and swept outward along the impeller vane. Somewhere along the non-visible side of the impeller vane, the pressure may once again exceed the vapor pressure and cause the bubbles to collapse, producing the phenomenon called air-lock.

During air locking, the pump not only fails to serve its basic purpose of pumping the liquid, but also may experience excessive noise and vibrations, internal damage, leakage from the seal and casing, bearing failure, etc. The extent of the air-locking damage can range from a relatively minor amount of pitting after years of service to catastrophic failure in a relatively short period of time. In summary, air-locking is an abnormal condition on the pump that can result in loss of production, equipment damage, and worst of all, personnel injury.

In the prior art, air-lock is cleared from the pump by turning the pump off, thus releasing the back pressure of air and allowing the water in the pump outlet hose to descend back through the pump, thereby forcing any trapped air out of the impeller chamber. The pump is then restarted, and in theory, but not always in practice, the pump resumes the normal pumping of liquid.

Numerous attempts have been made over the years to design a pump, which prevents or relieves air-lock. One is an "anti-airlock" pump manufactured by Rule. This pump incorporates a device, which is designed to periodically detect whether there is air present at the pump impeller. If air is detected at the pump impeller, the device shuts the pump off, allowing air to leave through the impeller output line. However, this device does not proactively clear the air-lock, and the impeller pump may remain air-locked during the interval between testing for air-lock.

U.S. Pat. No. 4,913,620 entitled "Centrifugal Water Pump" to Kusiak et al. teaches a centrifugal water pump in which the pumping chamber is horizontally oriented, and such chamber has two wall portions or sectors of different radius. One wall portion has a radius substantially the same as the outer most radial path of the impeller blades, and the other wall portion has a radius substantially constant, but slightly greater than the radius of the radical path of the impeller blades. Connecting the two chamber wall portions are terminal walls, one of which is located adjacent to the outlet port. A first deflecting wall directs the pumped water upward into the outlet port. A second deflecting wall breaks up any air and air bubbles, and fills any space wherein air or air bubbles could collect. The device of Kusiak et al. is mechanically complex, and in order to function properly, the device requires the divider wall to create a positive and negative pressure (as opposed to a normal flow of water), which actually reverses the flow of water, thereby allowing any trapped air to escape.

U.S. Pat. No. 4,087,994 entitled "Centrifugal Pump with Means for Precluding Airlock" to Goodlawson discloses a centrifugal pump with means for precluding air lock wherein the impeller of the pump includes finger-like projections on each blade which extend radially outwardly from the impeller body into the outer annulus of the pumping chamber. These projections cut through the liquid, which has been centrifuged to the outer annulus, thus causing a turbulence, which draws a portion of the liquid into the body of the impeller for mixing with trapped air.

This mixing action causes the air to be centrifuged with liquid and alleviates air lock in the pump. However, it should be noted that the vortex formed at the inlet of the pump is not reduced in size or eliminated.

U.S. Pat. No. 5,213,718 entitled "Aerator and Conversion Methods," and U.S. Pat. No. 5,275,762 entitled "Aerator" to Burgess, teach aerators wherein an impeller draws a water and air mixture down through an upwardly directed impeller inlet into a cavitation zone (i.e., the centrifugal pump is mounted upside down compared to the normal operating position). When the centrifugal pump rotates, the vacuum formed in the cavitation zone by rotation of the impeller will draw air through the air tube into the cavitation center axis where a portion of the air will be entrained in the water flowing through the vane impeller and out the water flow, directing means into the tank. Excess air drawn into the cavitation center axis through the inlet tube can escape upwardly through the water inlet, thereby preventing air-locking of the impeller, as would occur if air were to accumulate in the cavitation zone of a centrifugal pump mounted in the "normal" pump operating position, with the water inlet opening downwardly. The pump preferably floats on the water with the air/water inlet for the centrifugal pump immediately below the surface. Such a system has a number of attendant problems. First, a centrifugal pump is designed to be operated in a certain orientation. The pump may be operated upside down near the surface for periods of time without damage; however, if operated upside down at depth for any length of time, air in the motor housing will exit through the seal between the motor shaft and the impeller, and water will
enter the motor housing, thereby causing damage. Further, if the pump is operated on the surface, oxygenation of the water will occur near the surface of the tank, and the lower reaches of the bait well will not be aerated.

Further yet, if the pump is operated at depth, the design must permit escape of excess air out through the water inlet so as to prevent air-locking of the pump, or to permit flooding and restarting of an air-locked pump. The design must thus anticipate the various depths at which the pump may be operated, and the air-escape parameters for each depth. Such a design cannot optimize the air/water mixture for maximum oxygenation of the pump at every given depth. As a result of these design constraints, the oxygenation efficiency is adequate, but much less than optimal.

U.S. Pat. No. 4,917,577 entitled “High Speed Centrifugal Aerator” to Stirling teaches a high speed centrifugal aerator including (1) a frusto-conical shaped impeller chamber within which is mounted a similarly shaped mismatched impeller with blades significantly smaller than the chamber, the impeller chamber having a bottom inlet, and the bottom inlet having a venturi gas inlet for mixing gas with the flowing liquid. To be effective, the impeller must operate at a very high speed in order for the flow of fluid through the bottom inlet to be sufficient to create a suction on, and draw gas through, the venturi gas inlet. This high flow rate would render the aerator impractical for use in small applications such as bait wells, since the high turbulence would be injurious to the baitfish. More importantly, since the impeller blades are significantly smaller than the impeller chamber, most of the fluid does not come into contact with the blades. This may be desirable where the objective is to achieve high flow and low agitation. However, where the object is to achieve a high rate of mixing of air into a relatively small volume of water, as would be required in a bait well application, this high-speed centrifugal aerator is entirely unsuitable. Finally, the venturi gas inlets must be narrow to be effective as the pump is cycled through many ON-OFF periods, during which the venturi gas inlets will be flooded and dried, resulting in sedimentation and encrustation. The venturi jets will require attention and cleaning over time.

It would therefore be an advantage in the art to provide an impeller that eliminates or minimizes the above-mentioned and other problems, limitations and disadvantages typically associated with conventional pumps, and to prevent air lock of the pump impeller.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an impeller designed to prevent air-lock of the pump.

It is another object of the present invention to provide an impeller, which prevents air lock of the pump and does not require constant monitoring by the operator.

It is another object of the present invention to provide a mechanism by which air-lock may be prevented in currently available pumps.

It is another object of the present invention to provide a pump for pumping water, sewage or other liquid material from one location to another without having the problem of air lock.

Rotary pumps are designed to pump a non-compressible fluid such as water, fuel, etc. An example of the most commercially important type of rotary pump is centrifuge pumps.
impeller comprising a top plate, the top plate having a center axis and a peripheral edge; a plurality of vanes, each vane attached to the top plate; at least one small protrusion projecting from the periphery of the top plate; an inlet located near the protrusion, and an inlet located near the center axis of the top plate; pump drive means extending through the pump casing bottom and connected to the impeller; and means for mounting the housing and the pump means in operative association.

[0033] In the same way, the present invention includes a pump having an impeller according to the second, third, and fourth preferred embodiment of the present invention.

[0034] Finally, the present invention contemplates a method for preventing air lock in a pump, the method comprising the steps of:

[0035] providing a pump having an impeller operatively disposed within said pump casing for moving liquid from the water inlet to the water outlet, the impeller comprising a top plate, the top plate having a center axis and a peripheral edge; a plurality of vanes, each vane attached to the top plate; at least one small protrusion projecting from the periphery of the top plate; and at least one ventilation channel having an outlet located near the protrusion, and an inlet located near the center axis of the top plate;

[0036] rotating the impeller;

[0037] creating a negative pressure near the outlet of the ventilation channel; and

[0038] suctioning the air accumulated near the center axis of the impeller from the inlet to the outlet of the ventilation channel.

[0039] The foregoing has outlined rather broadly the more pertinent and important features of the present invention in order that the detailed description of the invention that follows may be better understood, and so that the present contribution to the art can be more fully appreciated. Additional features of the invention will be described hereinafter, which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the concept and the specific embodiments disclosed may be readily utilized as a basis for modifying or designing other aerators for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent structures do not depart from the spirit and scope of the invention as set forth in the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

[0040] For a fuller understanding of the nature and objects of the present invention, reference should be made by the following detailed description taken in with the accompanying drawings in which:

[0041] FIG. 1 is a cross-sectional view of the pump having an impeller according to the basic embodiment of the present invention.

[0042] FIG. 2 is a top view of the impeller according to the basic embodiment of the present invention.

[0043] FIG. 3 is a bottom view of the impeller according to the basic embodiment of the present invention.

[0044] FIG. 4 is a perspective bottom view of the impeller according to the basic embodiment of the present invention.

[0045] FIG. 5 is a top view of the impeller according to the first preferred embodiment of the present invention.

[0046] FIG. 6 is a bottom view of the impeller according to the first preferred embodiment of the present invention.

[0047] FIG. 7 is a perspective view of the impeller according to the first preferred embodiment of the present invention.

[0048] FIG. 8 is a top view of the impeller according to the second preferred embodiment of the present invention.

[0049] FIG. 9 is a bottom view of the impeller according to the second preferred embodiment of the present invention.

[0050] FIG. 10 is a perspective bottom view of the impeller according to the second preferred embodiment of the present invention.

[0051] FIG. 11 is a top view of the impeller according to the third preferred embodiment of the present invention.

[0052] FIG. 12 is a bottom view of the impeller according to the third preferred embodiment of the present invention.

[0053] FIG. 13 is a perspective bottom view of the impeller according to the third preferred embodiment of the present invention.

[0054] FIG. 14 is a perspective bottom view of the impeller according to the fourth preferred embodiment of the present invention.

[0055] FIG. 15 is a top view of the impeller according to the fourth preferred embodiment of the present invention.

[0056] FIG. 16 is a bottom view of the impeller according to the fourth preferred embodiment of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] For a fuller understanding of the nature and objects of the present invention, reference should be made by the following detailed description taken in with the accompanying drawings in which:

[0041] FIG. 1 is a cross-sectional view of the pump having an impeller according to the basic embodiment of the present invention.

[0042] FIG. 2 is a top view of the impeller according to the basic embodiment of the present invention.

[0043] FIG. 3 is a bottom view of the impeller according to the basic embodiment of the present invention.

[0044] FIG. 4 is a perspective bottom view of the impeller according to the basic embodiment of the present invention.

[0045] FIG. 5 is a top view of the impeller according to the first preferred embodiment of the present invention.

[0046] FIG. 6 is a bottom view of the impeller according to the first preferred embodiment of the present invention.

[0047] FIG. 7 is a perspective view of the impeller according to the first preferred embodiment of the present invention.

[0048] FIG. 8 is a top view of the impeller according to the second preferred embodiment of the present invention.

[0049] FIG. 9 is a bottom view of the impeller according to the second preferred embodiment of the present invention.

[0050] FIG. 10 is a perspective bottom view of the impeller according to the second preferred embodiment of the present invention.

[0051] FIG. 11 is a top view of the impeller according to the third preferred embodiment of the present invention.

[0052] FIG. 12 is a bottom view of the impeller according to the third preferred embodiment of the present invention.

[0053] FIG. 13 is a perspective bottom view of the impeller according to the third preferred embodiment of the present invention.

[0054] FIG. 14 is a perspective bottom view of the impeller according to the fourth preferred embodiment of the present invention.

[0055] FIG. 15 is a top view of the impeller according to the fourth preferred embodiment of the present invention.

[0056] FIG. 16 is a bottom view of the impeller according to the fourth preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0057] The present invention is directed to a pump for pumping water, sewage, or other liquid material from one location to another. The pump includes an impeller, or impellers that is rotated in moderately close proximity to a stationary plate or stator. The stationary plate has a central, coaxial inlet through which liquid passes, and is thereupon conveyed by centrifugal force along the impeller-plate spacing to an outlet at the periphery of the impeller and the plate.

[0058] The pump may be any conventionally available pump such as centrifugal pump, an impeller pump, or a mixed flow. Preferably, the pump is a centrifugal pump, such as a centrifugal rotary bilge pump that is well known in the art.

[0059] Centrifugal pumps are classified into three categories—submersible, dewatering and trash.

[0060] Submersible pumps offer contractors versatility on the job site. These pumps are, by definition, submersible in water containing solids up to one-quarter inch in diameter and less than 10 percent by weight. Submersible pumps are relatively inexpensive, can run unattended, and are lightweight and quiet. They can pump unwanted water from well casings, tunnels, shafts, flooded basements, manholes, vaults, swimming pools, and field drainage collection systems. They can also supply water-to-water fountains, waterfalls and small irrigation projects.

[0061] Dewatering pumps are also somewhat inexpensive but do not contain high-quality components. Centrifugal dewatering pumps feature high-volume flow capabilities, are lightweight, and have a compact design. The water being pumped must be relatively clean, containing solids up to one-quarter inch in diameter and less than 10 percent by weight. These units are best suited for pumping water from manholes, flooded basements, utility vaults, swimming pools, lakes and barge holds. Dewatering pumps can also supply water to rural fire trucks, water trucks and small irrigation projects.

[0062] In contrast, trash pumps cost more, but they contain high-quality components. The construction and rental industries often prefer this type of pump, which has high-volume flow capabilities, is lightweight and compact, and has a pump
housing that you can easily open for cleaning. These pumps can handle clean, muddy, mucky, and sandy or gravelly water with solids up to 2 inches in diameter and between 10 to 25 percent by weight. Trash pumps can remove unwanted water from excavations less than 20 feet deep, flooded basements, manholes, utility vaults, mining work, swimming pools, lakes and barge holds.

The term “centrifugal pump” as used herein is intended to mean a pump, which utilizes the towering force of a rapidly moving impeller. The liquid is pulled in at the center or center axis of the impeller and is discharged at the outer rim of this impeller. By the time the liquid reaches the outer rim of the impeller, it has acquired considerable velocity. The liquid is then slowed down by being led through either a volute or a conical housing. The simplest method for converting dynamic pressure to static pressure is to slowly increase the volute delivery channel area (e.g., a taper of no greater than 8 degrees). This is known as a diffuser, and is often used on small pumps. As the velocity of the liquid decreases, its pressure increases. The shape of the outlet has the effect of changing the low-pressure, high velocity fluid to high pressure, low velocity. That is, some of the mechanical kinetic energy is transformed into mechanical potential energy. In other words, the velocity head is partially turned into a pressure head.

The device according to the present invention will now be discussed in greater detail by reference to the drawings.

FIG. 1 illustrates a cross-sectional view of the pump device 10 according to the present invention. The pump comprising: a housing (not shown); a pump casing 20 defining a pump chamber, the casing 20 having a top, a bottom, and a side; an electric motor 25; at least one liquid inlet 30 located on the bottom of the housing; at least one liquid outlet 40 located on the side of the housing; an impeller 45 operatively disposed within said pump casing for moving liquid from the liquid inlet 30 to the liquid outlet 40. The impeller 45 comprising a top plate 50, the top plate having a center axis 60, a plurality of vanes 70, each vane radially attached to the plate 50, at least one small protrusion 80 slightly projecting from the periphery 85 of the top plate 50 and at least one ventilation channel 90 running from the periphery of the top plate 100 (exit) to an orifice 110 located near the center axis of the top plate 120 (entrance), wherein when the impeller rotates, a negative pressure is produced near the exit 100 of each ventilation channel 90, wherein the negative pressure suction the air accumulate near the center axis 60 of the impeller, wherein the air is release from the center axis 60 of the impeller via the orifices 110 and through the orifices 120 of the ventilation channels to the exit 100 of the ventilation channel; pump drive means 130 extending through the pump casing bottom and connected to the impeller 45; an air inlet to introduce air into the housing; and means for mounting the housing and the pump means in operative association.

The motor may be powered by any suitable means such as an internal battery, an external portable battery, or via electrical connections to the main electrical supply system of a boat (in which case the electric drive motor includes insulated and encased electrical conductors 140). The ends of the electrical connection means may be provided with electrically conductive clamps (not shown) whereby the clamps may be clamped to the terminals of an electric battery or other source of electrical power. The portable power supply (not shown) may be provided in a housing, which can be mated, integral with the pump casing 20, or may be located outside the motor casing and inside or outside the boat transom, in which case external electrical connection means 140 are required.

The pump housing 20 is shaped so as to encompass the impeller 45 and to define a liquid inlet 30 and a liquid outlet 40. In the design as illustrated in FIG. 1, the liquid inlet area is immediately below, and co-axial with, the drive shaft 130 and “eye” of the impeller 60.

The impeller 45 comprises a top plate 50, which is fixed at its center to the drive shaft 130. The impeller 45 is provided with a plurality of vanes 70 which are attached radially or axially to the impeller top plate 50. The vanes extend downwardly and are in close tolerance with the bottom wall portion 150 of the housing 20.

The material of the impeller depends of the type of fluid being pumped. In the majority of the cases, it is preferable that the impeller be made of a non-corrosive material such as plastic.

What differentiates the impeller of the present invention from those known in the art is that the basic embodiment of the impeller according to the present invention includes at least one small protrusion 80 slightly projecting from the periphery 85 of the top plate 50 and at least one ventilation channel 90 having an outlet 100 located near each protrusion 80, and an inlet 120 located near the center axis of the top plate.

The air accumulated near the center axis of the impeller enters the inlet 120 via an orifice 110 located near the center axis of the impeller.

The operation of the pump will now be described. When the electric motor 25 is energized, drive shaft 130 rotates, causing corresponding rotation of the impeller 45 whereby water is drawn into the water inlet 30 to the water outlet 40. When the impeller rotates, the protrusions close the gap B between the impeller vanes and the pump casing creating a decreasing cross-sectional area, thus the velocity of the liquid increases, and the static pressure decreases creating a venturi effect (Bernoulli’s principle). In other words, total system energy, i.e. sum of the potential and kinetic energy, remains constant in a flowing system (neglecting friction). The gain in velocity occurs at the expense of pressure. At the point of minimum cross-section, the velocity is at a maximum, and the static pressure is at a minimum.

The negative pressure suction the air accumulated near the center axis 60 of the impeller, thus the air is released from the pump via the orifices 110 and through the entrance 120 of the ventilation channels to the exit 100 of the ventilation channel. FIGS. 2-4.

There is a further drop in pressure due to shock and turbulence as the liquid strikes and loads the edges of impeller vanes. The net effect of all the pressure drops is the creation of a very low-pressure area around each ventilation channel.

In the first preferred embodiment, the impeller 150 for preventing air-lock in a pump according to the present invention comprises: a top plate 160, the top plate having a center axis 170, a top side 180, a bottom side 190, and at least one orifice 200; a plurality of vanes 210, each vane attached to the bottom side 190 of the top plate 160; and at least one small protrusion 220 projecting from the top side 180 of the top plate 160, wherein the each small protrusion is located near each orifice 200 of the top plate 160. FIGS. 5-7.
The protrusions in this embodiment act in the same manner as the protrusions in the basic embodiment.

In the second preferred embodiment, the impeller 230 for preventing air-lock in a pump according to the present invention comprises: a top plate 240, the top plate having a center axis 250, a top side 260, a bottom side 270, and at least one orifice 280; and a plurality of vanes 290, each vane attached to the bottom side 270 of the top plate 240; and wherein at least one orifice 280 is located near the center axis 250 of the top plate 240. FIGS. 8-10.

Each orifice includes an angled wall section (not shown). The angled wall increases the speed of the fluid creating a venturi effect in the impeller. Accordingly, due to the angle and velocity of the fluid, thus suction is generated at the top side of the impeller.

In the third preferred embodiment, the impeller 300 for preventing air-lock in a pump according to the present invention comprises: a top plate 310, the top plate having a center axis 320, a top side 330, a bottom side 340, a periphery 350, and at least one orifice 360; a plurality of vanes 370, each vane attached to the bottom side 340 of the top plate 310; and at least one ventilation channel 380 having an outlet 390 located near the periphery 350 of the top plate 310, and an inlet 400 located near the at least one orifice 360 of the top plate 310. FIGS. 11-13.

In the fourth preferred embodiment, the impeller for preventing air-lock in a pump according to the present invention comprises: a top plate 160, the top plate having a center axis 170, a top side 180, a bottom side 190; a plurality of vanes 210, each vane attached to the bottom side 190 of the top plate 160, wherein each vane is axially hollow 215. FIGS. 14-16.

During an extensive research, applicant discovered that any opening through the impeller will produce a drop in the pressure near the area of the opening, thus the air accumulate near the center axis of the impeller will be suctioned out of the impeller though the opening.

In accordance with this invention, the pump can automatically rid itself of air-lock. Thus, constant monitoring for the presence of air-lock, so that corrective action can be taken, is eliminated or reduced to a minimum.

It can, therefore, be seen that the design of the impeller disclosed herein offers a unique constriction for preventing or alleviating air-lock in a pump.

The output from the pump having an impeller according to the present invention is uninterrupted, smooth and non-turbulent, so as to provide optimal conditions.

Although this invention has been disclosed and described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form is only by way of example, and that numerous changes in the details of operation and in the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An impeller for preventing air-lock in a pump, the impeller comprising:
   a top plate having a center axis, a top side, a bottom side, and at least one orifice;
   a plurality of vanes, each being attached to the top plate;
   a small protrusion projecting from the periphery or the top side of the top plate; and
   at least one ventilation channel having an outlet and an inlet.

2. The impeller according to claim 1, wherein the plurality of vanes are radially attached to the top plate.

3. The impeller according to claim 1, wherein the plurality of vanes are axially attached to the top plate.

4. The impeller according to claim 1, wherein:
   the vanes are attached to the bottom side of the top plate; and
   the at least one small protrusion projects from the top side of the top plate and the each small protrusion is located near each orifice of the top plate.

5. The impeller according to claim 1, wherein:
   the at least one orifice is located near the center axis of the top plate.

6. The impeller according to claim 5, wherein the at least one orifice includes an angled wall.

7. The impeller according to claim 1, wherein:
   the outlet of the at least one ventilation channel is located near the periphery of the top plate, and the inlet is located near the at least one orifice of the top plate.

8. The impeller according to claim 1, wherein:
   the outlet of the at least one ventilation channel is located near the protrusion, and the inlet is located near the center axis of the top plate.

9. The impeller according to claim 1, wherein each vane is axially hollow.

10. A pump comprising:
    a pump casing defining a pump chamber, the casing having a top, a bottom, and a side;
    an electric motor;
    at least one water inlet located on the bottom of the housing;
    at least one water outlet located on the side of the housing;
    an impeller operatively disposed within said pump casing for moving liquid from the water inlet to the water outlet, the impeller comprising a top plate having a center axis, a top side, a bottom side, and at least one orifice; a plurality of vanes, each being attached to the top plate; at least one small protrusion projecting from the periphery or the top side of the top plate; and at least one ventilation channel having an outlet and an inlet;
    pump drive means extending through the pump casing bottom and connected to the impeller; and
    means for mounting the housing and the pump means in operative association.

11. A method for preventing air lock in a pump, the method comprising the steps of:
    providing a centrifuge pump having an impeller operatively disposed within said pump casing for moving liquid from the water inlet to the water outlet, the impeller comprising a top plate having a center axis, a top side, a bottom side, and at least one orifice; a plurality of vanes, each being attached to the top plate; at least one small protrusion projecting from the periphery or the top side of the top plate; and at least one ventilation channel having an outlet and an inlet;
    rotating the impeller;
    creating a negative pressure near the outlet of the ventilation channel; and
    suctioning the air accumulated near the center axis of the impeller from the inlet to the outlet of the ventilation channel.

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