

June 26, 1962

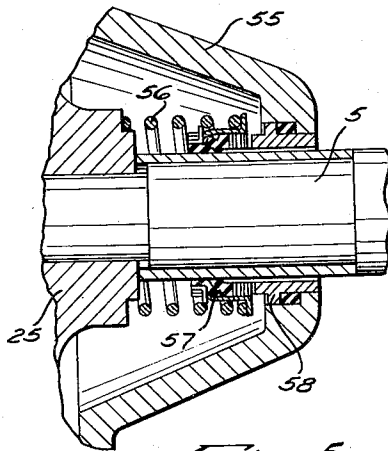
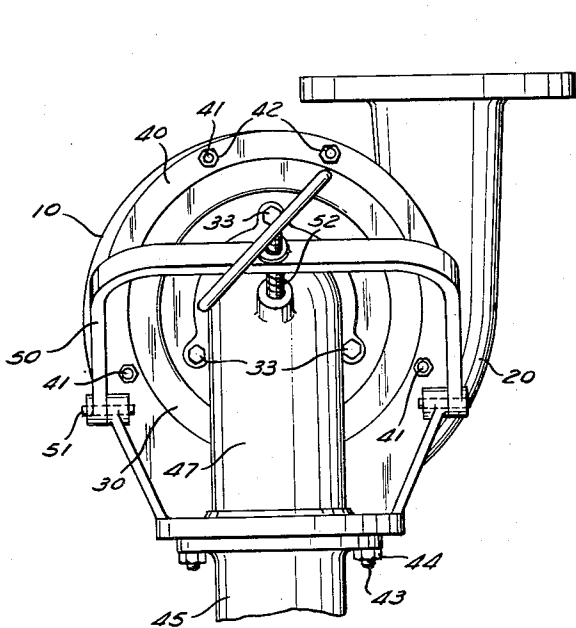
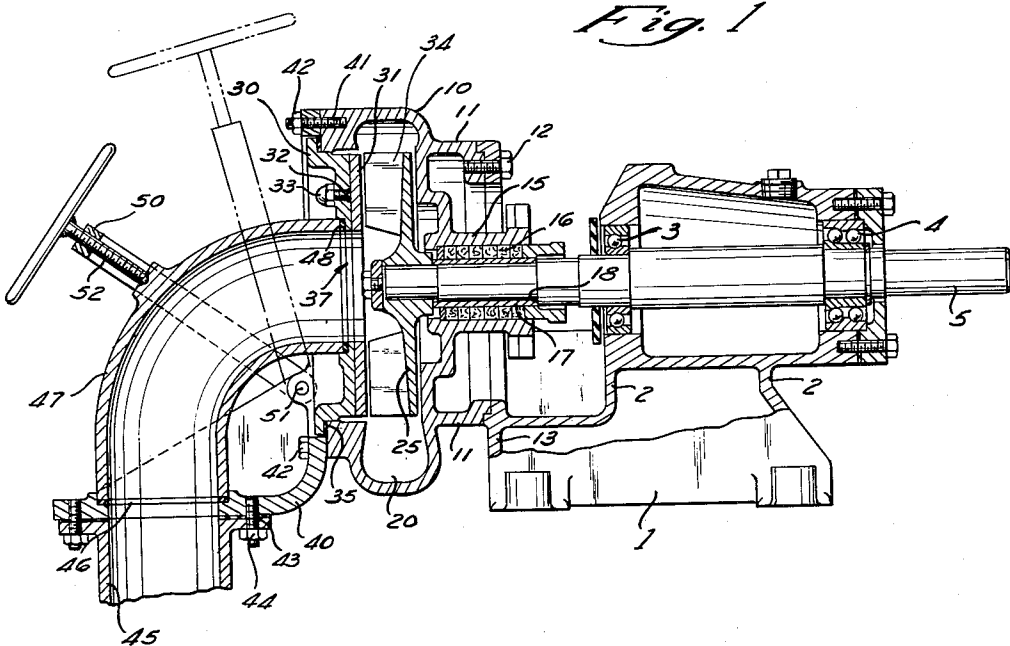
W. E. RUPP

3,040,669

QUICK OPENING CENTRIFUGAL PUMP

Filed Jan. 23, 1961

3 Sheets-Sheet 1



INVENTOR.

WARREN E. RUPP

BY

WATTS, EDGERTON, PYLE & FISHER

B. S. Watts
ATTORNEYS

June 26, 1962

W. E. RUPP

3,040,669

QUICK OPENING CENTRIFUGAL PUMP

Filed Jan. 23, 1961

3 Sheets-Sheet 2

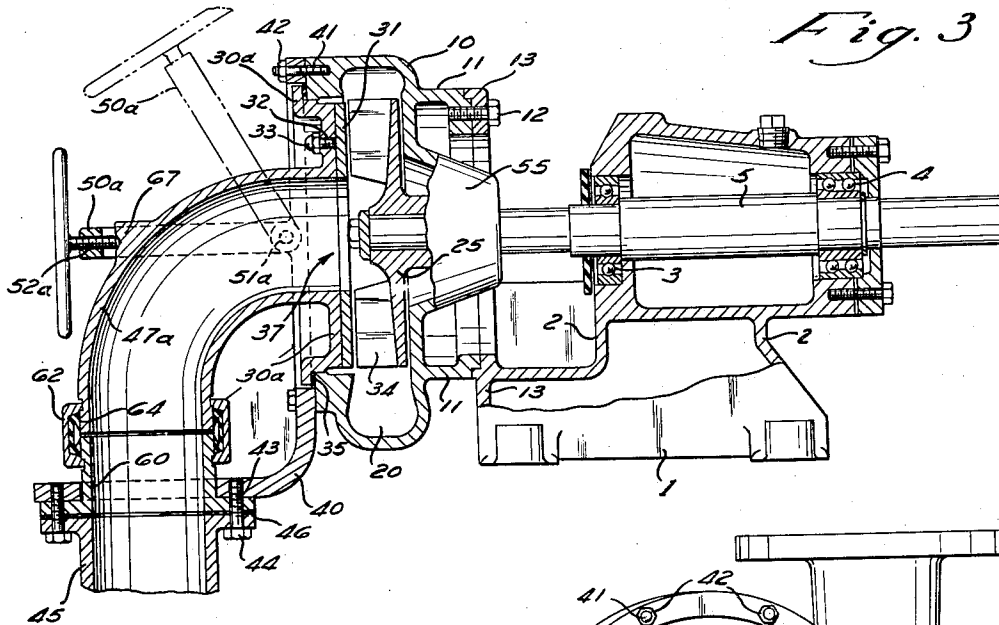


Fig. 3

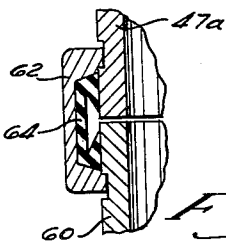


Fig. 10

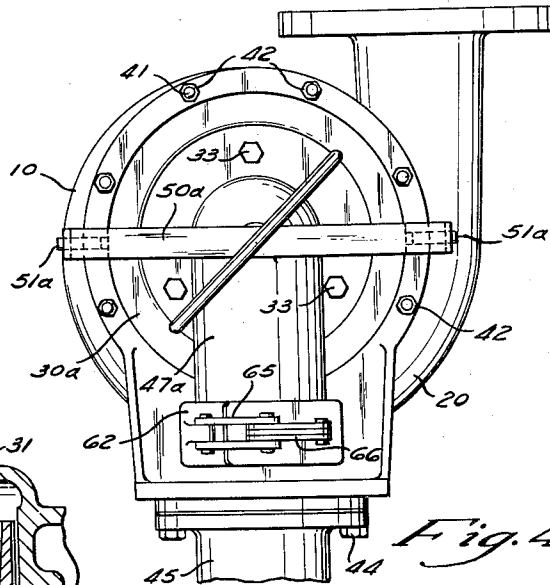


Fig. 4

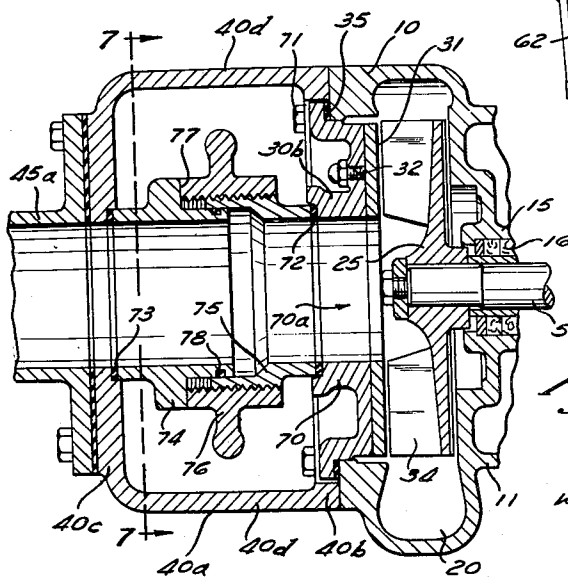


Fig. 6

INVENTOR.

WARREN E. RUPP

BY

WATTS, EDGERTON, PYLE & FISHER

B. Swatts
ATTORNEYS

June 26, 1962

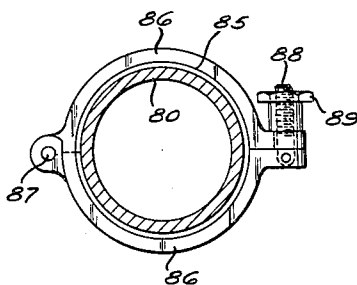
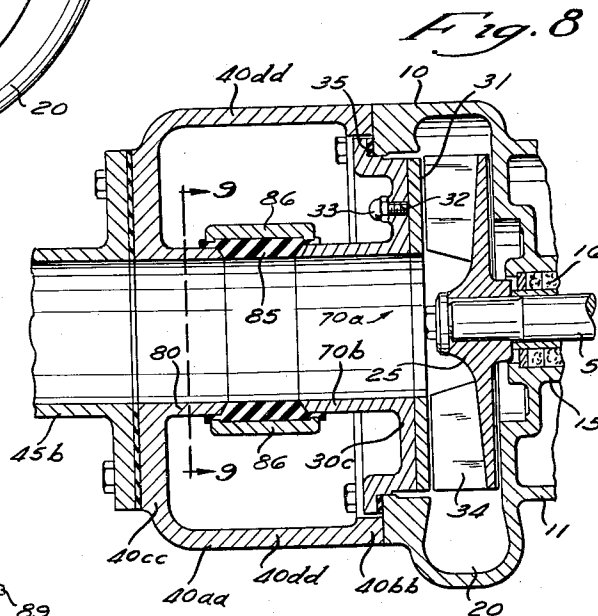
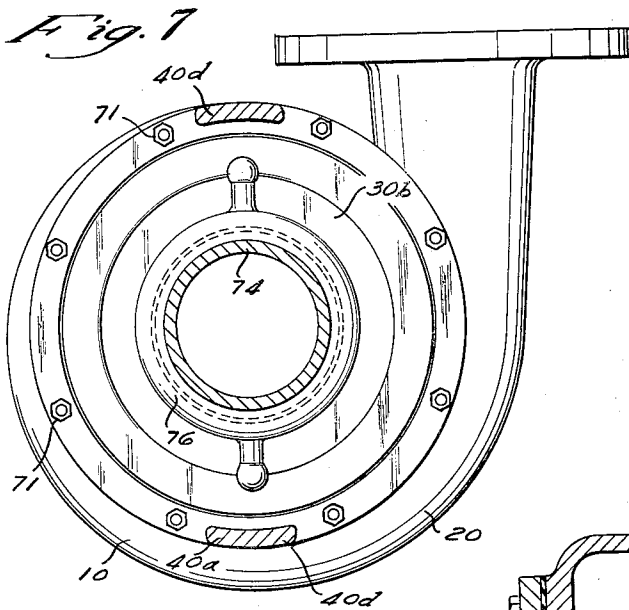
W. E. RUPP

3,040,669

QUICK OPENING CENTRIFUGAL PUMP

Filed Jan. 23, 1961

3 Sheets-Sheet 3



INVENTOR.

WARREN E. RUPP

BY

WATTS, EDGERTON, PYLE & FISHER

W. S. Watts
ATTORNEYS

1

3,040,669

QUICK OPENING CENTRIFUGAL PUMP

Warren E. Rupp, Mansfield, Ohio, assignor to The Gorman-Rupp Company, Mansfield, Ohio, a corporation of Ohio

Filed Jan. 23, 1961, Ser. No. 84,050
5 Claims. (Cl. 103—103)

This invention relates generally to centrifugal pumps and is particularly concerned with a new pump for pumping trash solids in liquid suspension.

There has been a long continuing need for a centrifugal pump for handling trash solids in fluid suspension such as sewage, paper stock, waste from packing houses and food processing plants and the like and which would combine low manufacturing cost with ready access to the interior of the pump for removal of clogging foreign matter and removal and replacement of parts such as the impeller, wear rings, the mechanical shaft seal, and the like, all without disturbing the piping of the pump and the driving means of the pump.

Efforts were made to satisfy that need by providing horizontally-split-casing type centrifugal pumps in which both the suction and discharge lines are connected to the lower portion of the casing and in which access could be had to the impeller and other internal parts by the removal of a large number of securing means. Such pumps had a restricted inlet into the eye of the impeller because of the shaft extended through the impeller and was supported on both sides of the latter and had a limited solids-handling capacity for that reason. Such pumps had the other drawbacks of high cost of manufacture because of the size and nature of the construction and slow and laborious access to the pumping chamber because of the necessity of removing the many nuts or bolts which held the casing parts in assembled position. Such pumps did not fully satisfy the long standing problem and need above stated.

Other efforts to solve the present problem and meet the present need provided side-suction type centrifugal pumps having a vertical casing which was vertically split. In such pumps the suction inlet entered the eye of the impeller around the drive shaft in the motor side of the casing, and the opposite side of the casing consisted of a removable end plate which gave access to the back of the impeller. Such pumps had the drawbacks that the presence of the shaft in the eye of the impeller restricted the size of solids which could enter the impeller and many of the solids tended to wrap around the shaft and clog the pump. Another drawback of such pumps was that clogging material could be removed only after the removal of the end plate and the impeller. While such pumps were less expensive to manufacture than the pump having horizontally-split-casings, they were not fully satisfactory because of the reduced size of solids the pumps could handle due to the necessity of removing the impeller in order to remove pump clogging material. Such vertical split casing pumps did not fully satisfy the existing need.

Another effort to solve the present problem was made to use a pump in which the shaft entered the back wall of the impeller and the suction inlet entered the eye of the impeller through a removable suction or end wall of the casing. Such pumps were less expensive to make than the horizontally-split casing pump above mentioned and was efficient and had a large solids-handling capacity due to the absence of restricting parts in the intake. However, the interior of the pump was not readily accessible because the inlet pipe was connected to the removable suction end wall and had to be removed before access could be had to the interior of the pump chamber. These pumps did not fully solve the problem.

Still another effort to solve the present problem was

2

made by using a fixed pump casing containing both the suction and discharge connections, the suction connection leading directly to the eye of the impeller. The impeller with driving means and motor were integral with a closure at the back of the casing, all of which could be removed as a unit away from the fixed casing, thus exposing the interior of the pump. This arrangement was impractical for the larger size pumps because of the weight of the motor which had to be removed along with the impeller, also because it required disconnecting the electric connections at the motor and the bolts holding the motor in place, and because it required the removal of many bolts or nuts at the rear closure. For these reasons, such pumps did not solve the long standing problem stated above.

The present invention aims to solve the foregoing long standing problem and achieves that aim by a new, useful and unobvious combination of elements. Pumps embodying the present invention are relatively inexpensive to manufacture, are similar in construction and can handle larger solids, all as contrasted with the horizontally-split casing pump; can handle larger solids than pumps in which the shaft enters the eye of the impeller; and affords quicker access to the interior of the casing for removal of clogging solids, interior parts and mechanical shaft seals than pumps in which the eye of the impeller is unobstructed but in which the inlet pipe is attached directly to the casing and either the inlet pipe or the impeller and its driving means must be moved to permit access to the pumping chamber.

The present invention will be better understood by those skilled in the art from the following description read in connection with the accompanying drawings in which:

FIGURE 1 is a longitudinal vertical sectional view through one form of apparatus embodying the present invention;

FIGURE 2 is an end elevational view of the apparatus of FIGURE 1;

FIGURE 3 is a sectional view similar to FIGURE 1 but showing another modified form of the invention;

FIGURE 4 is an end elevational view of the apparatus of FIGURE 2;

FIGURE 5 is a fragmentary sectional view of the shaft seal of FIGURE 3;

FIGURE 6 is a transverse cross sectional view of a third embodiment of the present invention;

FIGURE 7 is a fragmentary sectional view taken on line 7—7 of FIGURE 6;

FIGURE 8 is a sectional view similar to FIGURE 7 but showing still another embodiment of the present invention;

FIGURE 9 is an end elevational view partly in section taken on line 9—9 of FIGURE 8; and

FIGURE 10 is an enlarged fragmentary sectional view of the inlet pipe seal of FIGURE 3.

The apparatus shown in FIGURES 1 and 2 includes a base 1 having axially spaced walls 2 provided with ball bearings 3 and 4 in which a pump shaft 5 is rotatably mounted. A pump housing 10 has a rearwardly extending annular flange 11 which is detachably connected as by screws 12 in annular wall 13 of base 1. The rear wall of the casing 10 is provided with a tubular wall 15 within which packing 16 is wound around a sleeve 17 which, at one end, abuts a shoulder 18 on shaft 5 and at the other end acts as a stop for the impeller. The packing 16 prevents escape of fluid from within the housing and around the shaft.

The housing 10 defines a volute 20 and a pumping chamber surrounded thereby and in which impeller 25 is positioned on the front end of shaft 5 for rotation thereby. The front side of the casing 10 is provided with an opening of greater diameter than the impeller 25

and this opening is closed by means of a closure 30 which carries a wear plate 31 on its inner surface. This plate is connected to closure 30 by any suitable means, but as shown, by threaded studs 32 connected to the outer surface of the plate, extending through closure 30 and carrying nuts 33 on the outer ends thereof.

A sealing gasket 35 is positioned between the outer flange edge portion of closure 30 and the opposed surface of housing 10 to prevent egress of liquid from within the housing. Closure 30 is provided with a passage 37 in its central part leading into the eye of the impeller.

Rigid means in the form of a right-angled bracket 40 is detachably connected, as by bolts 41 and nuts 42, to housing 10 around closure 30 and is also detachably connected as by bolts 43 and nuts 44 to a suction or inlet pipe 45.

Tubular means in the form of an elbow-shaped pipe 47 constitutes a connection between inlet pipe 45 and closure 30 around passage 37. A gasket 46 is disposed between member 40 and tube 47 and a similar gasket 48 is disposed between the other end of pipe 47 and closure 30. When pipe 47 is pressed against gaskets 46 and 48, liquid may flow from inlet 45 to housing 10 without leakage at either end of pipe 47.

A U-shaped yoke 50 is pivotally connected, as by pivots 51, to member 40 and is provided with a handle-actuated threaded rod 52 which can be urged against pipe 47. When the yoke is in the full line position shown in FIGURE 1 and the rod 52 is moved inwardly against pipe 47 that pipe will be pressed against gaskets 46 and 48 with sealing engagement and the closure 30 will be pressed against gasket 35 with sealing engagement. When rod 52 is backed off to clear its seat in tube 47, the yoke 50 may be swung to the dotted line position shown in FIGURE 1 thereby quickly freeing pipe 47 and closure 30 for prompt removal with resultant exposure of the interior of the pump for removal of clogging solids, removal and replacement of the impeller and removal and replacement of wear plate 31.

The apparatus of FIGURES 3, 4, 5 and 10 resembles that of FIGURES 1 and 2 in many respects and corresponding numerals indicate corresponding parts in the two devices.

The housing 10 is provided in its rear side with a tubular flange 55 surrounding shaft 5 and a mechanical shaft seal is disposed within this flange. This shaft seal comprises a spring 56 around the shaft and bearing at its front end against the back of the impeller 25 and at the other end against a rotary seal ring 57 which is thereby pressed against stationary seal ring 58 fixed to the flange 55.

The closure 30a of FIGURE 3 is quite like closure 30 of FIGURE 1 but is integral with pipe 47a which corresponds to pipe 47 of FIGURE 1. A flanged tube 60 is secured between inlet pipe 45 and rigid member 40 and is aligned with one end of pipe 47a. A circumferentially split ring 62 has flanges seating in grooves in the opposed ends of tubes 60 and 47a and carries a sealing gasket 64 to make sealing engagement with the outer surfaces of pipe 60 and 47a and to prevent escape of liquid between the adjacent ends of those pipes. The ring 62 may be clamped around pipe 47a and 60 by any conventional means, for example the pivoted links 65 and 66 as shown in FIGURE 4.

Yoke 50a similar to yoke 50 of FIGURES 1 and 2 is pivotally connected as by pivots 51a to rigid member 40 and this yoke carries a hand-actuated threaded rod 52a which may be urged against an abutment 67 on pipe 47a.

When the parts are assembled as shown in full lines in FIGURE 3 and rod 52a is urged against abutment 67, closure 30a will be pressed into sealing engagement with gasket 35 and pipe 47a will be held in fluid-sealing engagement with gaskets 35 and pipe 60. When threaded rod 52a is backed off and the yoke is swung to the dotted

line position in FIGURE 3, and the links 65 and 66 are moved to ring 60 out of the grooves of pipe 47a and 60, the closure 30a may be bodily removed thereby exposing the parts within the housings for cleaning and repair, and the wear plate 31 for adjustment or replacement. When the impeller is removed from the shaft, the mechanical seal may also be removed.

The embodiment of the present invention shown in FIGURES 6 and 7 includes several parts corresponding to those shown in FIGURES 1 to 5, which parts bear numbers corresponding to the same parts in those figures. These parts include the casing 10, the impeller 25, the packing 16 and the wear plate 31. The housing 10 is provided with a closure 30b which is quite similar to closures 30 and 30a of FIGURES 1 and 3, respectively, but closure 30b is provided with an axially extending tubular flange 70 which defines a passage 70a into the eye of the impeller and corresponding to passage 37 of FIGURE 1. An inlet pipe is shown at 45a and is connected to housing 10 by a rigid member 40a which includes a ring portion 40b surrounding the housing opening around closure 30b and attached to the casing by studs 71. Rigid member 40a includes a ring portion 40c which is connected to the flange of pipe 45a and rings 40b and 40c are connected to two circumferentially short connectors 40d. Gasket 35 is positioned between closure 30b and housing 10, another gasket 72 is positioned against the outer end of flange 70 and a third gasket 73 is positioned against the inner surface of ring 40c around the opening therethrough which communicates with the interior of pipe 45a. Tubular means for connecting pipe 45a and pipe 70a include a ring 74 which at one end bears against gasket 73 and at the other end extends into tube 75 which at its far end bears against gasket 72. Tube 75 is exteriorly threaded and interiorly threaded ring 76 engages the threads on tube 75 and at one end may abut against a shoulder 77 on tube 74. A gasket 78 in a groove on the outside of tube 74 bears against the inner overlapping surface of tube 75 and prevents escape of fluid between tubes 74 and 75. When ring 76 is rotated on tube 75 and engages tube 74, it forces those tubes in opposite directions and presses them against gaskets 72 and 73 with fluid-sealing engagement.

It will be understood that when ring 76 is backed off, tubes 74 and 75 may be moved toward one another until they are free from the grooves in which gaskets 72 and 73 are located and may then be moved out of rigid member 40a. Thereupon, closure 30b may be removed with resultant exposure of the interior of the housing 10 for removal of clogging material of interior parts of the pump.

The device shown in FIGURES 8 and 9 contains many parts like those in FIGURES 1-6 inclusive and especially FIGURES 6 and 7, and including shaft 5, housing 10, impeller 25 and wear plate 31. The closure 30c for the open side of the housing is similar to closure 30b of FIGURE 6 and has a tubular, axially extending flange 70b which is quite similar to flange 70 of FIGURE 6. A gasket 35 is disposed between closure 30c and housing 10 after the manner shown in FIGURES 1, 3 and 6.

The inlet pipe 45b corresponds to pipe 45a of FIGURE 6 and rigid member 40aa corresponds closely to member 40a of FIGURE 6. This member 40aa has ring portions 40bb and 40cc which are connected, respectively, to the housing 10 and pipe 45b and also has circumferentially short connectors 40dd connecting these rings. Ring 40cc has an axially extending flange 80 in axial alignment with flange 70b of the closure 30c when these parts are in assembled relation. An axially elongated, circumferentially continuous resilient packing ring 85 is positioned between the conically shaped, opposed ends of flanges 70b and 80. A ring consisting of two arms 86 pivotally connected together as at 87 and detachably connected together by screw threaded rod 88 and nut 89 thereon serve to embrace ring 85 and deform it axially into liquid seal-

ing engagement with the opposed ends of flanges 70b and 80. The force exerted on gasket ring 85 by the arms 86 also urges closure 30c against gasket 35 with fluid sealing engagement.

When nut 89 is backed off on rod 86 and the arms 86 of the clamp are removed from flanges 70b and 80, the ring 85 will expand radially outwardly so that it may be slipped axially along flange 70b, whereupon closure 30c may be removed through the space between connectors 40aa with resultant exposure of the interior of the pump.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, I state that the subject matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiment of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What is claimed is:

1. A centrifugal pump, adapted to afford quick access to the interior thereof, comprising
 - (a) a fixed housing partly defining a pumping chamber and having an opening in one side,
 - (b) a closure for said opening having a passage therethrough into the pumping chamber,
 - (c) a rotatable impeller in said chamber of less diameter than said opening,
 - (d) a fixed suction pipe spaced from the housing,
 - (e) rigid means directly connected to and connecting the housing adjacent to said opening and said suction pipe,
 - (f) tubular means connecting said fixed suction pipe and said passage for fluid flow therethrough from said fixed suction pipe into said chamber.
 - (g) and quick detachable means connected to said rigid means and removably engageable with said tubular means, whereby said tubular means and said closure may be assembled with, and disassembled from, the said suction pipe and the said housing without disturbing the fixed condition of said suction pipe and said housing.
2. A centrifugal pump, adapted to afford quick access to the interior thereof, comprising
 - (a) a fixed housing partly defining a pumping chamber and having an opening in one side,
 - (b) a closure for said opening having a passage therethrough into the pumping chamber,
 - (c) a rotatable impeller in said chamber or less diameter than said opening,
 - (d) a fixed suction pipe spaced from the housing,
 - (e) rigid means directly connected to and connecting the housing adjacent to said opening and said suction pipe,
 - (f) tubular means integral at one end with said closure and connectable at its other end to said fixed suction

pipe for flow of fluid from the suction pipe into said chamber,

- (g) and quick detachable means connected to said rigid means and removably engageable with said tubular means, whereby said tubular means and said closure may be assembled with, and disassembled from, the said suction pipe and the said housing, respectively, without disturbing the fixed condition of said suction pipe and said housing.
3. A centrifugal pump, adapted to afford quick access to the interior thereof, comprising
 - (a) a fixed housing partly defining a pumping chamber and having an opening in one side,
 - (b) a closure for said opening having a passage therethrough into the pumping chamber,
 - (c) a rotatable impeller in said chamber of less diameter than said opening,
 - (d) a suction pipe spaced from the said housing and axially aligned with said pipe,
 - (e) means for fixedly maintaining said pipe and housing in said fixed positions, said means including a rigid member having ring portions surrounding and fixed to said suction pipe and surrounding said opening and fixed to said housing,
 - (f) tubular means within said rigid member connecting said suction pipe and said passage for fluid flow therethrough into the said chamber,
 - (g) and quick detachable means within said rigid member and removably engageable with said tubular means, whereby said tubular means and said closure may be assembled with, and disassembled from, said suction pipe and said housing, respectively, without disturbing the fixed condition of said pipe and housing.
4. The combination of elements set forth in claim 3 in which said tubular means includes an annular flange integral with the rigid member, an opposed annular flange integral with the closure, a packing ring engaging the adjacent ends of said flanges, and a quick detachable clamp securing said ring in position.
5. The combination of elements set forth in claim 3 in which said tubular means includes a first tube having an outwardly projecting annular flange, a second tube having an exteriorly threaded end, a ring having an end surface engageable with the annular flange of the first tube and having interior threads engageable with threads of the second tube, said ring, when rotated, serving to cause axial movement of said tubes relative to each other whereby the tubes and ring may be quickly assembled with, and disassembled from, said rigid means and closure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,060,899	Russell	Nov. 17, 1936
2,107,260	Ihara	Feb. 1, 1939
2,291,797	Dalzell	Aug. 4, 1942
2,347,386	Adams	Apr. 25, 1944
2,800,084	Butler	July 23, 1957