A centrifugal pump has a pump case and a rotatable impeller disposed within the pump case. A central aperture is defined within the rearward wall of the pump case to facilitate the connection of an impeller drive shaft to the impeller. A drive shaft seal is disposed within the central aperture to seal the impeller drive shaft to the pump case. A tab is disposed within the pump case such that it protrudes away from the rearward wall of the pump case. The tab is sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal to suppress the buildup of heat and chemical precipitates around the drive shaft seal.
PUMP WITH TURBULENCE INDUCING TAB

FIELD OF THE INVENTION

This invention relates generally to centrifugal pumps and, more specifically, centrifugal pumps used in water recreational apparatuses.

BACKGROUND OF THE INVENTION

Centrifugal pumps used for recirculating water in water recreational apparatuses, such as spas, hot tubs, swimming pools and recirculating bathtubs, are prone to fouling and chemical build-up within the pump case. The principal problem area is around the seal which seals the impeller drive shaft to the pump case. Such fouling is the result of the precipitation of salts and other chemicals dissolved within the water.

Also, the seal which seals the impeller drive shaft to the pump case is prone to failure due to heat build-up at the seal.

Thus, there is a need for a centrifugal pump which avoids this problem in the prior art.

SUMMARY OF THE INVENTION

The invention satisfies this need. The invention is a centrifugal pump comprising (a) a pump case having a forward wall, a rearward wall, and one or more side walls, the forward wall defining a central inlet opening, the one or more side walls defining a tangential outlet opening and the rearward wall defining a central drive shaft opening, (b) a rotatable impeller disposed within the pump case, (c) a drive shaft disposed through the drive shaft central opening and operatively attached to the impeller, (d) a drive shaft seal disposed around the drive shaft opening to seal the drive shaft to the pump case, and (e) a tab disposed within the pump case, the tab being attached to, and protruding away from, the rearward wall of the pump case and being sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal, while the pump is in use to pump a liquid, to suppress the build-up of chemical precipitates around the drive shaft seal.

DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description, appended claims and accompanying drawings where:

FIG. 1 is a perspective view of a centrifugal pump having features of the invention;

FIG. 2 is a perspective plan view of the centrifugal pump illustrated in FIG. 1;

FIG. 3 is a side view of the centrifugal pump illustrated in FIG. 1;

FIG. 4 is an exploded view of the pump illustrated in FIG. 1;

FIG. 5 is a cross-sectional view of the centrifugal pump illustrated in FIG. 1, taken along line 5-5; and

FIG. 6 is a cross-sectional detail view of the centrifugal pump illustrated in FIG. 4, taken along line 6-6.

DETAILED DESCRIPTION

The following discussion describes in detail one embodiment of the invention and several variations of that embodiment. This discussion should not be construed, however, as limiting the invention to those particular embodiments. Practitioners skilled in the art will recognize numerous other embodiments as well.

The invention is a centrifugal pump 10 having a pump case 12 and a rotatable impeller 14 disposed therein. At least one tab 16 is defined within the pump case 12 to induce turbulence within the pump case 12 during operation of the pump 10.

As illustrated in the drawings, the pump case 12 typically consists of two portions, a forward portion 20 and a rearward portion 22. The forward portion 20 has a forward wall 24 and the rearward portion 22 has a rearward wall 26. The pump case 12 also comprises a generally circular side wall 28. The rearward wall 26 defines a drive shaft opening 30 for admitting a drive shaft 32 into the interior of the pump case 12 to rotate the impeller 14. The pump case 12 is typically made from a metal or plastic material, depending upon the service for which the pump 10 is designed.

The forward wall 24 of the pump case 12 defines a suction opening 34 for allowing fluid to flow into the interior of the pump case 12. The side wall 28 of the pump case 12 defines a discharge opening 36 for allowing fluids to flow out of the pump case 12.

The impeller 14 is disposed within the pump case 12 and is adapted with impeller blades 38 to accept fluids flowing into the pump case 12 via the suction opening 34 and discharging that fluid via the discharge opening 36 by centrifugal force. The impeller 14 is rotatable about the axis of the drive shaft 32 disposed through the central opening 30 in the rearward wall 26 of the pump case 12. The drive shaft 32 is typically driven by an electric motor (not shown).

The drive shaft 32 is sealed to the pump case 12 by a drive shaft seal 40 disposed around the central opening 30 of the rearward wall 26 of the pump case 12. The drive shaft seal 40 comprises a seal ring 42 which presses against a disk 44. The seal ring 42 is urged into sealing contact with the disk 44 by a spring 46.

Preferably, the centrifugal pump 10 further comprises a flow guide 54 disposed within the pump case 12. The flow guide 54 comprises a first baffle surface 56 and an attached second baffle surface 58. The first baffle surface 56 is arcuate and is considerably longer than the second baffle surface 58. The junction of the first baffle surface 56 and the second baffle surface 58 defines an angle α greater than 90°. The distance between the first baffle surface 56 and the impeller 14 is less than the distance between the side walls 28 of the pump case 12 and the impeller 14. By this design, flow of liquids between the impeller 14 and the flow guide 54 are somewhat inhibited. This results in an increased flow from the discharge opening 36 in the pump case 12.

Also, it is preferable that the discharge opening 36 and the impeller 14 be disposed in the same plane. In the embodiment illustrated in FIG. 5, the impeller 14 actually is disposed in substantially the same plane 60 as the center of the outlet opening 36. By disposing the impeller 14 in the same plane as the discharge opening 36, pumps 10 of the
invention have been found to operate with markedly increased efficiency over pumps of the prior art.

[0021] The tab 16 is attached to and protrudes away from the rearward wall 26 of the rearward portion 22 of the pump case 12. The tab 16 is sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal 40, while the pump 10 is in use to pump a liquid, such as an aqueous solution, to suppress the buildup of heat and chemical precipitates around the drive shaft seal 40. The tab 16 is also sized, dimensioned and located so as to not create any more turbulence and drag than necessary to accomplish the suppression of buildup of heat and chemical precipitates around the drive shaft seal 40.

[0022] In the embodiment illustrated in the drawings, the tab 16 is triangular in shape and has one free corner 62. The height of the tab 16 from the lowermost corner 62 to its uppermost free corner 62 is typically between about 0.1 inch and about 1 inch, more typically between about 0.2 inch and about 1 inch, where the pump 10 is relatively small and useable in a recirculating bath tub. In such embodiments, the width of the tab 16, that is, the distance along the uppermost edge 66 of the tab 16, is typically between about 0.1 inch and about 1 inch, most typically between about 0.1 inch and about 0.5 inch.

[0023] The invention provides a centrifugal pump which successfully and efficiently avoids the problems in other centrifugal pumps of precipitated chemical fouling around the drive shaft seal and heat related failures of the drive shaft seal.

[0024] Having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention as set forth hereinafore and as described hereinafter by the claims.

What is claimed is:
1. A centrifugal pump comprising:
(a) a pump case having a forward wall, a rearward wall, and one or more side walls, the forward wall defining a central inlet opening, the one or more side walls defining a tangential outlet opening and the rearward wall defining a central drive shaft opening;
(b) a rotatable impeller disposed within the pump case;
(c) a drive shaft disposed through the drive shaft central opening and operatively attached to the impeller;
(d) a drive shaft seal disposed around the drive shaft opening to seal the drive shaft to the pump case; and
(e) a tab disposed within the pump case, the tab being attached to, and protruding away from, the rearward wall of the pump case and being sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal, while the pump is in use to pump a liquid, to suppress the buildup of chemical precipitates around the drive shaft seal.

2. The centrifugal pump of claim 1 wherein the tab is sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal, while the pump is in use to pump an aqueous solution, to suppress the buildup of chemical precipitates around the drive shaft seal.

3. The centrifugal pump of claim 1 wherein the tab has a height of between about 0.1 inch and about 1 inch.
4. The centrifugal pump of claim 1 wherein the tab has a width of between about 0.5 inch and about 1 inch.
5. The centrifugal pump of claim 1 wherein the tab has at least one sharp free corner.
6. The centrifugal pump of claim 1 wherein the outlet opening and the impeller are disposed in the same plane.
7. The centrifugal pump of claim 1 wherein the outlet opening and the impeller are disposed in substantially the same plane.
8. The centrifugal pump of claim 1 further comprising a flow guide disposed within the pump case, the flow guide comprising a first baffle surface and an attached second baffle surface, the first baffle surface being arcuate and being longer than the second baffle surface, the junction of the first baffle surface and the second baffle surface defining an angle greater than 90°, the first baffle surface being spaced apart from the impeller by a distance which is less than the distance between the impeller and the at least one side wall of the pump case, the second baffle surface being disposed proximate to the outlet opening.
9. A centrifugal pump comprising:
(a) a pump case having a forward wall, a rearward wall, and one or more side walls, the forward wall defining a central inlet opening, the one or more side walls defining a tangential outlet opening and the rearward wall defining a central drive shaft opening;
(b) a rotatable impeller disposed within the pump case;
(c) a drive shaft disposed through the drive shaft central opening and operatively attached to the impeller;
(d) a drive shaft seal disposed around the drive shaft opening to seal the drive shaft to the pump case; and
(e) a tab disposed within the pump case, the tab being attached to, and protruding away from, the rearward wall of the pump case, the tab having a height between about 0.2 inch and about 1 inch and a width between about 0.1 inch and about 1 inch, the tab being further sized, dimensioned and located so as to create sufficient turbulence proximate to the drive shaft seal, while the pump is in use to pump an aqueous solution, to suppress the buildup of chemical precipitates around the drive shaft seal.

10. The centrifugal pump of claim 9 wherein the tab has at least one sharp free corner.
11. The centrifugal pump of claim 9 wherein the outlet opening and the impeller are disposed in the same plane.
12. The centrifugal pump of claim 9 wherein the center of the outlet opening and the impeller are disposed in substantially the same plane.
13. The centrifugal pump of claim 9 further comprising a flow guide disposed within the pump case, the flow guide comprising a first baffle surface and an attached second baffle surface, the first baffle surface being arcuate and being longer than the second baffle surface, the junction of the first baffle surface and the second baffle surface defining an angle greater than 90°, the first baffle surface being spaced apart from the impeller by a distance which is less than the distance between the impeller and the at least one side wall of the pump case, the second baffle surface being disposed proximate to the outlet opening.
14. A centrifugal pump comprising:
(a) a pump case having a forward wall, a rearward wall, and one or more side walls, the forward wall defining a central inlet opening, the one or more side walls defining a tangential outlet opening and the rearward wall defining a central drive shaft opening;
(b) a rotatable impeller disposed within the pump case;
(c) a drive shaft disposed through the drive shaft central opening and operatively attached to the impeller; and
(d) a drive shaft seal disposed around the drive shaft opening to seal the drive shaft to the pump case;
wherein the outlet opening and the impeller are disposed in the same plane.

15. The centrifugal pump of claim 14 wherein the center of the outlet opening and the impeller are disposed in substantially the same plane.

16. The centrifugal pump of claim 14 further comprising a flow guide disposed within the pump case, the flow guide comprising a first baffle surface and an attached second baffle surface, the first baffle surface being arcuate and being longer than the second baffle surface, the junction of the first baffle surface and the second baffle surface defining an angle greater than 90°, the first baffle surface being spaced apart from the impeller by a distance which is less than the distance between the impeller and the at least one side wall of the pump case, the second baffle surface being disposed proximate to the outlet opening.