

April 14, 1964

L. M. NECHINE
HYDRAULIC PUMP

3,128,713

Filed Sept. 26, 1958

3 Sheets-Sheet 1

Fig. 1

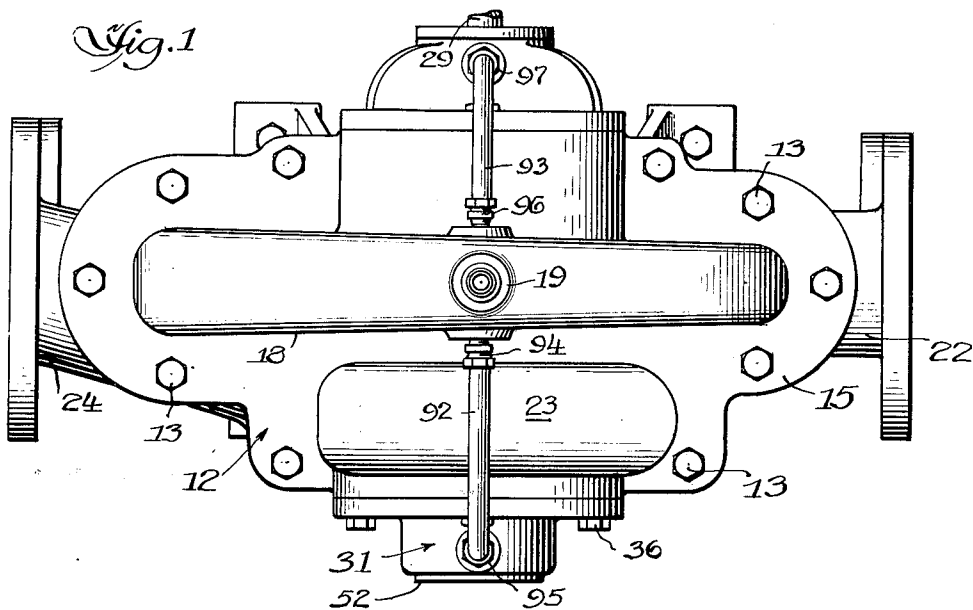
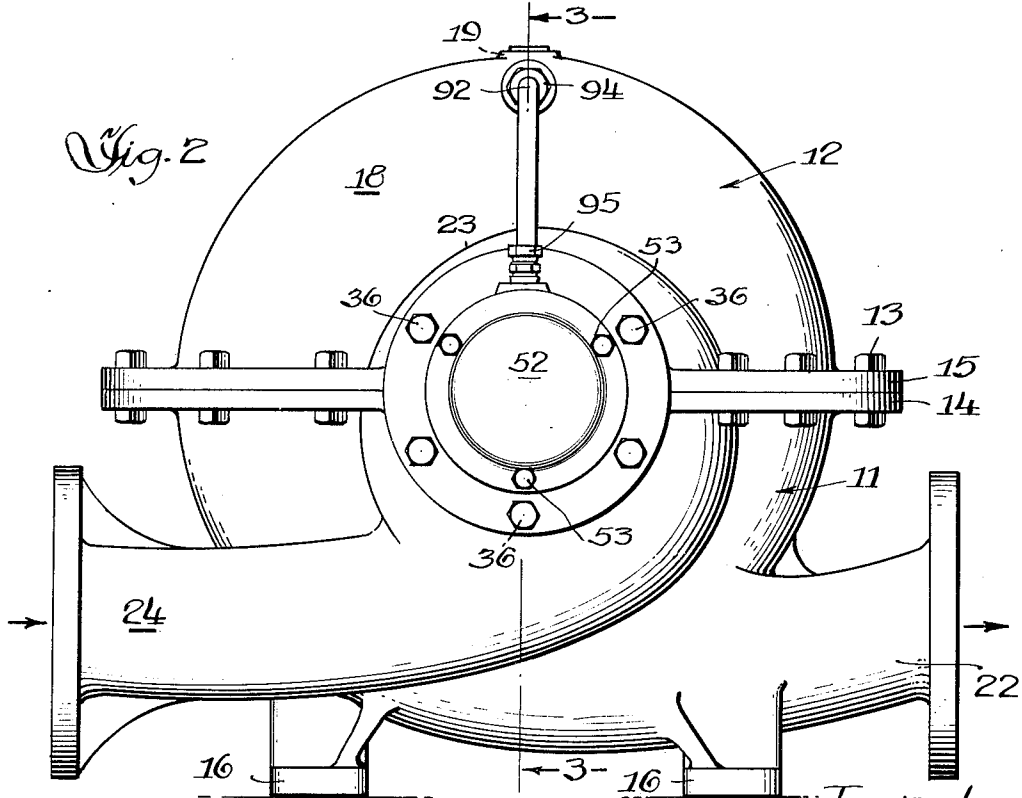


Fig. 2



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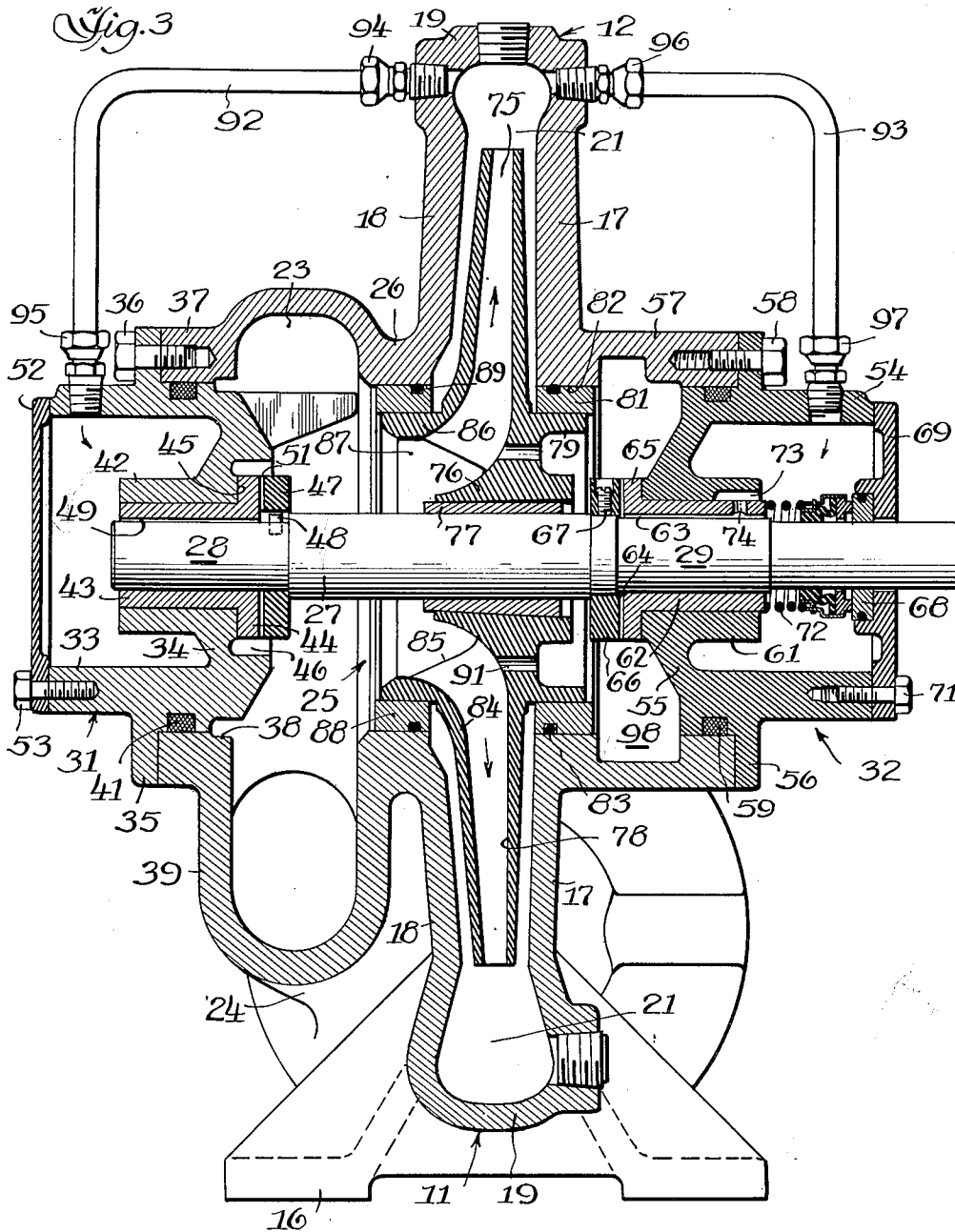
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3 Sheets-Sheet 3

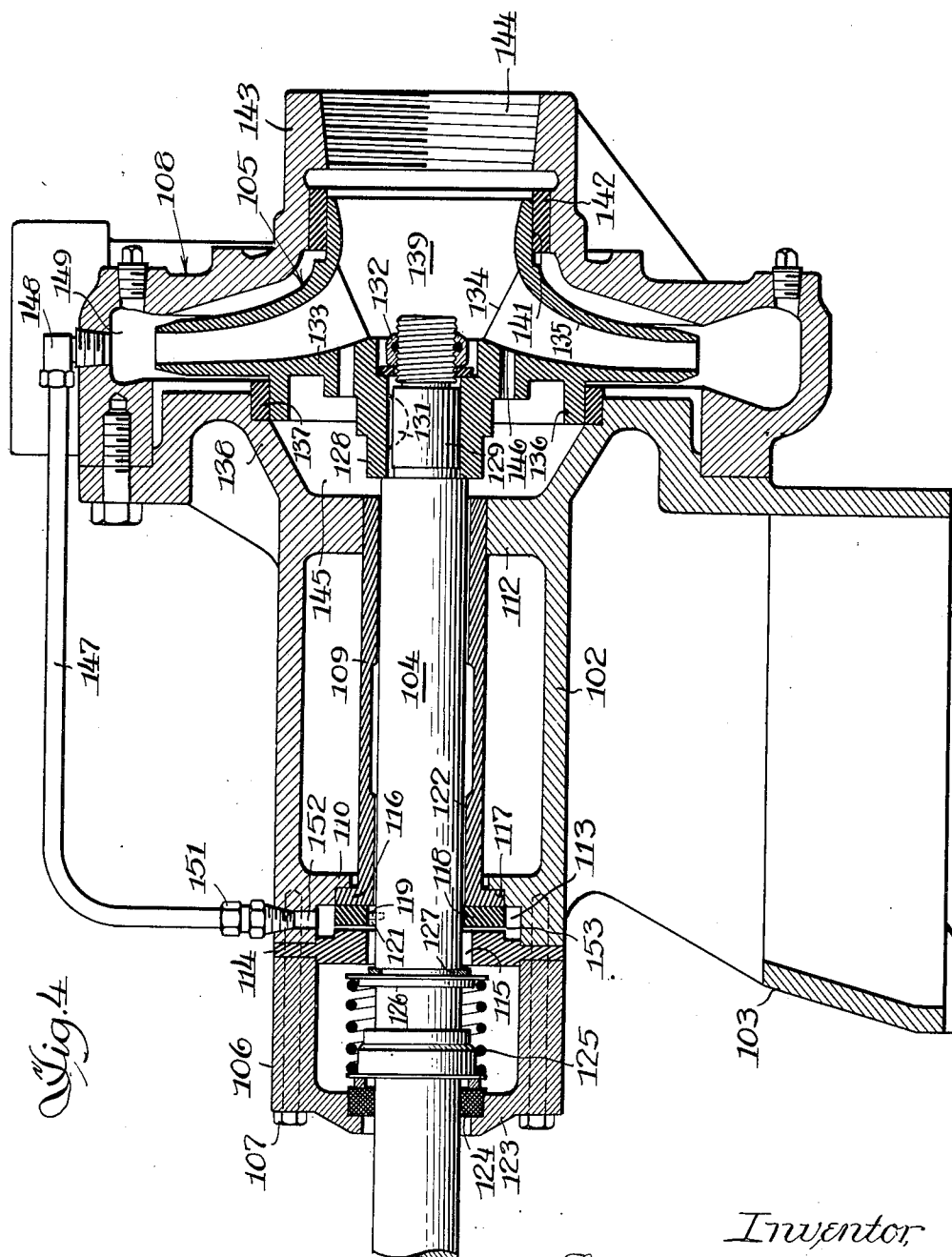


Fig. 4

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1

3,128,713

HYDRAULIC PUMP

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2 Claims. (Cl. 103-103)

The invention relates to improvements in hydraulic pumps, and is more particularly concerned with a single suction split case pump structure including novel means for lubricating the impeller shaft bearing with fluid handled by the pump.

In accordance with the present invention, the means for feeding fluid handled by a single suction pump directly to an impeller shaft bearing comprises a fluid flow conduit having one end in direct flow communication with the pressure side of the impeller casing and its other end in flow communication with the interior of the bearing housing. A steady flow of fluid under pressure is delivered directly to the impeller shaft bearing that is inclosed in the bearing housing. The bearing has grooves and channels therein to permit the fluid delivered into the bearing housing to flow therethrough, and thereby lubricate said bearing. After lubricating the bearing, the fluid flows back into the impeller casing. The structure is such that it may be used in double- or single inboard or outboard bearing assemblies and further, the fluid flow conduit may be disconnected readily in installations where the fluid being pumped would have a deleterious effect on the bearings, in which instance an outside source of water or other lubricant supply can be used.

More specifically, the fluid flow conduit will have one of its ends connected by means of a suitable fitting directly with the impeller casing in a manner as to be in the path of the pressure flow from the impeller. Its other end is connected by a suitable fitting with the bearing housing at a point outwardly of the bearing, so that fluid delivered to said housing through the conduit will flow inwardly axially through and around the bearing surface and back into the impeller casing in the region of the region of the inlet or low pressure side of the impeller.

The structure, by means of which the above noted and other advantages of the invention are attained, will be described in the following specification, taken in conjunction with the accompanying drawings, showing two preferred illustrative embodiments of the invention, in which:

FIG. 1 is a top plan view of a split case hydraulic pump of a type having two outboard bearings for its impeller shaft, and embodying the invention;

FIG. 2 is an end elevational view of the pump;

FIG. 3 is a vertical axial sectional view taken substantially on line 3-3 of FIG. 2, and on an enlarged scale; and

FIG. 4 is a vertical axial sectional view of an end suction pump having a single outboard sleeve-type bearing lubricated by means of the structure of the present invention.

Referring now to the pump structure illustrated in FIGS. 1, 2 and 3, the single suction hydraulic pump includes a casing comprised of a lower half 11 and an upper half 12 suitably joined together by means of bolts 13 extended through flanges 14 and 15 respectively, on the matching faces of said halves. A mounting base 16 may be formed integral with the lower casing half 11. The casing has a substantially circular centrally located enlargement defined by radially extending walls 17 and 18 which are joined together integrally at their outer perimeter by a circumferential wall 19 and are spaced

2

apart to define an impeller chamber 21 having a fluid outlet 22 extending from the lower periphery thereof.

A convolute inlet chamber 23 also is formed in the pump casing outwardly of impeller chamber wall 18. This inlet chamber has a tangential fluid inlet conduit 24 in communication with its bottom region. Inlet chamber 23 communicates with impeller chamber 21 through a circular passageway 25 defined by an annular connecting wall 26 between the two chambers. An impeller shaft 27 is extended axially through the pump casing, and its bearing areas 28, 29 of reduced diameter are journaled in bearing housings 31, 32, respectively, mounted on the pump casing 11-12.

Bearing housing 31 comprises a substantially cupshape body 33 closed at its inner end by a wall 34 and having an external mounting flange 35 secured, as by cap screws 36, to a cylindrical mounting flange 37 surrounding an axial opening 38 in the outside wall 39 of inlet chamber 23. The closed end of the bearing housing 31 extends through said axial opening 38 and preferably has an external packing ring 41 embedded in its outside circumferential surface so as to afford a hydraulic seal between bearing housing 31 and mounting flange 37. An internal bearing boss 42, integral with end wall 34, extends from said wall back into the bearing housing and it carries a stationary bearing 43 in which bearing area 28 of the shaft is journaled. Bearing 43 may be fabricated from any suitable bearing material adapted for water or other fluid lubrication, such as sintered bronze graphite or solid graphite.

Bearing 43 has an external annular flange 44 on one of its ends which is in tight abutment with a machined face 45 on the outside surface of bearing housing end wall 34. As shown, machined face 45 is recessed to provide an annular overhang defining an annular channel 46 surrounding bearing flange 44. A thrust ring 47, carried on shaft 27 firmly, as by a pin 48, bears at all times against the outside face of bearing flange 44. Bearing 43 has at least one longitudinal groove 49 on its inside bearing surface which is in communication with a radial groove 51 on its flange face for a purpose to be described presently. A closure cap plate 52 is secured tightly over the open outer end of the cup shape bearing housing 31, as by means of cap screws 53.

Bearing housing 32 is substantially like housing 31 and it comprises a substantially cup-shape body including a cylindrical wall 54, an end wall 55 and an external flange 56 substantially midway between its ends for securing it to a cylindrical wall 57 extending outwardly from the pump casing wall 17, as by cap screws 58. A sealing ring 59 carried by cylindrical wall 54 provides a water tight seal between the bearing housing and the casing. The end wall 55 in said bearing housing carries a boss 61, which reenters the housing as shown. A bearing 62, fabricated like the bearing 43, is positioned within boss 61. This bearing has journaled therein bearing area 29 of impeller shaft 27. An internal longitudinal groove 63 in said bearing 43 is in communication with a radial channel 64 on the outside face of an annular external flange 65 on said bearing. A thrust ring 66, anchored firmly to the shaft 27, as by a set screw 67, bears against said flange face.

The shaft 27 extends outwardly from bearing 62 through a packing gland 68 in an end cap 69 secured over the outer end of the cylindrical bearing housing wall 54 by cap screws 71. The shaft is suitably connected with any source of power for rotating it. Packing gland 68 is maintained effective by a compression spring 72 coiled around the shaft and having one of its ends abutted against said gland and its other end abutted against the opposed or outer end of the bearing 62. The related

end of bearing boss 61 is suitably undercut to provide a recess 73 having fluid flow communication with the longitudinal bearing groove 63 through one or more ports 74 therein.

An impeller 75 is mounted on shaft 27 for operation in impeller chamber 21. This impeller has a hub 76 carrying a tapered bearing liner 77 affording a tight drive fit on the shaft. The hub has integral therewith a concentric circular web or back wall 78, of a diameter to substantially occupy the chamber 21, having a concentric flange 79 on its back surface. Flange 79 has a rotating fit in a wear ring 81 fitted snugly in an internal shoulder 82 formed by the inner peripheral edge of casing wall 17. A packing ring 83 embedded in the outer circumferential surface of wear ring 81 affords a water tight seal between said wear ring and shoulder 82.

The impeller 75 also includes a circular front wall 84 spaced from and integrally connected to the back wall 78 by circumferentially spaced radial webs or vanes 85. Front wall 84 has its inner peripheral margin 86 flared outwardly away from the back wall 78 to provide an annular throat 87 in direct flow communication with inlet chamber 23. A wear ring 88, seated on said peripheral margin 86 and carrying a sealing ring 89, is fitted into the passageway 25 to provide a concentric bearing surface for the flared margin of the impeller. A plurality of circumferential spaced ports 91 are provided in the impeller back wall 78 closely adjacent to the hub 76 for a purpose to be described presently.

In the structure described above, shaft bearings 43, 62 and wear ring bearings 78-81 and 86-88 are lubricated by the fluid handled by the pump. Lubrication of the bearings is accomplished by means of flow conduits 92 and 93. One end of flow conduit 92 is connected by a fitting 94 in flow communication with the peripheral region of the impeller chamber 21. Its other end is connected to a fitting 95 threaded into the cylindrical wall 33 of bearing housing 31 so as to be in flow communication with the interior thereof. The other flow conduit 93 has one end connected to the peripheral region of the impeller chamber 21 through a fitting 96, and its other end is in flow communication with the interior of bearing housing 32 through a connecting fitting 97.

During operation of the pump, fluid pumped by the impeller is drawn into the impeller throat 87 from the inlet chamber 23, and is discharged radially under pressure into the peripheral region of the impeller chamber 21. The fluid flows out of the impeller chamber through outlet 22. However, some of said fluid in the impeller chamber enters the conduits 92, 93 and flows therethrough into the respective bearing housings 31, 32. Fluid entering bearing housing 31 is forced under pressure through the longitudinal and radial grooves 49 and 51 in bearing 43, into the annular channel 46 defined by the undercut end of bearing boss 42, and then into the low pressure inlet chamber 23. Pumped fluid entering bearing housing 32 flows into the channel 73, through port 74 into and through the longitudinal bearing groove 63 and out of the bearing through radial groove 64. Fluid leaving radial groove 64 enters a circumferential flow chamber 98 located inwardly of bearing housing 32, and is drawn into impeller 75 through ports 91 in its back wall. It is obvious that, during operation of impeller 75, there is a continuous flow of pumped fluid through bearings 43 and 62 so as to lubricate the same. The wear ring bearing 86, 88 is lubricated by the flow of fluid through inlet chamber 23, whereas wear ring bearing 79-81 is lubricated by fluid flowing through flow chamber 98.

In the event that the fluid being pumped is deleterious to the bearings and therefore unsuitable as a lubricant, the flow conduits 92 and 93 may be disconnected and plugs (not shown) inserted in the fitting openings in the impeller chamber walls. Fluid from another source may then be piped into the bearings housings through conduits connected to the bearing housing fittings 95 and 97, which

fluid will be drawn into the impeller, as before, and ejected with the pumped fluid.

An end suction pump having a single outboard bearing assembly and embodying the features of the invention is shown in FIG. 4. In this exemplary disclosure, the pump assembly includes a casing 102 having an integral base 103. The casing has an externally driven impeller shaft 104 extending therethrough, one end of which carries an impeller 105 and the other end of which extends through a cup shaped end housing 106 mounted firmly on an end of the split casing, as by means of cap screws 107. The other end of casing 102 has secured thereto an impeller housing 108 within which the impeller operates.

Shaft 104 is freely rotatable in a sleeve bearing 109 mounted firmly at its ends in end walls 110, 112 of the casing. End wall 110 is spaced inwardly from the related end of the casing to define an annular space 113. A plate 114 positioned over the end of annular space 113 has an axial opening 115 that is larger in diameter than the diameter of shaft 104 which extends therethrough. As shown, plate 114 is arranged between end housing 106 and the related end of the casing and preferably is secured in place by screws 107.

The sleeve bearing 109 has an external annular flange 116 at one end seated in an axial recess 117 on the outside face of the end wall 110. A thrust ring 118, secured firmly to the shaft, as by a pin 119, is located in annular space 113 and bears normally against the outer face of bearing flange 116. Thrust ring 118 and sleeve bearing 109 have longitudinal grooves 121 and 122 respectively, on their inside circumferential surfaces for a purpose to be explained presently.

The cup shaped end housing 106 has its end wall 123 apertured to permit the shaft to extend therethrough. A suitable packing gland assembly 124, mounted on shaft 104, is held in water tight relation against the end wall 123 by a compression spring 125. Spring 125 is coiled about the shaft and maintained under tension by end abutment with a collar 126 held on the shaft by a split collar 127.

The impeller 105 includes a hub 128, secured on the shaft end 129 by a key 131 and lock nut 132. A circular web or back wall 133 extends radially from the hub and has a plurality of circumferentially spaced radial vanes 134 integral with its front face. The impeller also includes a circular front wall 135 spaced from the back wall and integral with the vanes. The impeller back wall 133 has a concentric flange 136 on its back face which has a sliding fit in a bearing ring 137 carried at the forward end of the outwardly radially flared wall portion 138 of casing 102. The inner peripheral margin of the impeller front wall 135 is flared forwardly to define an axial fluid inlet opening or throat 139. The outside circumferential surface 141 of the free margin of the flared front wall portion defining the throat is seated for free rotation in a wear ring 142 carried by a forwardly projecting circular wall 143 of impeller housing 108. Wall 143 extends forwardly beyond said wear ring and may be internally threaded, as at 144, to receive a fluid inlet conduit, not shown.

The outwardly radially flared wall portion 138 of the casing and the related area of the impeller back wall 133 define a flow chamber 145 in fluid flow communication with the interior of the impeller through ports 146 in the impeller back wall.

In order to lubricate the sleeve bearing 109, fluid pumped by the impeller 105 is delivered to the bearing through a flow conduit 147. As shown, one end of said conduit 147 is connected by a fitting 148 with the interior of the outer peripheral region of the impeller chamber 149. The other end of conduit 147 is connected to a fitting 151 in the casing 102 which is in flow communication with the annular space 113 through a port 152. The operation is such that during operation of the im-

5

5 peller, fluid flows under pressure from the impeller chamber 149 through conduit 147, fitting 151, port 152 and into the annular space 113. The spacing between the back face of bearing flange 116 and plate 114 is slightly greater than the width of the thrust ring 118 so as to insure that there is always a circumferential gap 153 leading from space 113 outside said thrust ring to the shaft surface. The fluid delivered into the space 113 will then flow through the gap 153 and into the end housing 106 for cooling and lubricating the packing gland assembly 124. The fluid will also flow along the shaft through the thrust ring groove 121 and the bearing groove 122 into the bell-shaped flow chamber 145 from where it is returned through ports 146 to the low pressure side of the impeller. Should a separate fluid flow be required for lubricating the bearing, owing to the nature of the fluid being pumped, the conduit 147 can be eliminated and the fitting 151 can be connected to an independent fluid supply.

Although two preferred embodiments of the invention have been described in considerable detail hereinabove, it will be understood that the description thereof is intended to be illustrative, rather than restrictive, as many details of the structures may be modified or changed without departing from the spirit or scope of the invention. Accordingly, I do not desire to be restricted to the exact construction disclosed.

I claim:

1. In a fluid pump including spaced apart circular walls connected at their outer perimeter to define an impeller chamber between them, an impeller arranged in said chamber, a shaft mounting said impeller, a bearing surface on the inside peripheral edge of each wall, concentric annular bearing surfaces on the impeller seated in said wall bearing surfaces, a bearing for said shaft outwardly of each side wall, a fluid chamber in which said shaft bearings are mounted, conduits in flow communication with the pressure side of the impeller chamber and said fluid chambers for conveying fluid under pressure from the impeller chamber while the impeller is operating to said fluid chambers for lubricating the bearings therein, and means for conducting said lubricating fluid from the shaft bearings into contact with the impeller bearings for

6

lubricating the same and then into the low pressure side of the impeller.

2. In a fluid pump including spaced apart peripherally connected circular walls defining an impeller chamber between them, an impeller arranged in said chamber, a shaft mounting said impeller, an annular surface on the inside peripheral edge of each wall concentric with the shaft, a wear ring mounted in each surface, concentric annular bearing surfaces on each side face of the impeller seated in said wear rings, a bearing for said shaft on each side of the impeller, a fluid chamber in which said shaft bearings are mounted, conduits in flow communication with the pressure side of the impeller chamber and said fluid chambers for conveying fluid under pressure from the impeller chamber while the impeller is operating to said fluid chambers for lubricating the bearings therein, and means for delivering said lubricating fluid from the shaft bearings into the low pressure side of the impeller, said returning fluid lubricating the impeller bearings.

References Cited in the file of this patent

UNITED STATES PATENTS

896,585	Salzer	Aug. 18, 1908
1,130,616	Lorenz	Mar. 2, 1915
1,334,461	Kerr	Mar. 23, 1920
1,667,992	Sherwood et al.	May 1, 1928
1,736,002	Frickey et al.	Nov. 19, 1929
1,805,765	Frederick	May 19, 1931
1,931,724	Pageol et al.	Oct. 24, 1933
2,301,063	McConaghy	Nov. 3, 1942
2,469,846	Roth et al.	May 10, 1949
2,604,257	Church et al.	July 22, 1952
2,632,395	Jennings et al.	Mar. 24, 1953
2,704,516	Mock et al.	Mar. 22, 1955
2,741,990	White	Apr. 17, 1956
2,875,697	Fernstrum	Mar. 3, 1959
2,921,533	Williams	Jan. 19, 1960
2,963,980	White	Dec. 13, 1960

FOREIGN PATENTS

137,828	Austria	June 11, 1934
140,587	Australia	Apr. 2, 1951
153,318	Great Britain	Nov. 2, 1920