March 10, 1970 H. A. EBERHARDT 3,499,388

CENTRIFUGAL PUMP

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FIG. 2.

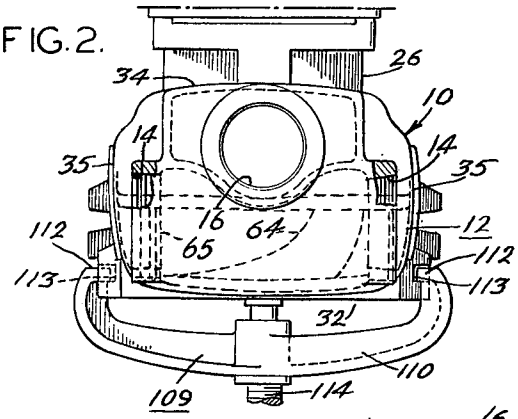


FIG. 1.

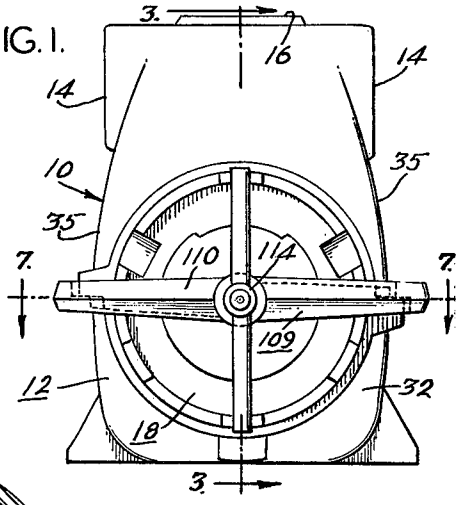
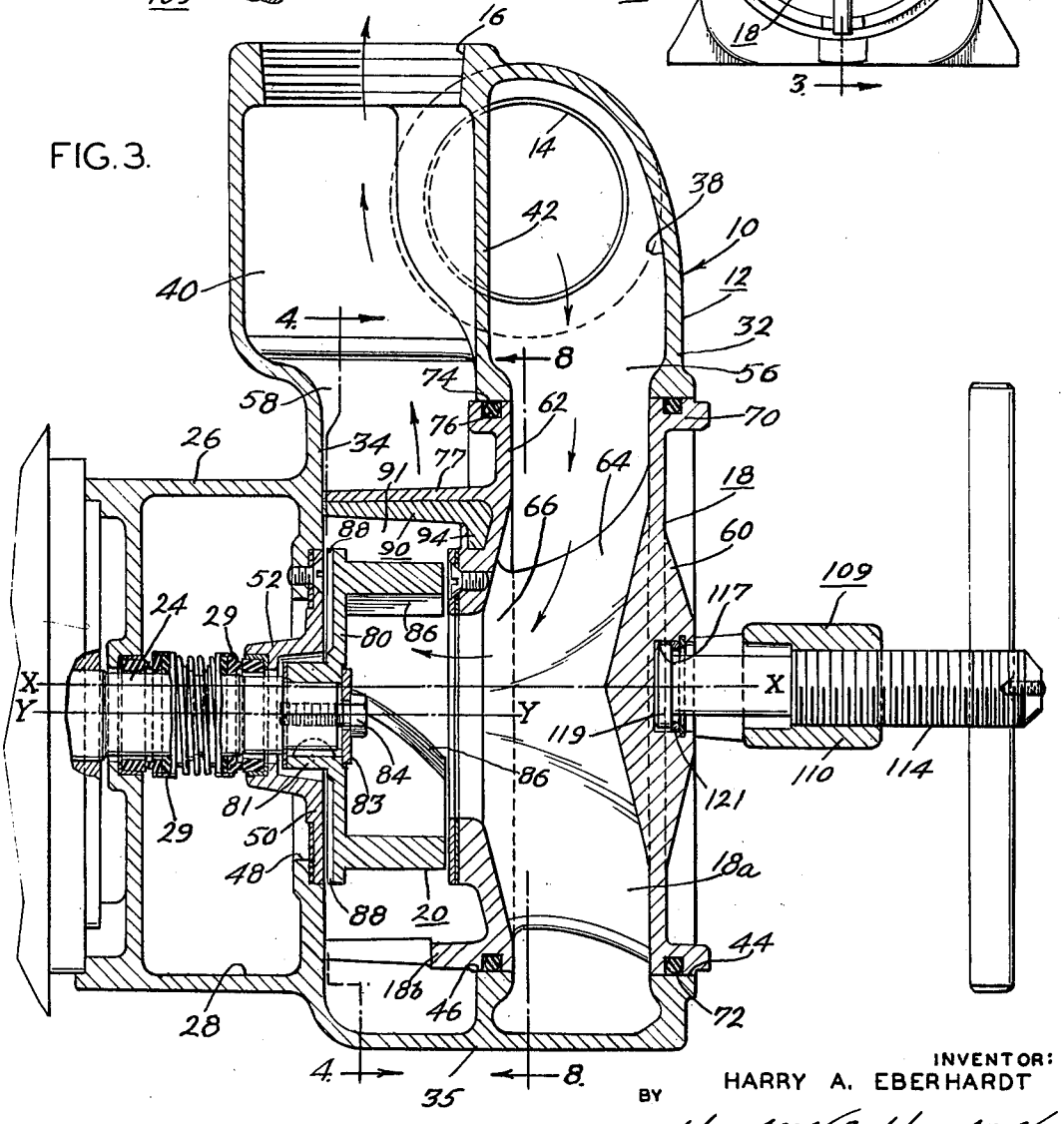


FIG. 3.



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FIG. 4.

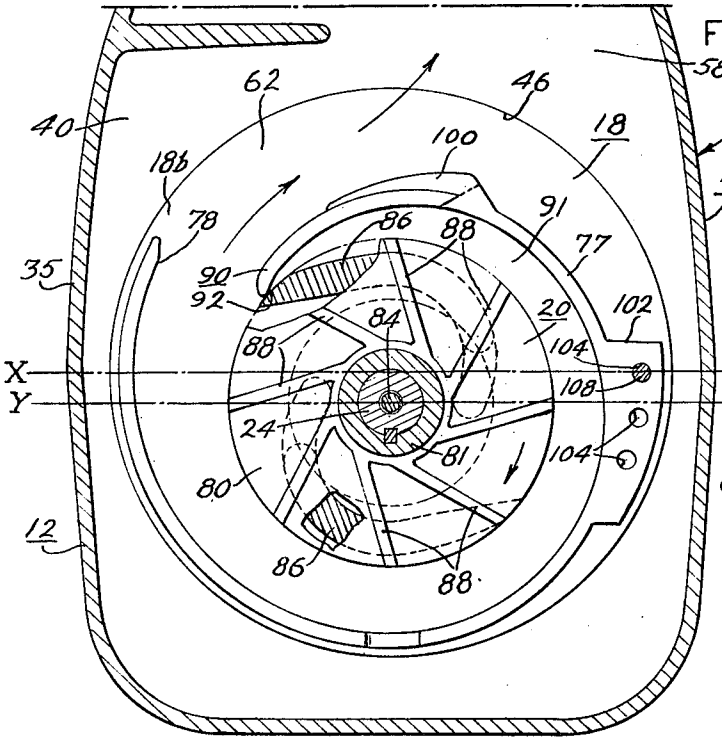


FIG. 5.

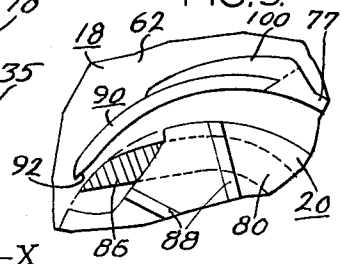


FIG. 9.

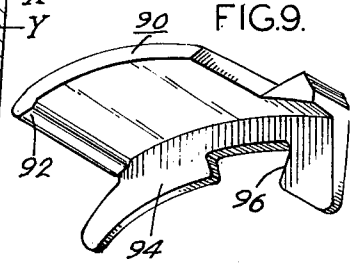
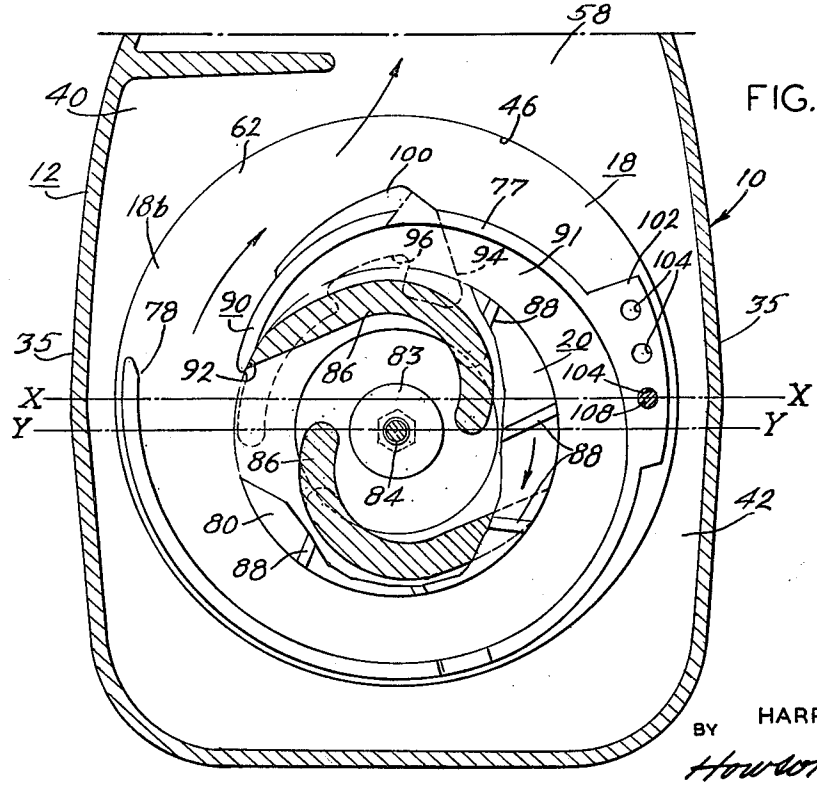


FIG. 6.



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FIG. 7.

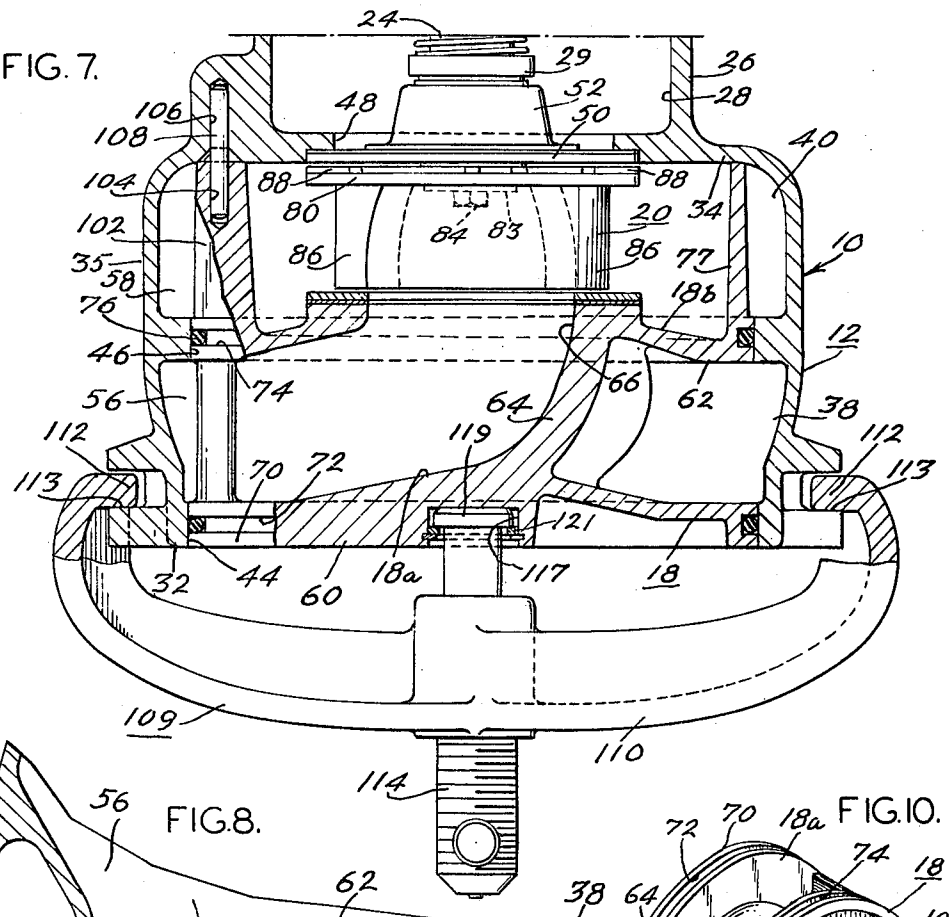


FIG. 8.

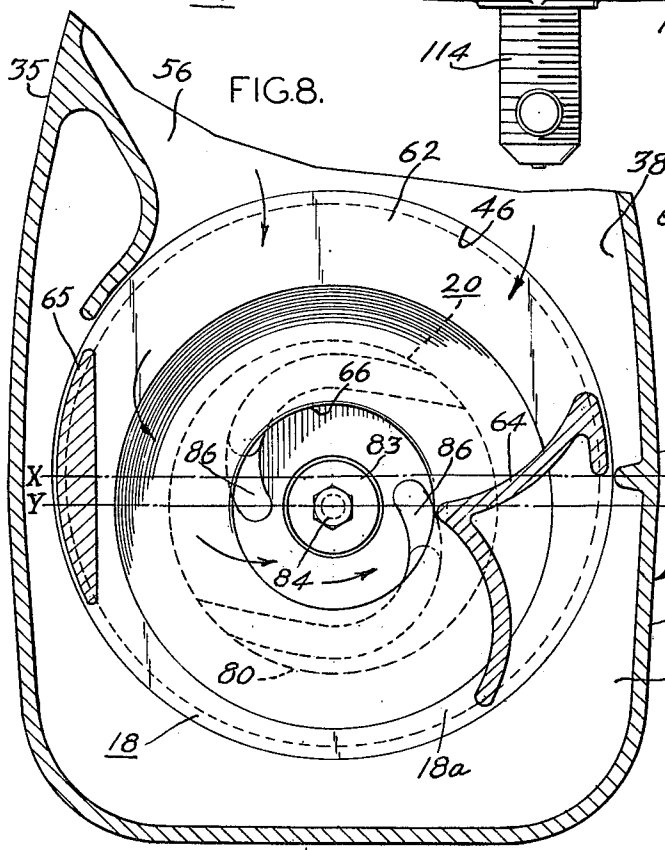
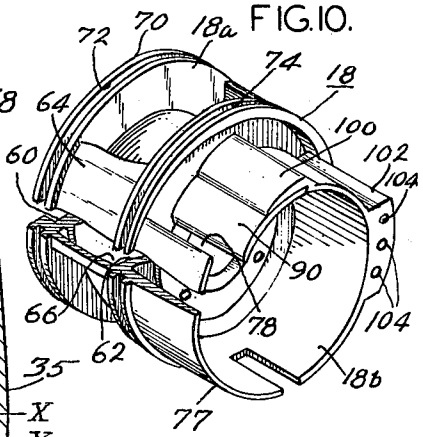


FIG. 10.



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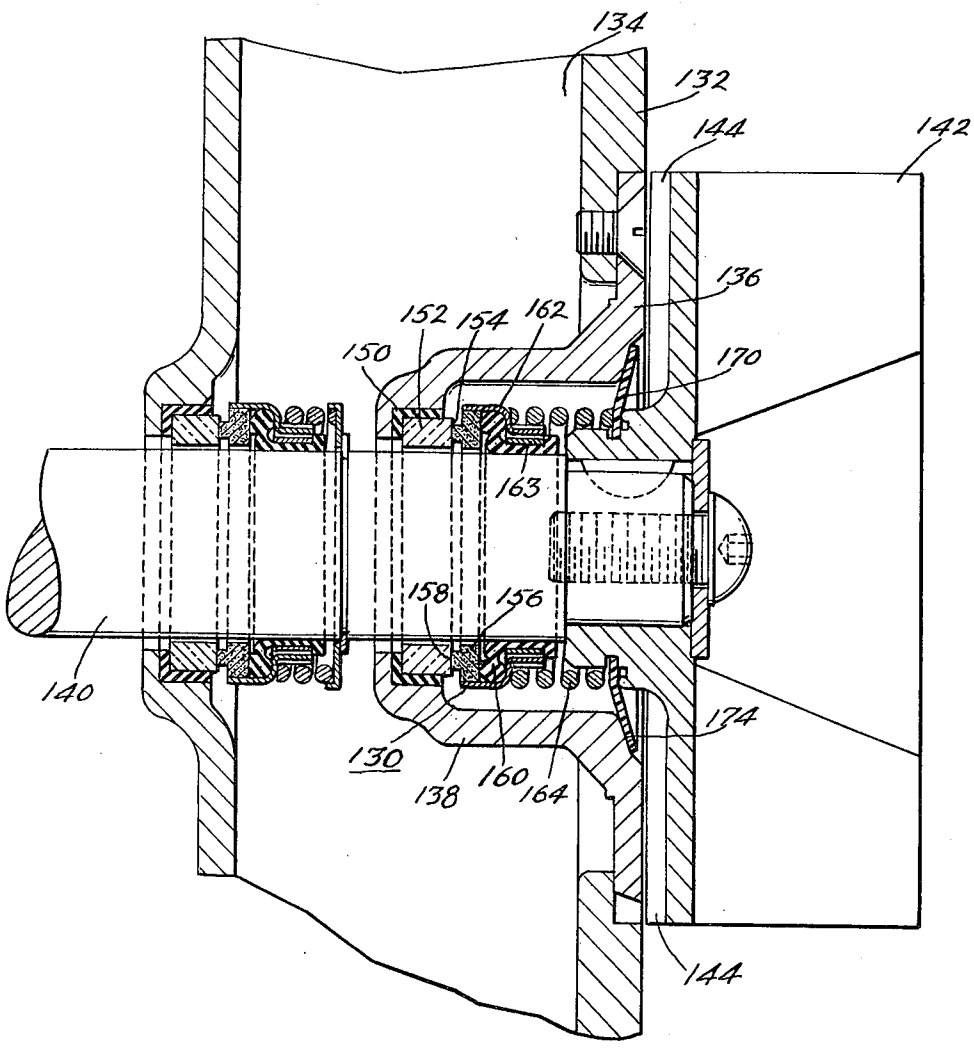
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FIG. 11.



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United States Patent Office 3,499,388 Patented Mar. 10, 1970

3,499,388

CENTRIFUGAL PUMP

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Filed June 13, 1967, Ser. No. 645,708
Int. Cl. F04d 1/00, 29/02; F15j 15/40
U.S. Cl. 103—103 19 Claims

ABSTRACT OF THE DISCLOSURE

A centrifugal pump comprising a one-piece casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly mounted in the casing comprising a suction volute section and a discharge volute section, an impeller mounted in the discharge volute section. Chambers, passages and passageways are provided in the various parts of the pump so that flow of fluid is directed through the pump from the inlet to the discharge port. The volute includes a volute tongue which in the present instance is a blade-like insert positioned closely adjacent the trace of the outer edge of the impeller blades, the juncture of the blades and inner edge defining a cut-off point. The volute assembly is mounted for rotation about an axis eccentric to the rotational axis of the impeller for adjustment of the volute relative to the impeller blades.

This invention relates generally to centrifugal pumps and more particularly to a pump specifically adapted for pumping fluid waste products which may include sludge and foreign matter.

Centrifugal pumps of the type to which the present invention relates are used in sewage plants to pump fluid products which often include relatively large foreign solid objects. Some of these prior pumps generally comprise an outer casing having inlet and discharge ports connected by a plurality of internal passageways, an impeller rotatably mounted in the casing and a cut-off member or blade disposed adjacent the peripheral trace of the impeller in the discharge section of the pump. The casing may be provided with an opening adjacent the impeller covered by a panel including locking means to seat the panel. When centrifugal pumps are used in these applications, it has been found that it is necessary from time to time to disassemble parts of the pump to clean various parts and in some instances replace worn out parts. One of the problems with prior centrifugal pumps of this type is that they have been comprised of many parts and that they are difficult to disassemble for complete cleaning purposes and repair. As a practical matter, these pumps may be characterized as "limited access" pumps. For example, if the pump gets jammed by a large object removal of the panel only provides access to the impeller area. Moreover the locking means employed usually only seats the panel and over a period of use the panel may become frozen or locked in place due to corrosion. Thus, even this access becomes difficult. In order to gain access to some other areas of the pump, it is necessary to disconnect the inlet and discharge piping to the pump which in many installations are designed as permanent fixtures. In view of the above the problems of complete clean out can be appreciated. Additionally similar disassembly problems cause the task of replacing seals and bearings to be time consuming and costly.

The juncture of the blade and the outer edge of the impeller is commonly defined as the "cut-off" point. In self-priming pumps, it is necessary to have a close clearance at the cut off in order to "peel off" air bubbles during the priming cycle. It has been found that over a

period of normal use the cut-off blade tends to wear and a gap develops at the cut-off juncture. In order to reestablish the close clearance, it is necessary in these prior pumps to disassemble the pump and replace the entire volute, and in some cases, the pump body, to obtain close clearance at the cut-off. Furthermore, it has been found that in these prior pumps, especially where the fluid is dirty water, for example, the seals wear rapidly, which obviously requires disassembly of the pump to replace the seal from time to time. This is also expensive and time consuming.

The centrifugal pump of the present invention overcomes the difficulties and disadvantages of the prior pumps discussed above. In accordance with the present invention, the pump includes a volute assembly rotatably mounted in the pump body having a spiral wall surrounding the impeller and a volute tongue in the present instance an insert forming part of the spiral wall which is adapted to be positioned closely adjacent the peripheral trace of the impeller blades to define the "cut-off." The volute assembly is adapted for rotational adjusting movement about the axis of the casing bore and which is offset radially or eccentrically relative to the rotational axis of the impeller whereby the position of the volute insert edge relative to the peripheral trace of the impeller blades may be selectively varied to compensate for wear over a period of normal use. This provides a relatively simple means for maintaining close clearance at the cut-off without major disassembly of the pump. Another feature of the present invention is the provision of a plurality of radial vanes on the back face of the impeller disc confronting the bearing side mounting the impeller which in the operation of the pump repel dirt and foreign matter and also create a vacuum pulling lubricant across the contacting faces of the shaft seal thereby preventing any dirt or foreign matter from entering between the shaft seal faces. This arrangement extends the life of the seals considerably and again minimizes disassembly of the pump due to wear of the parts.

Further, the pump comprises basically three parts, a one-piece body, a volute, and the impeller. These parts are arranged in a manner so that they are easy to assembly and quick to disassemble by means including a novel screw jack assembly whereby the volute may be securely seated in the casing and easily removed when desired. By minimizing the number of parts, the cost of the entire assembly is reduced initially and, of course, the time required to disassemble the pump is reduced considerably. The pump of the present invention provides easy access to the impeller, the discharge and section volute sections and all other internal passageways and thus, may be termed a "complete access" assembly. This permits quick removal of any large objects in the media pumped which may become lodged in the pump without major disassembly of the pump or disconnection of pipes in a system connected to the pump.

With the foregoing in mind, an object of the present invention is to provide a centrifugal pump characterized by novel features of construction and arrangement which is comprised of relatively few parts so that it is easy and economical to manufacture and is fully effective for the purposes intended.

Another object of the present invention is to provide a centrifugal pump including a novel eccentric mounting for the volute whereby the clearance between the volute insert and the impeller blades may be selectively varied to facilitate cut-off adjustment.

Another object of the present invention is to provide a centrifugal pump which may be assembled relatively easily and which may be disassembled easily and quickly from time to time to provide complete access to all of the

internal parts thereof for cleaning and replacement if necessary.

A still further object of the present invention is to provide a novel pump construction including an impeller having a plurality of radial vanes which in the operation of the pump repel dirt and foreign matter and also create a vacuum pulling lubricant across the contacting faces of the shaft seal thereby preventing dirt and foreign matter from entering between the shaft seal faces.

These and other objects of the present invention and the various features and details of the pump and the operation thereof are hereinafter more fully set forth with reference to the accompanying drawings, wherein:

FIG. 1 is an an end elevational view of a centrifugal pump in accordance with the present invention;

FIG. 2 is a plan view of the pump shown in FIG. 1;

FIG. 3 is an enlarged sectional view taken on lines 3—3 of FIG. 1;

FIG. 4 is a sectional view taken on lines 4—4 of FIG. 3;

FIG. 5 is a fragmentary view showing the cutoff section of the pump after a period of use;

FIG. 6 is a sectional view similar to FIG. 4 showing the volute insert after repositioning closely adjacent the trace of the impeller blades;

FIG. 7 is an enlarged sectional view taken on lines 7—7 of FIG. 1;

FIG. 8 is a sectional view taken on lines 8—8 of FIG. 3;

FIG. 9 is an enlarged perspective view of the volute insert;

FIG. 10 is a perspective view of the volute; and

FIG. 11 is an enlarged fragmentary sectional view of a seal assembly for the centrifugal pump.

Referring now to the drawings and considering broadly the structural details and arrangement of a pump constructed in accordance with the present invention, the pump, which is generally designated by the numeral **10**, comprises a pump casing or body **12** having, in the present instance, a pair of aligned inlet ports **14** and a discharge port **16**, a volute assembly **18** and an impeller **20** mounted in the pump body. The impeller **20** is mounted on one end of a drive shaft **24** extending through a generally cylindrical extension of the pump body forming the pump head **26**. The drive shaft **24** is connected to a suitable actuating means such as a motor (not shown) to drive the impeller. As best illustrated in FIG. 3, the pump head **26** forms an oil chamber **28** surrounding the drive shaft **24** and a pair of seals, for example, a pair of mechanical shaft seals **29**, are mounted on the drive shaft **24** to prevent leakage of the pumped media into the oil chamber **28** and leakage of oil out of the chamber. Suitable passages, passageways, chambers and the like are provided in the pump casing and volute assembly so that in operation of the pump, upon rotation of the impeller **20**, flow of fluid is effected through the pump from the inlet ports **14** to the discharge port **16**.

Considering now more specifically the structural details and arrangement of the parts of the pump, the pump casing **12** includes spaced apart front and rear walls **32** and **34** respectively and a side wall **35** of generally U-shaped configuration. In the present instance the interior of the pump casing **12** is divided into an intake side **38** and a discharge side **40** by a vertical partition **42** approximately equispaced between the front and rear walls of the pump body. The front wall **32** and partition **42** are provided with aligned generally circular openings **44** and **46** respectively to accommodate and provide a seat for the volute assembly **18**. The lower portion of the rear wall **34** which forms a radial wall of the oil chamber **28** also has a circular opening **48** therein, the center of which is radially offset from the circular openings **44** and **46** in the front wall and partition for purposes to be explained in detail hereinafter.

A rear wear plate **50** is mounted in the opening **48** in

the rear wall having a hub portion **52** circumscribing the drive shaft **24**. As best illustrated in FIG. 3, the upper portions of the partition **42** and front wall **32** of the body portion define an inlet manifold **38** which communicates with the inlet ports **14** and the volute assembly **18**, and the upper portion of the rear wall **34** and partition **42** define a discharge manifold communicating with the discharge port **16**.

The volute assembly **18** comprises a suction volute section **18***a* and a discharge volute section **18***b*. The configuration of the volute assembly **18** is best shown in FIG. 10 and as illustrated, the suction volute section **18***a* is defined by a generally circular front wall **60**, an annular wall section **62** spaced from the front wall and connected thereto by ribs **64** and **65** of shaped cross sections as shown in FIG. 8 defining a funnel-like passageway **66** from the inlet manifold to the inner peripheral edge of the annular wall **62** which opens into the eye of the impeller. The front wall **60** and the annular wall **62** of the volute are axially spaced apart a distance equal to the spacing between the front wall of the casing and the central dividing partition to seal the intake and discharge sections from one another and the back wall of the pump in the assembled pump as shown in FIG. 3.

Thus,, the rear wall **60** has a circumferentially extending flange **70** with a groove **72** therein to receive an O-ring seal and likewise the annular wall **62** has a circumferentially extending groove **74** to accommodate an O-ring **76** providing fluid-tight seals at the juncture between the volute and the pump body. Projecting rearwardly from the annular wall **62** and defining the discharge volute section **18***b* is a spiral wall section **77**, the spaced ends of which define a discharge opening **78** communicating with the discharge manifold. The spiral wall section circumscribes the impeller and the spiral configuration provides a snail-like discharge volute chamber between the trace of the impeller blades and the spiral wall **77** of progressively increasing width going from the cutoff to the discharge outlet as illustrated in FIGS. 4 and 6.

The impeller **20** comprises a generally circular disc-like member **80** having a collar **81** which mounts over a reduced end portion of the drive shaft extension and is keyed thereto so that the impeller rotates with the rotation of the shaft. The impeller **20** is held on to the shaft by means of a washer **83** which engages the inner edge of the disc and a screw **84**. The impeller further includes a pair of spiral-like blades **86** which project forwardly from the front face of the disc **80** and a plurality of vanes **88** in the form illustrated, eight equispaced about the periphery of the rear face of the disc and of generally radial orientation.

These vanes **88** during operation of the pump repel dirt and foreign matter and also create a vacuum pulling lubricant across the contacting faces of the shaft seal thereby preventing any dirt or foreign matter from entering between the shaft seal faces.

Thus, in the operation of the pump, the fluid enters the pump body through the inlet ports **14** to the inlet manifold **56** and from there flows through the funnel-like passageway in the suction volute section through the central opening in the annular wall **62** to the eye of the impeller. Now with respect to FIGS. 4 and 6, as the impeller rotates in a clockwise direction, the blades **86** move the fluid through the spiral or snail-shaped discharge volute chamber **91** between the trace of the impeller and the spiral wall and discharges it through the discharge opening to the discharge manifold **58** and out of the discharge outlet **16**.

In self-priming pumps of the above type it is desirable and necessary to have a close clearance at the cut-off, that is, the juncture of the innermost portion of the spiral wall of the volute and the outer trace of the impeller blades in order to peel off air bubbles during the priming. It has been found that in pumps of this type the initial clearance may be accurately controlled, but that after a

period of use a gap develops due to wear in this area which results in very slow priming time.

In the past this necessitated time consuming disassembly of the pump and replacement of expensive parts to re-establish the close tolerance. In accordance with the present invention "cut-off" clearance may be adjusted from time to time easily and quickly without major disassembly of parts of the pump. To this end, there is provided a volute tongue in the present instance, in the form of a blade-like volute insert **90** which in effect, is the inner extension of the spiral volute rear wall, the outer edge of which has a downwardly depending lip **92** spaced closely to the outer trace of the impeller blades. This insert has a depending shoe **94** with a notch cutout **96** therein which snugly fits in a pocket in the annular wall of the volute, the blade being rigidified or supported by a support shield **100** overlying the blade and formed as an integral extension of the inner edge of the spiral wall of the volute. In the illustrated embodiment, the insert is adapted to be cast in position in the volute. Preferably, the volute is made of cast aluminum and the insert and impeller are cast from a wear-resistant nickel chromium.

In operation of the pump, therefore, the edge **92** of the volute tongue lies closely adjacent the peripheral trace of the impeller blades as noted above and after a period of use to pump, for example a liquid containing solids such as sand, the gap between the inner edge **92** of the insert and the impeller blades will open up as illustrated in FIG. 5 due to wear. In accordance with the present invention, a comparatively simplified means is provided for re-adjusting the gap from time to time to compensate for wear and maintain the desired close critical clearance between the insert edge **92** and the trace of the impeller blades. To this end, the volute assembly is rotatably mounted in the body of the pump in such a way that the center of the volute assembly or axis of rotation thereof (represented by the line XX in the drawings) is offset radially from the center of the impeller or the axis of rotation thereof (represented by the line YY in the drawings). By this arrangement, when it is necessary to adjust the gap at the cut-off point, the volute is simply rotated, in the present instance, in a counterclockwise direction with respect to FIG. 6 which has the effect,, because of the eccentric disposition of the axis of rotation of the volute relative to the axis YY of the impeller, of displacing the edge **92** radially inwardly to a position closely adjacent the peripheral trace of the impeller blades. The spiral wall has a raised lug portion **102** at its outer periphery with a series of spaced locating holes **104** therein. These locating holes are adapted to register with a pilot hole **106** in the pump head and for a given adjustment the volute is fixed in position by means of a pin **108** forcibly engaging in one of the holes **104** and loosely engaging in a pilot hole **106** (see FIG. 7).

Displacement of the volute assembly is controlled by means of a jack screw assembly **109** comprising a yoke member **110** having inturned lugs **112** adjacent opposite ends thereof which engage in groove-like pockets **113** in the exterior of the pump body and a jack screw **114** threaded in a hub portion of the yoke, the inner end of which engages in a pocket **117** in the end wall **60** of the volute. As illustrated in FIGS. 3 and 7, the inner end of jack screw **114** is provided with an enlarged head **119** which is adapted to engage a ring **121** seated in a groove in the pocket **117**. By this arrangement the jack screw may be used to disassemble the volute assembly simply by turning the jack screw. In normal operation, the jack screw **114** is turned in to firmly seat the volute in place in the pump body, the spiral wall **77** abutting the front wall of the pump body to properly locate the walls of the volute with the walls of the pump body to establish seals between the intake section and discharge section. Now when it is desired to remove the volute assembly, the jack screw is simply threaded outwardly whereby the volute is displaced axially toward the rear of the pump body. This arrangement provides an easy means for assembling the volute to the one-piece body portion initially and also provides the necessary power leverage to break the volute free should it be stuck from corrosion or foreign matter, thus affording an easy means for rotating the volute to adjust the cut-off clearance as discussed above.

It is noted that even though the volute tongue or blade insert is described above as being a separate piece of the volute assembly, the volute tongue, suction and discharge volute sections may be made integrally of one piece, for example by an iron casting.

There is illustrated in FIG. 11 an enlarged fragmentary sectional view of a seal assembly for a shaft seal. The seal assembly which is generally designated by the numeral **130**, is adapted for use in a centifugal pump of the type described above. Only those portions of the pump pertinent to the operation of the seal assembly are shown in FIG. 11. Thus, the pump includes a casing having a front wall **132** and a generally cylindrical enclosed pump head extension defining an oil chamber **134**, a wear plate **136** mounted in an opening in the front wall **132** which has a generally cylindrical hub portion **138** providing an enclosure for the seal assembly **130**. A vent hole (not shown) is provided in the oil chamber to maintain atmospheric pressure therein permitting proper differential across the seal. A shaft **140** connected to a suitable drive source at one end, mounts an impeller **142** at its opposite end. This impeller has a plurality of vanes **144** on its back face which in the operation of the pump repels dirt and foreign matter and also create a vacuum pulling lubricant across the contacting faces of the shaft seal thereby preventing any dirt or foreign matter from entering between the shaft seal faces.

The seal assembly **130** includes a rubber cup **150** fixedly mounted in the outer terminal portion of the hub **138** and an annular ceramic ring **152** having a radial sealing face **154** mounted inside of the cup **150**. The seal further includes a ring **156** made of either carbon or a ceramic material having a radial sealing face **158** confronting and engaging the seal face **154** of the ceramic ring **152**, a rubber bellows **160** of generally Z-shaped cross sectional configuration, the ring **156** and bellows being housed interiorly of a circumferentially extending Z-shaped retainer **162**. The retainer **162** is connected to the ring **156** by cooperating circumferentially spaced notches and indentations in the ring **156** and retainer respectively. The bellows **160** is pressed into engagement with the shaft **140** by a band **163** having a plurality of circumferentially spaced radially outwardly extending projections which seat in corresponding pockets or grooves in the reduced portion of the retainer. The ring **156** is biased into engagement with the ceramic ring **152** by means of a coil spring **164** abutting the offset portion of the retainer **162** at one end and at its opposite end engaging an annular slinger **170** made of polyurethane rubber. The slinger as illustrated, seats in the hub portion of the impeller and is pressed into engagement with an arcuate seat portion **174** of the wear plate **136**. Thus, in operation of a pump embodying the present invention, even though the vanes **144** tend to impel dirt and foreign matter and create a vacuum sucking oil across the contacting sealing faces **154** and **158** of the rings **152** and **156**, the slinger **170** is an added protection against finer dirt particles entering the seal area.

In summary, therefore, the one-piece body and volute are easily assembled and disassembled by means of the reversible jack screw clamp. Also by this arrangement it is possible to pry the pump apart should it tend to bind from corrosion or dirt. Further, this arrangement provides for a minimum of seal areas so that the pump may be effectively used to handle impure fluids such as dirty water. In this regard the vane configuration on the back face of the impeller tends to repel dirt particles

from the seal areas and creates a high vacuum which tends to pull clean oil across the face of the seal instead of dirt. An additional advantage of the one-piece body and volute construction and the ease of disassembling the two is that all the internal passageways are easily accessible for periodic cleaning purposes.

While particular embodiments of the present invention have been illustrated and described herein, it is of course, to be understood that changes and modifications may be made herein within the scope of the following claims.

I claim:

1. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a unitary volute assembly consisting of a suction volute section and a discharge volute section, an impeller mounted for rotation about a predetermined axis and releasable means having means for moving said volute assembly into an assembled position interiorly of the casing and for moving said volute assembly into a disassembled position whereby on releasing of said releasable means alone permitting complete disassembly of said volute assembly from said casing and any other interior parts of said pump.

2. A centrifugal pump as claimed in claim **1** wherein said volute assembly includes a tongue having an edge positioned adjacent the trace of the outer edge of the impeller blades defining a cut-off point, said volute assembly being rotatably supported in said housing for movement about an axis eccentric to the rotational axis of the impeller so that the position of the tongue edge and trace of the impeller blades may be selectively adjusted.

3. A centrifugal pump as claimed in claim **1** wherein said releasable means comprises a reversible jack screw assembly for positioning the volute assembly in an assembled position interiorly of the casing and a disassembled position.

4. A centrifugal pump as claimed in claim **3** wherein said jack screw assembly comprises a yoke having inturned lugs at opposite ends thereof engageable in pockets in the casing and a jack screw threaded in a hub portion of the yoke, the inner end of said jack screw engaging in an opening in the end wall of the volute assembly.

5. A centrifugal pump as claimed in claim **1**, including a pump head at one end of the casing defining a lubricant chamber, a shaft mounting the impeller and a shaft seal, and wherein said impeller has a plurality of radially extending vanes on the back face thereof operable to repel dirt and foreign matter and create a vacuum to pull lubricant across the shaft seal.

6. A centrifugal pump as claimed in claim **5**, including an annular slinger mounted on a hub portion of the impeller and engaging a portion of a wear plate mounted in an opening in the front wall of the casing adjacent said shaft seal.

7. A centrifugal pump as claimed in claim **6** wherein said slinger is made of polyurethane rubber.

8. A centrifugal pump as claimed in claim **6**, wherein the wear plate is provided with an annular arcuate seat portion engageable by said slinger

9. A centrifugal pump as claimed in claim **1** including means for securing the volute assembly in a predetermined fixed position in the casing.

10. A centrifugal pump as claimed in claim **9** wherein said means includes a pilot hole in said casing, a plurality of locating holes in said volute assembly adapted to register with said pilot hole upon rotation of the volute assembly relative to said casing, and a pin engageable in a selected one of said locating holes and said pilot hole.

11. A self-priming centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly removably mounted in said casing and an impeller mounted for rotation about a predetermined axis, said volute assembly including a tongue having an edge positioned closely adjacent the trace of the outer edge of the impeller blades defining a cut-off point, means rotatably supporting said volute assembly in said housing for movement about an axis eccentric to the rotational axis of the impeller whereby the position of the tongue edge relative to the trace of the impeller blades may be selectively adjusted to compensate for wear and consequently restore priming ability.

12. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly removably mounted in said casing, said volute assembly being removably mounted in said casing, an impeller mounted for rotation about a predetermined axis, and a reversible jack screw assembly for positioning the volute assembly in an assembled position interiorly of the casing and a disassembled position.

13. A centrifugal pump as claimed in claim **12** wherein said jack screw assembly comprises a yoke having inturned lugs at opposite ends thereof engagable in pockets in the casing and a jack screw threaded in a hub portion of the yoke, the inner end of said jack screw engaging in an opening in the end wall of the volute assembly.

14. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly removably mounted in said casing, an impeller mounted for rotation about a predetermined axis, a pump head at one end of the casing defining a lubricant chamber, a shaft mounting the impeller and a shaft seal, said impeller having a plurality of radially extending vanes on the back face thereof operable to repel dirt and foreign matter and create a vacuum to pull lubricant across the shaft seal, an annular slinger mounted on a hub portion of the impeller and engaging a portion of a wear plate mounted in an opening in the front wall of the casing adjacent said shaft seal.

15. A centrifugal pump as claimed in claim **14** wherein said slinger is made of polyurethane rubber.

16. A centrifugal pump as claimed in claim **14** wherein the wear plate is provided with an annular arcuate seat portion engageable by said slinger.

17. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly removably mounted in said casing and an impeller mounted for rotation about a predetermined axis, means for securing the volute assembly in a predetermined fixed position in the casing comprising a pilot hole in said casing, a plurality of locating holes in said volute assembly adapted to register with said pilot hole upon rotation of the volute assembly relative to said casing, and a pin engageable in a selected one of said locating holes and said pilot hole.

18. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a volute assembly removably mounted in said casing for rotating about a fixed axis, means defining an opening in the casing, a wall adapted to be positioned in said opening which is removable to provide access to the impeller, and a reversible jack screw assembly for removing and replacing said wall.

19. A centrifugal pump comprising a casing having an intake side with at least one inlet port and a discharge side with a discharge port, a pump head at one end of the casing having spaced inner and outer sidewalls defining a lubricant chamber, a shaft extending through said inner and outer sidewalls, an impeller mounted in an impeller chamber on said shaft adjacent said inner wall of the pump head and exteriorly of said lubricant chamber, spaced inner and outer seal assemblies mounted adjacent opposed sidewalls of said lubricant chamber, said inner seal assembly being the sole sealing means between said lubrication chamber and said impeller including a stationary member and a rotating member, said rotatable

and stationary member having mating contacting surfaces, at least one of said members being spaced from the periphery of said shaft to define a circumferentially extending annular passage communicating with said lubricant chamber, said impeller having a plurality of vanes adjacent the inner wall of said pump head whereby upon rotation members thereby pulling lubricant through said annular passage radially outward across said mating contacting surfaces of said inner seal assembly thereby to exclude dirt and foreign matter from said mating contacting surfaces.

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HENRY F. RADUAZO, Primary Examiner

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,499,388 Dated March 10, 1970

Inventor(s) HARRY A. EBERHARDT

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 50; "section" should read --suction--

Column 9, lines 6-8; "whereby upon rotation members thereby pulling lubricant through said annular passage" should read --whereby upon rotation of said impeller a vacuum is created around the seal members thereby pulling lubricant through said annular passage--

SIGNED AND
SEALED
AUG 18 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

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