

[54] **PUMP**
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[22] **Filed:** **Oct. 19, 1972**
[21] **Appl. No.:** **298,823**

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[52] **U.S. Cl.**..... **415/111, 415/55, 415/180, 415/212**
[51] **Int. Cl.**..... **F01d 11/00**
[58] **Field of Search**..... **415/52, 55, 59, 111, 180, 415/182, 212**

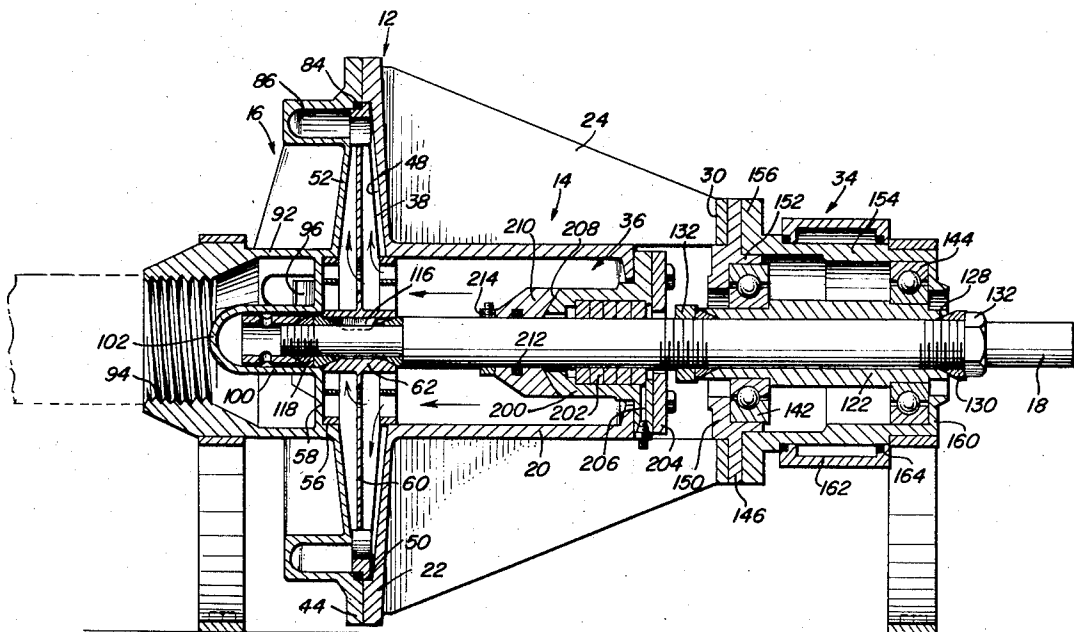
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[57] **ABSTRACT**

A rotary centrifugal pump having an axial inlet and discharge in a casing together with an impeller having liquid impelling vanes on both surfaces thereof with the impeller having central openings enabling inlet liquid to be impelled by vanes on both surfaces of the impeller. The pump includes a pressured water cooled bearing and a seal in which grease or other lubricant is maintained under pressure by the liquid being pumped. The pump is adapted for use as a single stage or multiple stage and is capable of producing relatively high pressures and high volume discharge.

13 Claims, 7 Drawing Figures



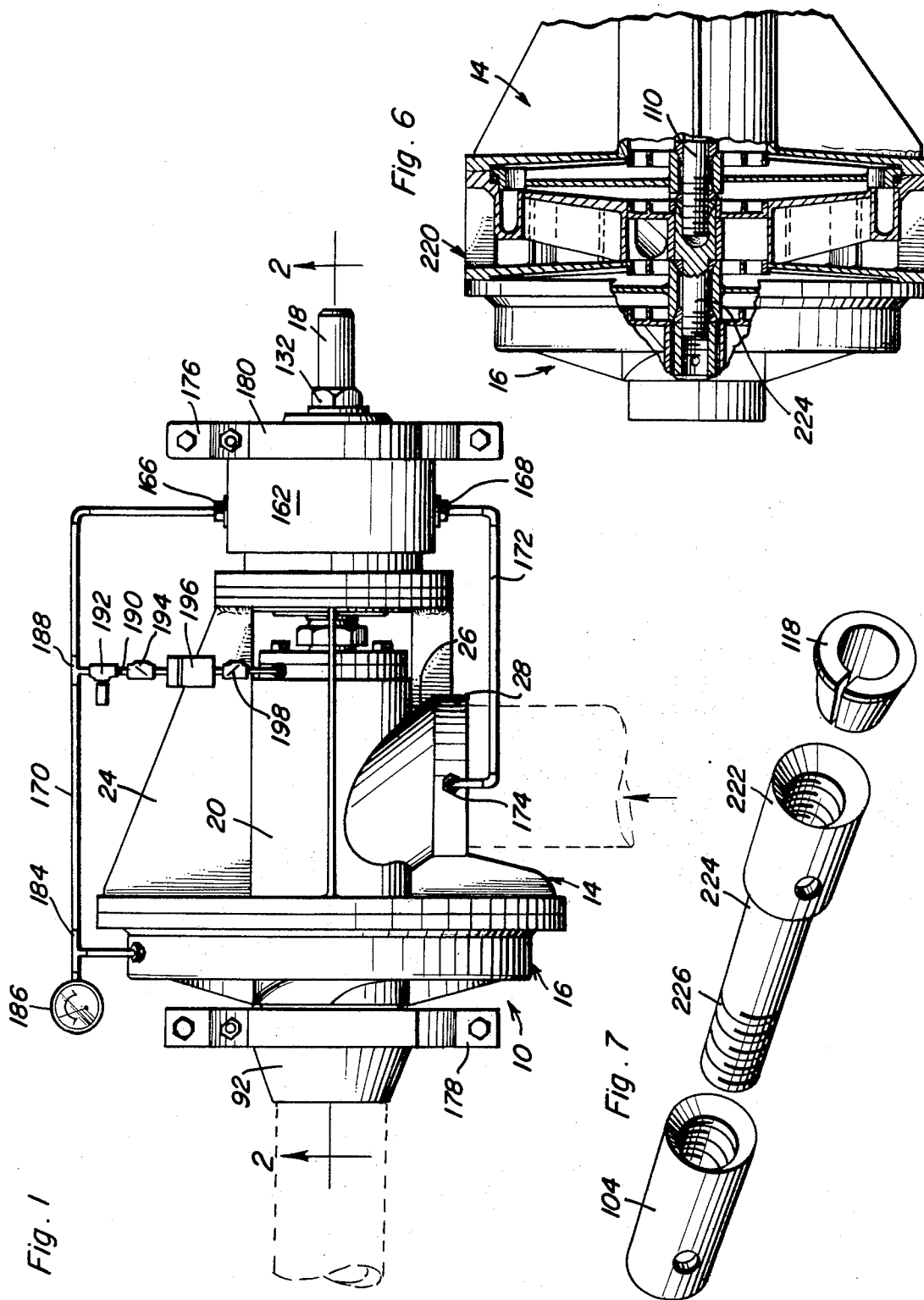


Fig. 2

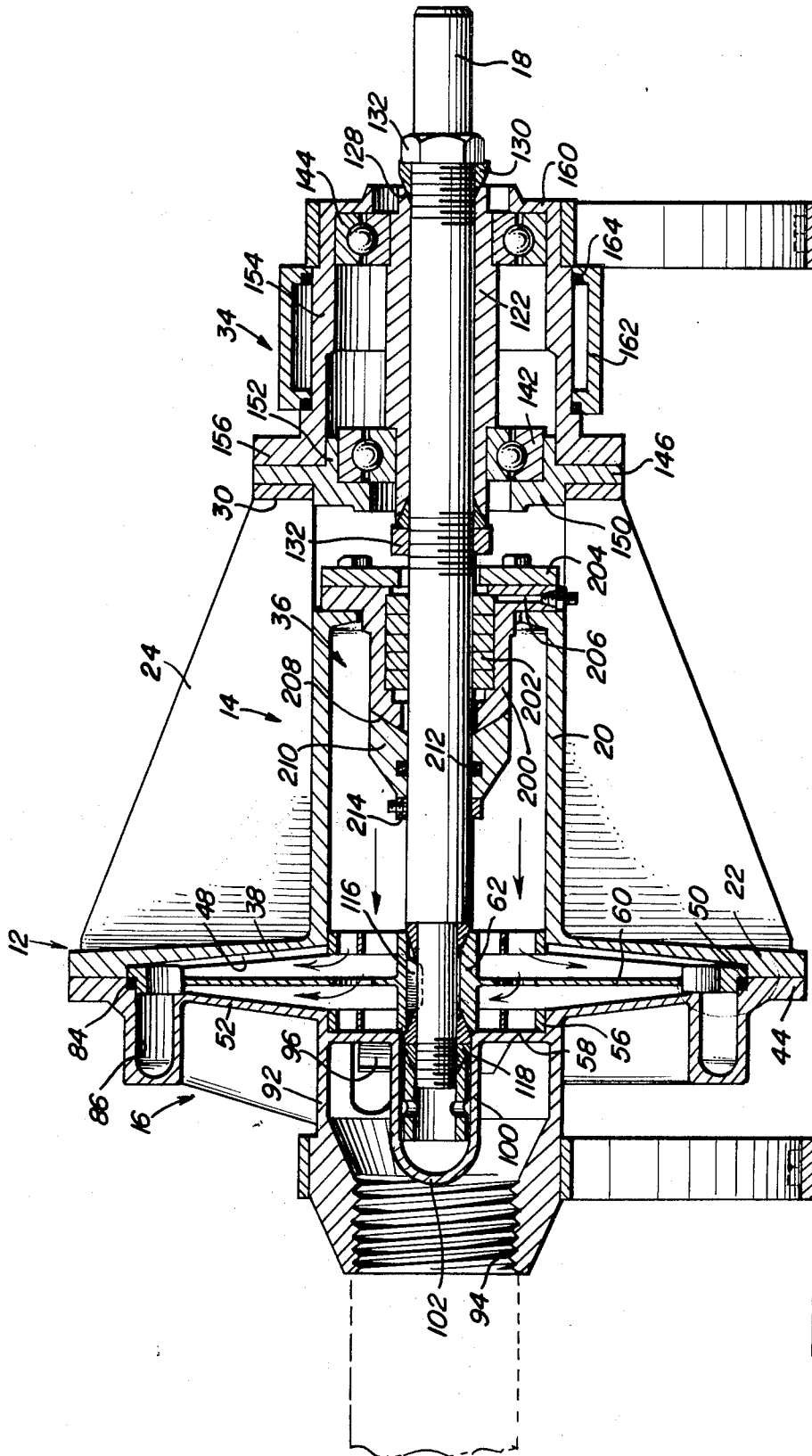


Fig. 3

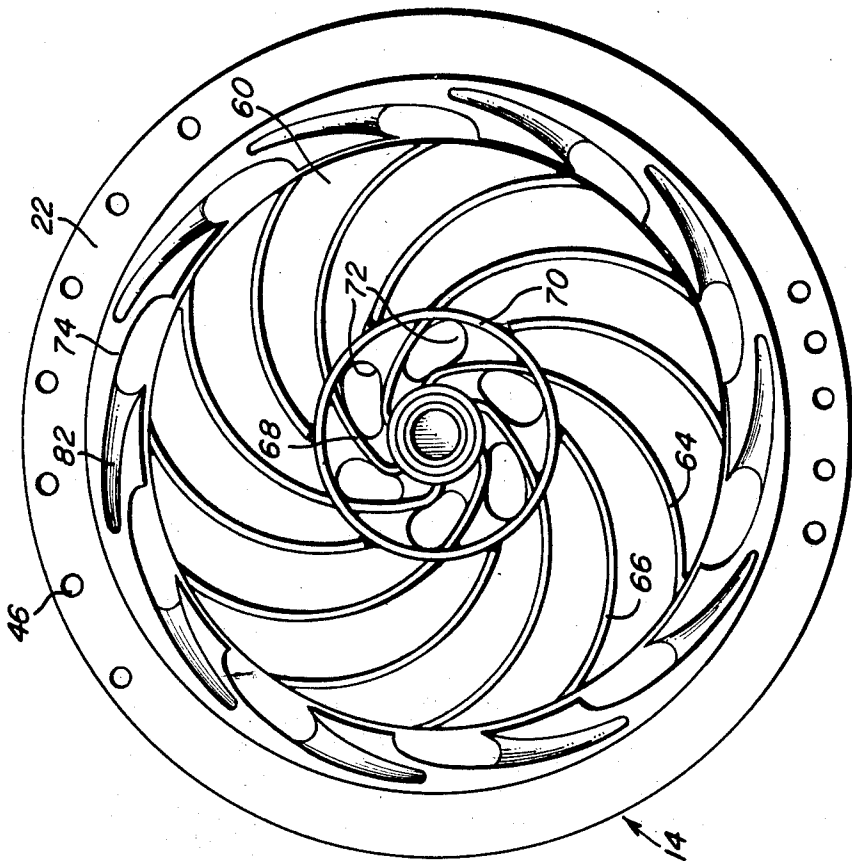
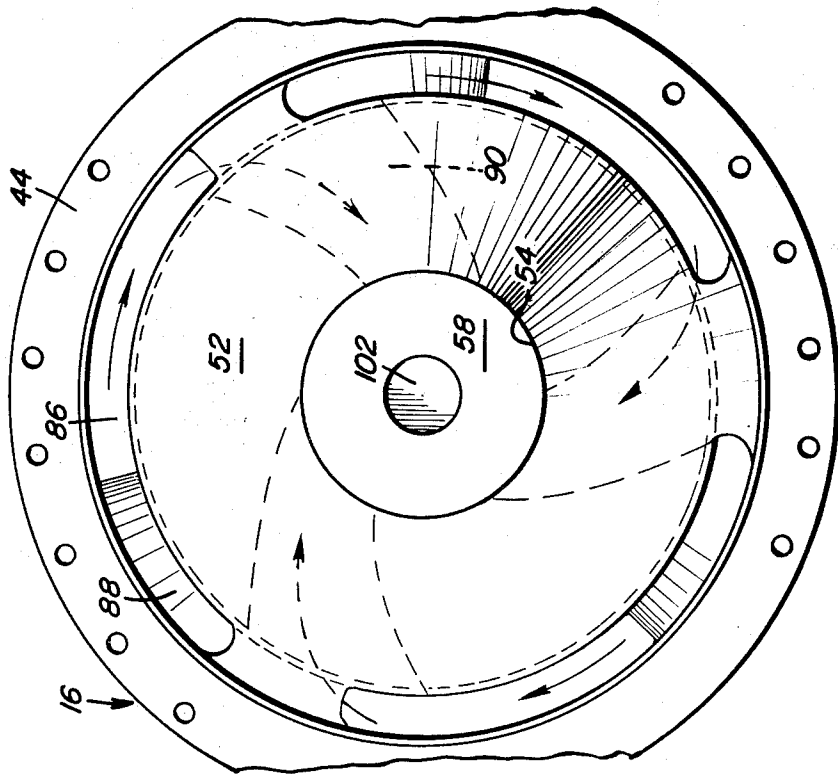
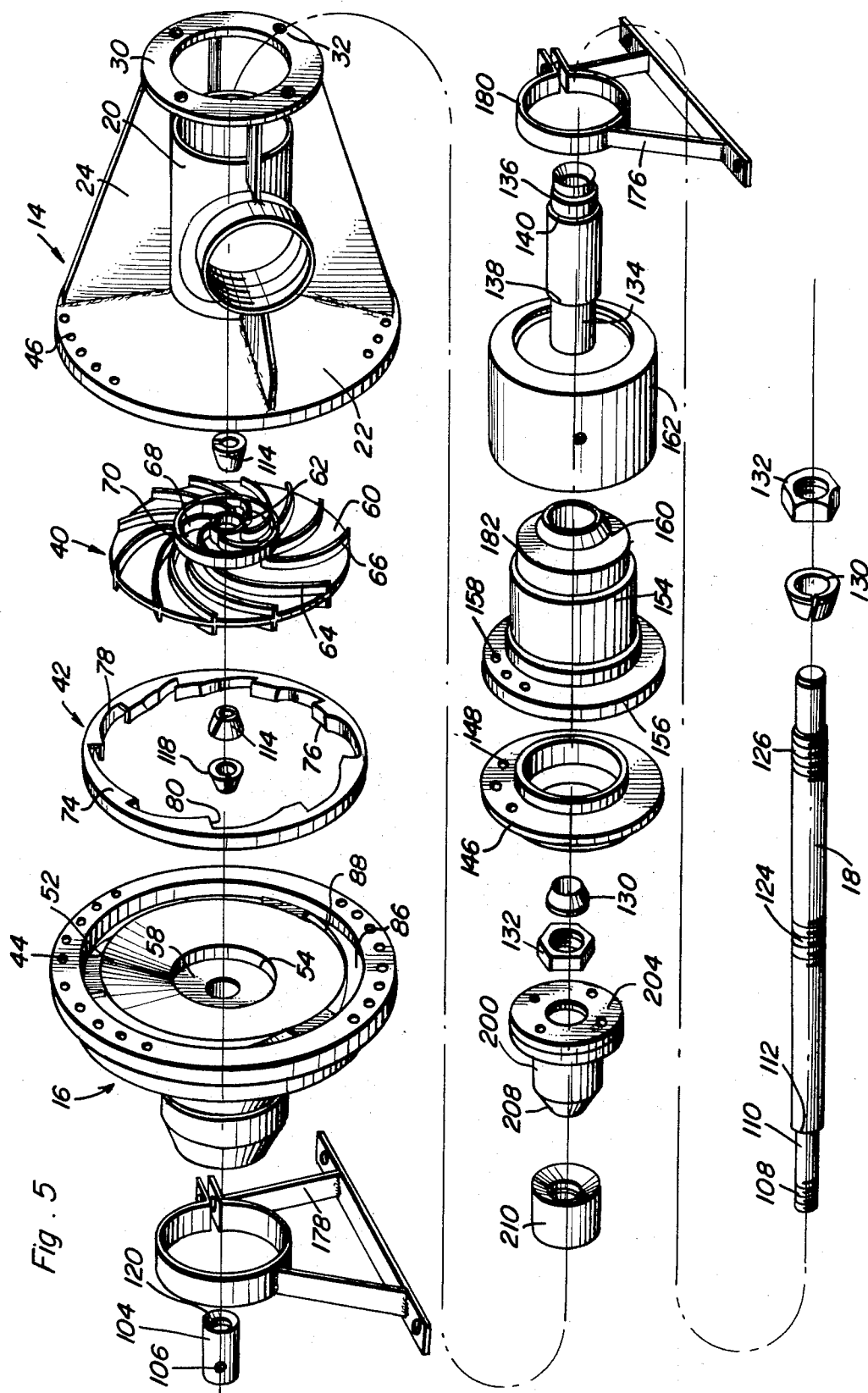


Fig. 4





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PUMP

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to a rotary pump having axial intake and discharge and an impeller having vanes on both sides thereof for producing a high discharge pressure and a novel and unique bearing and sealing arrangement for the drive shaft in relation to the intake of the pump.

2. Description of the Prior Art

Rotary pumps generally of the centrifugal type have been provided for pumping liquids under various circumstances. An example of one type pump for this purpose is found in my prior U.S. Pat. No. 3,363,576, issued Jan. 16, 1968. Known centrifugal pumps have been performed satisfactorily under some conditions but in some situations, such pumps either perform inefficiently or inadequately.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a rotary pump incorporating a casing having a rotary impeller disposed therein with the impeller having vanes on both surfaces thereof and a central opening to enable fluid to be pumped from a single axial inlet by both surfaces of the impeller.

Another object of the invention is to provide a pump in which the casing is provided with passageways for guiding, directing and discharging the fluid being pumped from the outer peripheral portion of the impeller in a radially inward direction for discharge axially of the pump or axially into a subsequent stage of the pump.

Another object of the invention is to provide a pump in accordance with the preceding objects in which the power shaft which drives the impeller is supported from the casing or other stationary support by a bearing assembly lubricated by the fluid being pumped and the power shaft is also sealed by a lubricated seal arrangement in which the lubricant is maintained under pressure by the pressure of the fluid being pumped.

A further important object of the present invention is to provide a rotary pump in which the impeller has central annular ring members thereon generally in sealing relation to the housing with the impeller being accurately positioned and supported in relation to the casing by the bearing and supporting structure for the drive shaft and a tail shaft provided on the impeller that is journaled in the casing.

Yet another significant object of the invention is to provide a rotary pump of the centrifugal type capable of discharge of liquid at a relatively high volume and high pressure which is efficient in operation capable of assembly into a single stage or any number of stages depending upon the output pressure desired, long lasting and dependable in operation and relatively inexpensive to manufacture and maintain.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the pump.

FIG. 2 is a longitudinal, sectional view taken substantially upon a plane passing along section line 2—2 of FIG. 1 illustrating the relationship of the structural components of the pump.

FIG. 3 is an end elevational view of the impeller and associated deflector ring and casing with the intake portion of the casing removed.

FIG. 4 is a view similar to FIG. 3 but with the impeller and deflector ring removed.

FIG. 5 is an exploded group perspective view illustrating the components of the pump and their relationship.

FIG. 6 is an elevational view, partially in section, illustrating the adapter insert by which the pump may be converted from a single stage to a multiple stage.

FIG. 7 is a group perspective view of the extension assembly used in the multiple stage pump.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now specifically to the drawings, the pump of the present invention is generally designated by reference numeral 10 and includes a casing generally designated by the numeral 12 which includes an intake portion 14 and a discharge portion 16. The pump is supplied with rotational power by virtue of a power shaft 18 oriented longitudinally in the casing 12 with the input end thereof projecting from the intake portion of the casing for connection with a suitable power source such as an internal combustion engine, electric motor or the like by any suitable means so that shaft 18 may be rotated at a desired rotational speed with a desired torque.

The intake portion 14 of the casing 12 includes a longitudinally extending hollow cylindrical member 20 having a circular plate 22 rigid with one end thereof with reinforcing gussets 24 bracing and rigidifying the tubular member 20 and plate 22 with respect to each other. The tubular member 20 is provided with an angularly extending adapter tube 26 which terminates in a laterally extending tubular element 28 that forms an inlet for the pump and is connected to a suitable pipe, conduit or the like for supplying liquid such as water to the pump.

The gussets 24 extend beyond the end of the tubular member 20 and rigidly support an annular flange 30 having a plurality of apertures 32 therein on which is mounted a bearing assembly 34 which journals and supports the shaft 18. The end of the tubular member 20 is spaced from the flange 30 and receives a seal assembly 36 which sealingly engages the shaft 18 and prevents water leakage along the shaft 18 from the interior of the pump.

The casing 12 includes a hollow chamber 38 which may be considered the working chamber of the pump and is annular in configuration and this chamber receives an impeller generally designated by the numeral 40 and an annular deflector ring 42 which is stationary with respect to the casing with the impeller rotating with the shaft 18.

As illustrated in FIG. 2, the plate 22 abuts and is rigid with a flange 44 on the discharge portion 16 of the casing with the periphery of the plate 22 also defining a flange that is secured in rigid relation with the flange 44

by suitable through bolts received in apertures 46. The interior surface of the plate 22 is inclined as at 48 with the inner edge of the inclined surface 48 merging with the interior of the tubular member 20 and the outer edge of the inclined surface 48 being defined by a shoulder 50 that extends peripherally of the plate 22 inwardly of the circumference thereof.

The discharge portion of the casing 16 also includes a plate 52 which has an inclined surface 54 that is integral with the flange 44 and diverges from the inclined surface 48 and cooperates therewith to define the hollow chamber 38 which receives the impeller 40. Centrally of the plate 52, there is provided an annular shoulder or recess 56 that is the same diameter as and in alignment with the interior of the tubular member 20 with the rear limit of the recess or shoulder 56 being defined by a circular plate 58 which forms a rearward partition wall or closure for the hollow chamber 38.

As illustrated in FIG. 5, the impeller 40 includes a circular plate 60 having a centrally disposed tubular hub 62 therein which extends to both sides of the plate 60.

Each side of the plate 60 is provided with a plurality of radially extending but arcuately curved vanes 64 and 66 with the vanes 64 and 66 being in alternate relationship. The vanes 64 extend completely inwardly to and are joined with the hub 62 while the inner ends of the vanes 66 terminate in circumferentially spaced relation to the hub 62. The inner ends of the vanes 64 have the same depth as the length of the hub 62 projecting from the plate 60 with the inner ends of the vanes 64 being designated by numeral 68 with the outer ends of the inner end portions 68 of the vanes 64 defining axially extending shoulders on which is mounted an annular ring 70 that is rigidly secured to the shoulders defined by the juncture of the outer portion of the vane 64 and the inner portion 68 thereof with the outer edge of the ring 70 generally being flush with the end of the hub 62 as illustrated in FIG. 2. The vanes 66 terminate in alignment with the ring 70 with the vanes 64 and 66 being rigidly secured to the plate 60 and substantially equally spaced with the omission of the inner ends of the vanes 66 providing an open area inwardly of the ring with an elongated and generally oval-shaped opening 72 being provided in the plate 60 with the openings 72 communicating between the two sides of the plate 60. The relationship of the openings 72, the vanes 64 and 66 and the annular ring 70 is illustrated in FIG. 3 with the relationship of the rings 70 to the interior of the tubular member 20 and the shoulder or recess 56 being illustrated in FIG. 2. Thus, as water enters through the inlet 28 into the tubular member 20 it will flow through the ring 70 received in the tubular member 20 with the water being divided with a portion of it being impelled outwardly along the surface of the impeller plate 60 facing the tubular member 20 and the remaining portion of the water passing through the openings 72 and moving radially outwardly and being impelled by the vanes on the opposite side of the impeller plate 60 thereby providing effective movement of the water or other liquid during rotation of the impeller 40 in a clockwise direction as viewed in FIG. 5 with the vanes being arcuately curved so that such rotation will impel the water or other liquid outwardly in the annular chamber 38 toward the periphery of the casing 12 where it comes into contact with the deflector ring 42.

The deflector ring 42 includes an annular member 74 which has an inner edge 76 that closely surrounds the impeller plate 60 and has a width substantially equal to the width of the combined impeller plate 60 and the other ends of the vanes 64 and 66. The inner edge 76 of the annular member 74 is provided with a plurality of arcuately extending notches 78 defined by an outer periphery that tapers from the inner edge 76 towards the outer edge of the annular member in the direction of rotation of the impeller plate 60 with the terminal edge of each notch 78 being substantially radially disposed on the side of the annular member 74 which faces the plate 22 as designated by numeral 80 in FIG. 5. The opposite side of each notch 78, that is, where the notch communicates with the surface of the annular member 74 which faces the discharge portion 16 of the casing, the annular member is provided with an elongated arcuately curved and tapering groove 82 which extends in the direction of rotation of the impeller so that water which is discharged from the impeller will enter the notches 78 and be deflected or directed toward the discharge portion 16 of the casing by the tapering configuration of the groove 82 which commences at the radial edge 80 which is substantially a feather edge or very thin edge and inclines towards the surface of the annular member 74 which faces the discharge portion 16 of the casing. In order to seal the annular member 74 in relation to the casing, an O-ring of neoprene, or the like designated by numeral 84 is provided between the inner edge of the flange 44 which has a recess therein and a corresponding peripheral notch or recess in the annular member 74. As illustrated, the plate 52 of the discharge portion is closely adjacent to the annular member 74 and serves to define the outer portion of the hollow chamber 38.

At the inner edge of the flange 44, a plurality of tapering channels or passageways 86 are provided which commence as shallow grooves at the inlet end 88 thereof and progressively deepen in the direction of rotation of the impeller and movement of the water or liquid until they reach a maximum axial depth and communicate with a radially, inwardly extending curved passageway 90 which extends to and communicates with the interior of a tubular member 92 which forms an extension on the plate 58 and which includes an internally threaded extension 94 that defines a discharge pipe for the liquid being pumped. As illustrated in FIG. 4, three circumferentially spaced and isolated channels or passageways 86 are provided with the tapering of the groove 86 being gradual and continuous into the passageway 90 with the juncture between the passageway 86 and the passageway 90 being smoothly curved and rounded with the bottom limits of the passageway 86 also being curved and generally of U-shaped configuration as illustrated in FIG. 2. Where the water or liquid exits from the passageway 90 into the hollow interior of the tubular member 92, curved deflectors 96 are provided for deflecting the water and making more efficient movement of the water possible.

The circular plate 58 is provided with a tubular member 100 extending axially in concentric relation to the tubular member 92 with the outer end thereof being rounded and closed as at 102. The tubular member 100 forms a bearing member for an internally threaded extension 104 on the shaft 18. The extension 104 has an external surface that is journaled in the interior surface of the tubular member 100 and includes radial open-

ings 106 for receiving a spanner wrench or the like for threading the extension 104 rigidly onto the threaded end 108 of a reduced end portion 110 on the shaft 18. The reduced end portion 119 is received within the hub 62 of the impeller 40 and includes a shoulder 112 at the inner end of the reduced end portion 110. The reduced end portion 110 receives a pair of tapered split collars 114 thereon with the inner collar having its large end abutted against the shoulder 112 and the outer collar received in the discharge end of the impeller hub 62 with the end portions of the hub 62 being bevelled at an angle corresponding to the external surfaces of the collars 114. Also, the hub 62 and the reduced end portion 110 is grooved to receive a key 116 in order to securely lock the impeller 40 to the shaft 18 but enable disassembly thereof. A split collar 118 is disposed on the threaded portion 108 or the outer end of the reduced end portion 110 with its large end abutting the large end of the rearmost collar 114 and the tapering surface thereof is engaged with an internal tapering surface 120 on the extension 104 so that as the extension 104 is rotated, the internal threads thereon will fixedly assemble the impeller 40 on the shaft 18 with the shaft and impeller being concentrically oriented due to the tapered split collars 114 and 118. The threaded connection of the extension also enables the pump to be assembled into a multiple stage pump in a manner defined hereinafter and if desired, the tubular member 100 may be provided with an inserted bushing or the like to extend the wear capabilities thereof.

Referring now specifically to FIG. 2, the bearing assembly 34 includes a tubular sleeve 122 received on the power shaft between threaded portions 124 and 126 thereon. The ends of the sleeve 122 are internally tapered at 128 and tapered split collars 130 are mounted on the shaft 18 in engagement with the tapered ends 128 on the sleeve 122 and nuts 132 are threaded onto the threaded portions 124 and 126 to rigidly fix the sleeve 122 on the shaft 18 in concentric relation thereto. The external surface of the sleeve 122 is provided with reduced end portions 134 and 136 which define shoulders 138 and 140 respectively. The reduced end portions 134 and 136 receive conventional bearing assemblies 142 and 144 respectively with the inner races of the bearing assemblies engaging the shoulders 138 and 140 as illustrated in FIG. 2.

The bearing assembly 34 also includes an inner end plate 146 that is apertured for alignment with and engagement with the flange 30 and the apertures 32 therein with the apertures in the plate 146 being designated by numeral 148. One side of the plate 146 is provided with a projecting shoulder 150 which extends into the interior of the flange 30 as illustrated in FIG. 2 and the opposite side of the plate 146 is provided with a cylindrical extension 152 which defines a seat for engaging the external race of the bearing assembly 142. The bearing assembly 34 also includes a tubular member 154 which includes an outwardly extending flange 156 on its inner end having apertures 158 therein for engagement with the plate 146 and registry with the openings therein so that bolts may be employed for securing the bearing assembly to the flange 30. The flange 156 and the internal dimension of the tubular member 154 engage the extension 152 on the plate 146 to provide for accurate alignment thereof and the outer end of the tubular member 154 is provided with an inwardly extending flange 160 which engages the outer

race of the bearing assembly 144 and the bolts which extend through the flange 156 and 30 and the plate 146 serve to retain the bearing assembly 34 in position and accurately support and align the shaft 18 with respect to the casing 12 which provides for accurate positioning of the rotary impeller in relation to the casing 12.

Disposed around the tubular member 154 is a water jacket 162 in the form of a tubular member having inturned flanges at each end thereof and O-ring seals 164 in the inner edge of the flanges in sealing engagement with the tubular member 154. Threaded fittings 166 and 168 are provided in the water jacket 162 for receiving and connection with a water line 170 communicated with the high pressure side of the pump such as the discharge portion thereof and a similar pipe or conduit 172 interconnects the fitting 168 and a similar fitting 174 on the inlet 28 of the pump for providing for circulation of water and cooling of the bearing assembly 34.

Supporting brackets 176 and 178 are provided each of which includes a split clamp sleeve 180 which encircles a reduced end portion 182 on the tubular member 154 and a corresponding surface on the discharge pipe or tubular member 92 respectively. This bracket will effectively retain the water jacket 162 in position or any other suitable fastening means may be provided for this purpose. The high pressure water pipe, tube or the like 170 is communicated with the discharge portion 16 of the casing 12 in any suitable manner such as by the use of a T-connection 184 provided with a suitable pressure gauge 186 and the pipe or hose 170 is provided with another similar T-connection 188 to which a branch pipe 190 is connected that is associated with the seal assembly 36 with the pipe 190 including a pressure regulator 192 and a check valve 194 disposed outwardly of a cylinder 196 which has a piston movable therein and which forces lubricant into the seal assembly with the lubricant being any suitable grease or the like so that as pressure is exerted on the outside of the piston within the cylinder 196, grease will be forced into the seal. A suitable check valve 198 is provided to prevent water pressure in the pump from reverse flowing into the lubricant cylinder when the pump is not operating.

The seal assembly 36 includes a tubular member 200 receiving conventional seal elements with a retaining flange 204 serving to retain the seal members 202 within the tubular member 200. A passageway 206 is provided in communication with the lubricant cylinder 196 through the check valve 198 for retaining lubricant under pressure within the seal. The inner end of the tubular member 200 is bevelled or tapered at 208 and a collar 210 having a correspondingly tapered surface can engage the end of the tubular member 200 and is longitudinally movable on the shaft 18 with an O-ring seal 212 being provided to prevent water pressure in the pump from damping the seals 202 when the pump is inoperative inasmuch as the collar 210 serves as a protecting device against high pressure water coming into direct contact with the seals 202. A limit collar 214 is secured to the shaft by a suitable setscrew in a manner to limit the longitudinal movement of the protective collar 210 in relation to the tubular member 200. The inner end of the collar 210 is bevelled or tapered and is maintained as small as possible in length and di-

ameter to eliminate unnecessary restrictions in the flow path of the water passing into the pump.

With this construction, as the shaft is rotated, water enters through the inlet through the intake tubular member 20 and is pumped by the impeller and discharged through the notches and grooves in the deflector ring, the passageways in the discharge portion of the housing and out through tubular member 92 into the discharge pipe 94. All components are maintained at a desired thickness which will provide the requisite strength and at the same time all flow restrictions are reduced by eliminating sharp corners and providing deflecting vanes, guides and the like for water passing through the pump.

The pump may be converted from a single stage pump as illustrated in FIG. 2 to a multiple stage pump as illustrated in FIG. 6 by the insertion of an adapter 220 between the intake portion 14 of the casing and the discharge portion 16 thereof. The adapter 220 includes a duplicate of the plate 52, inclined surface 54 and the other associated structure of the discharge portion except that the tubular member is provided at its rear-most end with a duplicate of the plate 22 and the inclined surface 48 thereon which, when combined with the discharge portion 16 defines a second chamber the same as the hollow chamber 38 so that a second rotor positioned thereon will pump the water through the second stage of the pump. In inserting the adapter, it is only necessary to remove the discharge portion 16 from the intake portion 14 and the impeller 40 which is assembled therewith. The extension 104 is also removed and in lieu thereof, an extension adapter 222 is attached to the threaded end 108 of the shaft 18. The adapter 222 (see FIG. 7) is the same as the extension 104 except that it is provided with a rigid shaft portion 224 that has a threaded end portion 226 thus, in effect, forming an extension of the reduced end portion 110 of the shaft 18 so that the extension 104 may be reapplied to the threaded end 226 in the same manner as it was originally applied to the threaded end 108 with the association of all the other components remaining the same.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A rotary pump comprising a casing having an interior hollow chamber, a rotary impeller disposed in said chamber, a shaft connected with said impeller and extending exteriorly of the casing for rotatably driving the impeller, inlet means in said casing for admitting flowable material to be pumped to the central portion of the impeller, said impeller including vanes thereon for impelling the material as the impeller rotates, outlet means incorporated into the casing and communicating with the portion of the casing receiving the periphery of the impeller for receiving the material impelled by the impeller, said outlet means including radially and inwardly extending passage defining means communicating with an outlet pipe extending axially and generally coincident to the rotational axis of the impeller.

2. The structure as defined in claim 1 wherein said impeller is in the form of a substantially circular plate, and vanes being disposed radially on each surface of the plate, the central portion of the plate including aperture means therein enabling flowable material to be impelled by the vanes on both sides of the impeller.

3. The structure as defined in claim 1 wherein said rotary impeller includes a hub received on said shaft, means rigidly fixing the hub to said shaft, each end of the hub having a tapering internal surface, a pair of split tapered collets interposed between the shaft and the tapered ends of the hub with at least one of the collets being longitudinally movable on the shaft for centering the hub and impeller in relation to the shaft, and screw threaded means connected with the shaft for balancing the collets toward each other for securing the hub fixedly in concentric relation to the shaft.

4. The structure defined in claim 2 wherein said aperture means in the impeller includes a plurality of openings through the plate to provide hydraulic balance to both surfaces of the impeller plate.

5. A rotary pump comprising a casing having an interior hollow chamber, a rotary impeller disposed in said chamber, a shaft connected with said impeller and extending exteriorly of the casing for rotatably driving the impeller, inlet means in said casing for admitting flowable material to be pumped to the central portion of the impeller, said impeller including vanes thereon for impelling the material as the impeller rotates, outlet means incorporated into the casing and communicating with the portion of the casing receiving the periphery of the impeller for receiving the material impelled by the impeller, said outlet means including inwardly extending passage defining means communicating with an outlet pipe generally coincident to the rotational axis of the impeller, said impeller being in the form of a substantially circular plate, said vanes being disposed radially on each surface of the plate, the central portion of the plate including aperture forming means therein enabling flowable material to be impelled by the vanes on both sides of the impeller, said inlet means being in the form of a tubular member having an inlet pipe communicated therewith, said shaft being disposed in said tubular member, seal means interconnecting the shaft and tubular member outwardly of the inlet pipe for sealing the shaft, and bearing means on said casing axially outwardly of the tubular member for supporting said shaft in relation to the casing, and means enabling circulation of cooling fluid in relation to the bearing means for preventing excessive temperatures occurring in the bearing means.

6. The structure as defined in claim 5 wherein said means enabling circulation of cooling fluid including a pipe extending from the periphery of the chamber in the casing for inlet of cooling fluid, a pipe communicating with the tubular member to return the cooling fluid to the inlet means on the pump, and a jacket encircling the bearing means for enabling circulation of cooling fluid.

7. The structure as defined in claim 6 wherein said seal means includes a tubular member disposed concentrically within the tubular member defining the inlet means and receiving a plurality of seal rings therein in sealing engagement with the shaft, lubrication means for said seal rings, said lubrication means including a piston and cylinder to force lubrication means into the seal rings, and conduit means interconnecting the lubri-

cation cylinder and piston and the pipe extending from the periphery of the chamber in the casing for inlet of cooling fluid to the jacket thereby providing pressure lubrication of the seal rings.

8. A rotary pump comprising a casing having an interior hollow chamber, a rotary impeller disposed in said chamber, a shaft connected with said impeller and extending exteriorly of the casing for rotary driving the impeller, inlet means in said casing for admitting flowable material to be pumped to the central portion of the impeller, said impeller including vanes thereon for impelling the material as the impeller rotates, outlet means incorporated into the casing and communicating with the portion of the casing receiving the periphery of the impeller for receiving the material impelled by the impeller, said outlet means including inwardly extending passage defining means communicating with an outlet pipe generally coincident to the rotational axis of the impeller, said impeller being in the form of a substantially circular plate, said vanes being disposed radially on each surface of the plate, the central portion of the plate including aperture forming means therein enabling flowable material to be impelled by the vanes on both sides of the impeller, said impeller including a centrally disposed annular ring on each side thereof in encircling relation to the aperture means, one of the rings being received closely within the inlet means, said casing including a recess receiving the other annular ring

9. A rotary pump comprising a casing having an interior hollow chamber, a rotary impeller disposed in said chamber, a shaft connected with said impeller and extending exteriorly of the casing for rotatably driving the impeller, inlet means in said casing for admitting flowable material to be pumped to the central portion of the impeller, said impeller including vanes thereon for impelling the material as the impeller rotates, outlet means incorporated into the casing and communicating with the portion of the casing receiving the periphery of the impeller for receiving the material impelled by the impeller, said outlet means including inwardly extending passage defining means communicating with an outlet pipe generally coincident to the rotational axis of the impeller, said outlet means including a substantially circular plate defining the rear surface of the chamber, said radially extending passage defining means being

rigid with said plate, tapering inlet channels communicating the outer periphery of the chamber with the radial passage defining means.

10. The structure as defined in claim 9 wherein said casing is provided with a deflector ring at the outer periphery of the impeller, said deflector ring including a plurality of radial notches therein with each of the notches including an inclined surface extending circumferentially in the direction of rotation and inclined axially toward the channels for deflecting the material being pumped into the channels and passage defining means for discharge.

11. The structure as defined in claim 10 together with an insert adapter for converting the pump to a multiple stage pump, said casing including an inlet portion and a discharge portion, said portions of the casing being separable at the outer periphery of the chamber, said insert adapter including a duplication of the discharge portion and the inlet portion of the casing, a duplication of the impeller and deflector ring and an extension for the drive shaft for enabling a single or multiple number of insert adapters to be incorporated into the pump to enable any number of stages to be provided.

12. The structure defined in claim 11 wherein said extension for the drive shaft is threadly connected thereto and includes a duplicate connection with the impeller.

13. A rotary pump comprising a casing having a hollow interior chamber with an inlet at one side thereof, a rotary impeller disposed within said chamber and separating the chamber into two compartments with the inlet communicating with one compartment, said impeller including a plate of generally circular configuration with the periphery of the plate being disposed closely adjacent the internal periphery of the chamber, said plate including centrally disposed aperture means communicating the compartments of the chamber with each other and enabling inlet of flowable material from the inlet to both compartments for hydraulically balancing the impeller, said impeller plate including projecting vanes on both surfaces thereof for impelling flowable material thereof during rotation, and discharge means communicated with the casing for discharge of flowable material being pumped.

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