

May 24, 1955

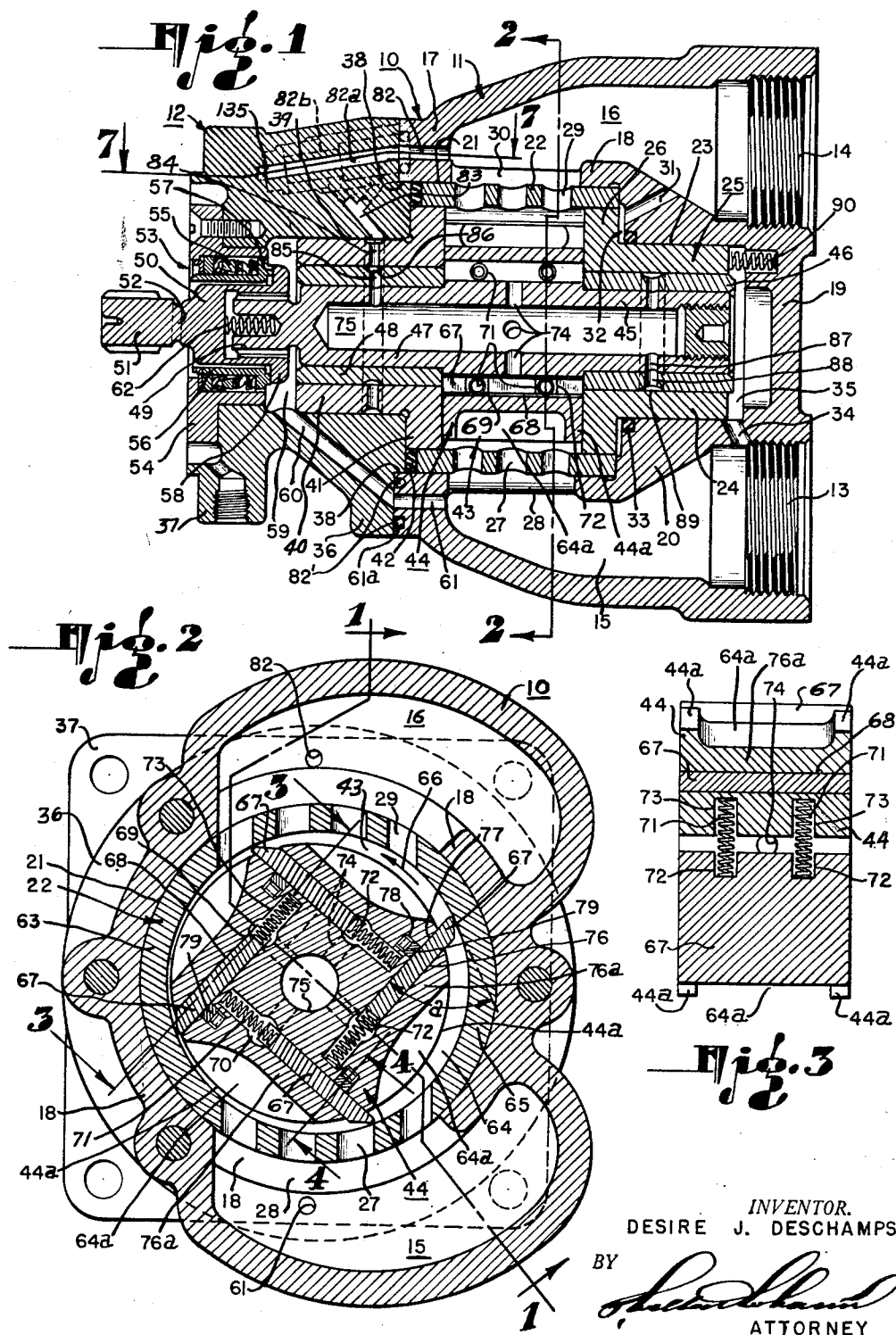
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2,708,884

HIGH SPEED AND PRESSURE VANE PUMP

Filed Dec. 12, 1949

3 Sheets-Sheet 1



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Fig. 5

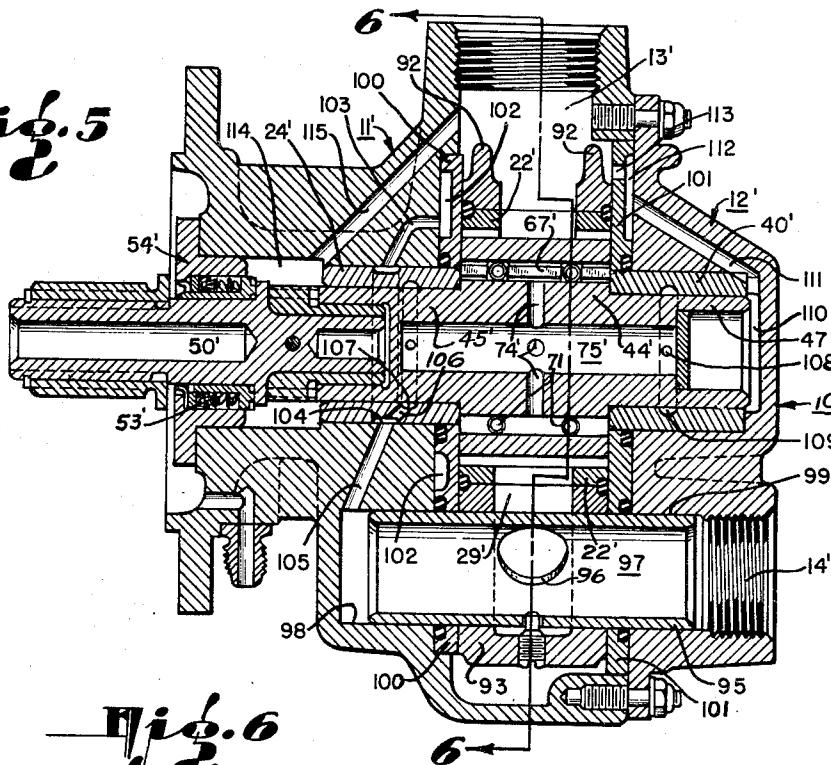


Fig. 6

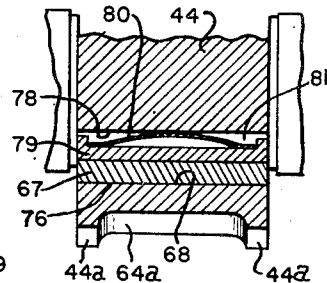
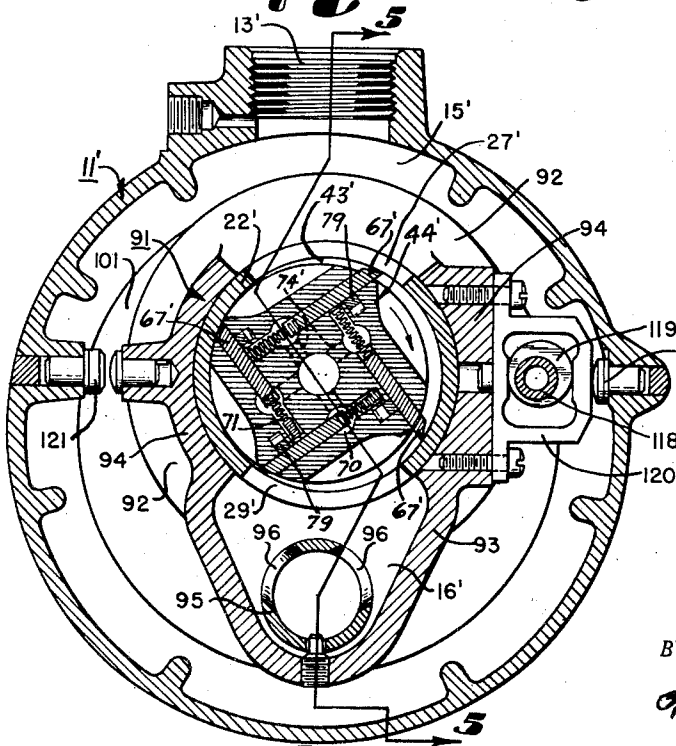


Fig. 4

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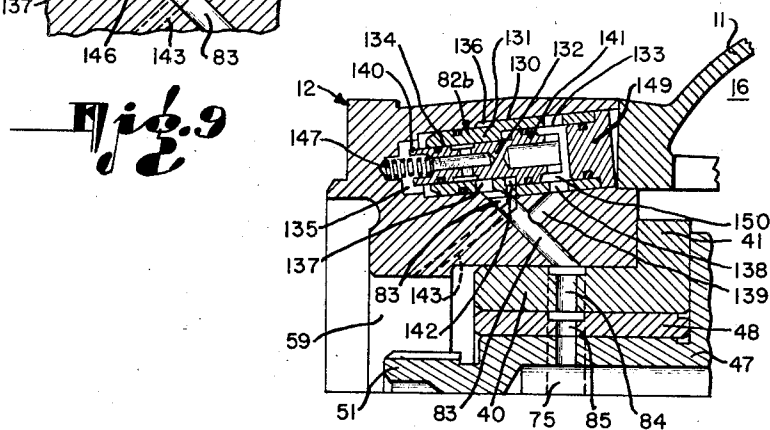
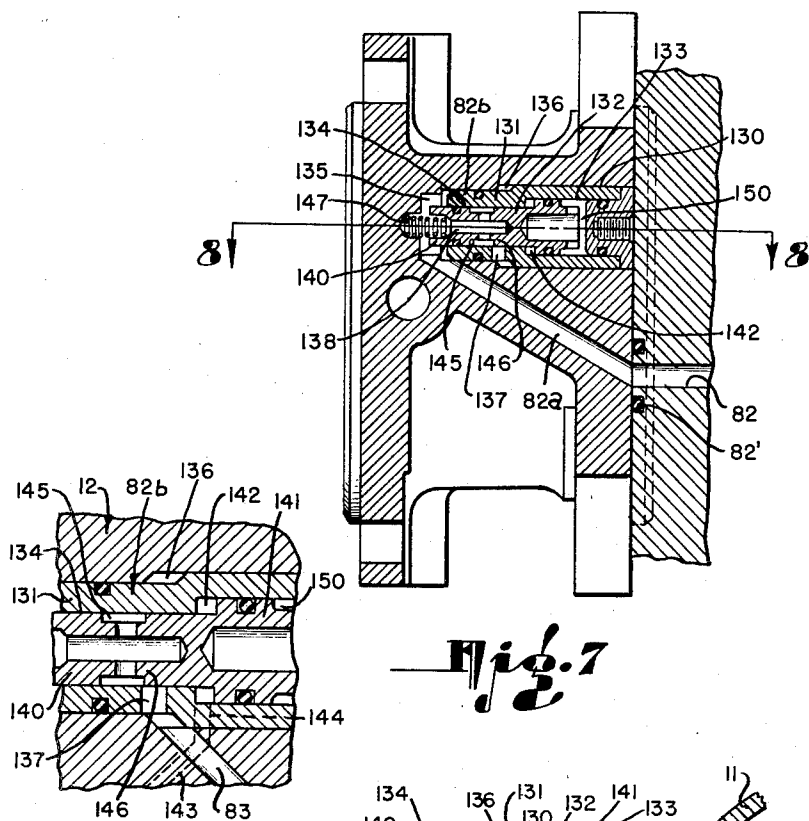
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HIGH SPEED AND PRESSURE VANE PUMP

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8 Claims. (Cl. 103—135)

This invention relates in general to rotary vane pumps and more particularly to high speed vane pumps especially adapted to supply fuel at high pressures to aircraft turbine engines.

It is an object of the invention to provide a vane pump capable of pumping fluids of low viscosity and of poor lubricating characteristics, which may be operated at high speeds and with comparatively high outlet pressures such as required for delivery of fuel to aircraft turbines and the like. Vane pumps, characterized by simplicity in design and manufacture, small size for a given output, high volumetric efficiency with smooth flow and ability to develop high suction so as to be easily primed, have been extensively adopted as a very satisfactory means for pumping lubricating oils, the so-called hydraulic fluids and the like, but these pumps have not been completely successful in pumping low viscosity fluids such as gasoline, for example, when operated at speeds above 2500 R. P. M. and with outlet pressures above 25 p. s. i.

It is an object of the invention to provide a simple and effective means for proper pressure lubrication of all of the pump bearings, the pumped fluid being employed as a lubricant.

It is a further object of the invention to provide a rotor for this vane pump having blades disposed at angles of application especially suited for high speed operation, this rotor being formed of cooperating parts which may be readily machined so as to support the blades in their selected positions and also to provide ample bearing area.

Another object of the invention is to provide a vane pump of the character described herein where internal leakage is limited to a minimum, thereby increasing the volumetric efficiency and suction. This minimized internal leakage gives the pump the ability to develop high fluid pressure at low speeds of rotor rotation when starting the engine which is supplied with fuel by the pump.

It is a further object of the invention to provide a vane pump having cooperating housing parts which are easy to assemble and to seal with relation to each other, thereby avoiding high pressure leakage through the joints existing between the cooperating housing parts. The normal practice in aircraft fuel pump design is to make the pump housing in two parts, held together by means of bolts, the top part, opposite to the drive end, carrying the ports for fuel inlet and outlet. Good high pressure sealing between the housing parts has been found difficult to attain and maintain, and the expedients adopted to overcome these difficulties include special gaskets or seals and rather intricate additional machining operations of the pump housing parts.

It is a further object of the invention to provide a rotary vane pump having pressure lubricated bearings and having its parts so arranged that the fluid inlet and outlet ports and passages are contained within a single casting which is joined with another part of the housing at an annular joint.

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A further object of the invention is to provide in this vane pump means for sealing the rotor blades, and a further object is to provide a rotor formed so as to contribute to high speed operation of rotors of small diameter, through the provision of spaces which will permit ready flow of liquid from the inlet passage of the pump into the pumping space between the rotor and the cylinder in which the rotor operates.

A further object of the invention is to incorporate the valuable features heretofore disclosed in a variable capacity pump which also has a novel arrangement of internal parts including a movable pump housing supported for adjustable springing movement on a tubular high pressure outlet member arranged within the shell and having the ends thereof communicating with the outlet part of the shell and with high pressure fluid passages within the shell for accomplishing lubrication and automatic end adjustment of cooperating parts.

A further object of the invention is to provide means for hydraulic loading of the vanes so as to hold the same against the inner surface of the pump housing sleeve; to provide hydraulic balance of the pressures against the ends of the rotor; to provide for automatic adjustment of cooperating end walls so as to take up end clearance between the rotor and the confronting walls of the housing; and to arrange the fluid passages within the pump, and the porting of the rotor, so as to facilitate the passage of fluid into the pump, the low velocity of the fluid passing through the pump increasing its volumetric efficiency and its ability to operate at high speeds.

Further objects and advantages of the invention will be brought out in the following part of the specification wherein I have described preferred embodiments of the invention for the purpose of giving a detailed disclosure, without limiting the scope of the invention set forth in the appended claims and without limitation on the rights to use of and coverage of mechanical equivalents.

Referring to the drawings, which are for illustrative purposes only:

Fig. 1 is a sectional view of a fixed displacement pump embodying my invention, taken as indicated by the line 1—1 of Fig. 2,

Fig. 2 is a cross-sectional view, to enlarged scale, taken as indicated by the line 2—2 of Fig. 1,

Fig. 3 is a slightly enlarged sectional view of a portion of the pump rotor, taken as indicated by the line 3—3 of Fig. 2,

Fig. 4 is a fragmentary sectional view taken as indicated by the line 4—4 of Fig. 2, and showing the blade sealing means carried by the rotor,

Fig. 5 is a longitudinal sectional view of a variable displacement pump embodying a modified form of my invention, taken as indicated by the line 5—5 of Fig. 6,

Fig. 6 is a cross-section view taken as indicated by the line 6—6 of Fig. 5,

Fig. 7 is an enlarged fragmentary section taken as indicated by the line 7—7 of Fig. 1,

Fig. 8 is a sectional view taken as indicated by the line 8—8 of Fig. 7,

Fig. 9 is an enlarged fragmentary sectional view of the slide valve parts of the pressure reducing valve shown in Figs. 7 and 8.

The pump as shown in Figs. 1 to 4 has a housing 10 comprising a housing body 11 and a housing cover 12. The housing body 11 comprises a hollow casting having at the outer end thereof a threaded inlet port 13 and a threaded discharge or outlet port 14, these ports 13 and 14 communicating respectively with inlet and outlet passages 15 and 16 which are formed entirely within the body 11. At the inner end of the body 11, the end opposite the

ports 13 and 14, the body 11 has a ring or annular wall 17 against which the housing cover 12 is bolted and which permits a simple and effective means for sealing the joint between the parts 11 and 12. A cylindrical wall 18 extends from the annular wall 17 toward the ported end of the housing, this cylindrical wall 18 being connected to the end wall 19 of the housing by a conoidal wall portion 20, adjacent which lie the ports 13 and 14 which both face away from the annular wall 17 and make possible installation of the pump in limited space in jet propelled aircraft. The annular wall 17 and the cylindrical wall 18 conjointly define a cylindrical bore or cavity 21 which receives a pump cylinder 22, and the conoidal wall portion has therein a counter-bore 23 forming a bearing recess which receives the cylindrical portion 24 of an axially movable bearing member or sleeve 25, which bearing member 25 has a flange or radial plate portion 26 which consists of an annular radially directed wall projecting within the rightward portion (Fig. 1) of the cylinder 22 and being axially slidable therein for purpose of adjustment, as will be hereinafter explained.

The cylinder 22 has inlet ports 27 which communicate with the inlet passage 15 through a port 28 in the cylindric wall 18, and discharge ports 29 which communicate with the outlet passage 16 through an outlet opening 30 in the upper portion of the cylindric wall 18. The inlet ports 27 and the discharge ports 29 are diametrically opposed. A high pressure passage 31 connects the outlet passage 16 with an annular space 32 existing between the outer radial face of the flange 26 and the radial wall of the conoidal wall 20, there being a sealing ring 33 disposed around the cylindrical part 24 of the bearing member 25 to prevent escape of fluid from the space 32 through the counterbore 23. A low pressure passage 34 connects the space 35 at the end of the counter-bore 23 with the inlet passage 15.

The housing cover 12 is of generally cylindrical form and at its rightward end, Fig. 1, has an annular flange 36 adapted to be bolted against the annular wall 17 of the housing body 11. At the leftward end (Fig. 1) of the housing cover 12 there is a square flange 37 for bolting the pump onto the casing of a drive gear. The member 12 has an annular shoulder 38 to engage a small portion of the bore 21 and to thereby center the cover 12 with relation to the bore 21. In the cover 12, there is an axial opening 39 forming a bearing recess into which a sleeve bearing 40 is pressed. This sleeve bearing 40 has a flange 41 which projects into the leftward end (Fig. 1) of the cylinder 22. A ring seal 42 is disposed between the leftward end of the cylinder 22 and the adjacent wall of the housing cover 12.

The cylinder 22 and the flanges 26 and 41 define a cylindrical chamber 43 which receives a pump rotor 44 of diameter smaller than the internal diameter of the cylinder 22, as shown in Fig. 2. The rotor 44 has, at one end thereof, a projecting shaft member 45 carrying a bearing sleeve 46 which operates in the bearing member 25. A shaft member 47 projects from the other end of the rotor 44 and has thereon a bearing sleeve 48 which operates in the bearing 40 carried by the housing cover 12. An externally splined stub 49 projects leftwardly from the shaft 47 and is engaged by an internally splined drive coupling 50 which is also externally splined at its outer end 51 to engage with a driving means, not shown. The drive coupling 50 is provided with a portion 52 of reduced diameter to provide a shearing section weakened so that it will shear off if the driving torque transmitted through the coupling 50 becomes too great. A low pressure seal 53 is provided between the drive coupling 50 and the opening 39 of the housing cover 12. This seal 53 comprises a retainer 54 of annular form which fits into the end of the housing cover 12, sealing elements 55 carried within the retainer 54 and a sleeve 56 supported within the retainer 54 by the sealing elements 55 in a position to surround the body of the drive connection 50

and having at its inner end an annular surface 57 to engage the confronting surface of a flange 58 formed on the inner end of the drive coupling 50. Within the opening 39 between the bearing 40 and the sealing means 53 there is a chamber 59 which communicates with the inlet passage 15 of the housing body 11 through passage 60 in the housing cover 12 and passage 61 in the annular wall 17 of the housing body 11. A compression spring 62 operates between the leftward end (Fig. 1) of the shaft 47 and the drive coupling 50 to move the drive coupling 50 so that its flange 58 will engage the surface 57 and the sleeve 56.

The rotor 44 is supported by the bearings 25 and 40 on an axis of rotation which is laterally offset from the axis of the cylinder 22, to an extent to bring the cylindrical surface of the rotor 44 substantially into engagement with, or close to, the arcuate portion 63, Fig. 2, of the cylinder 22, leaving a pumping space 64 between the rotor 44 and the arcuate wall 65 of the cylinder 22. The rotor 44 rotates in the counter-clockwise direction indicated by the arrow 66, and carries vanes 67 which move fluid through the pumping space 64 from the inlet ports 27 to the outlet ports 29 of the cylinder 22. The vanes 67 are disposed so as to lie in planes which are tangential to an imaginary cylindrical surface having a diameter substantially one-half the internal diameter of the cylinder 22, such a plane being indicated by the line 3—3 of Fig. 2. In this way the vanes 67 are given angles of approach α of less than 90° relative to the inner surface of the cylinder 22, whereby the friction of the vanes 67 against the cylinder 22 is reduced, and better sealing between the ends of the vanes 67 and the cylinder 22 is accomplished. Long vanes 67 may be employed and the slots 68 in which they are carried in the rotor 44 may be readily machined, for the reason that the leading surfaces 69 of the slots 68 lie outside the imaginary cylinder defined by the surfaces of the shafts 45 and 47. Therefore, the slots 68 may be milled lengthwise of the rotor without the milling cutter being brought within the imaginary cylinder defined by the outer surfaces of the shafts 45 and 47. The leading surfaces 69 of the slots 68 are enlarged, this being accomplished by the drilling of longitudinal holes 70 in the rotor in positions longitudinally aligned with the slots 68 and parallel to the axis of the rotor 44, the slots 68 being then cut so that they intersect these holes 70.

Springs 71 are disposed behind the vanes 67 to urge them outwardly. As best shown in Fig. 3, the ends of the springs 71 extend into notches 72 cut in the inner ends of the vanes 67 and into blind holes 73 drilled in the rotor so as to continue inwardly from the bottoms of the slots 68. Radial openings 74 connect the slots 68 with a chamber 75 in the rotor 44 and the shafts 45 and 47. After machine work on the rotor 44 and its shafts 45 and 47 is completed, the shaft enlargements formed by the bearing sleeves 46 and 48 are pressed onto the shafts 45 and 47, the effective bearing surfaces of the shafts 45 and 47 being then the circumferential surfaces of the bearing sleeves 46 and 48.

When the rotor 44 is in rotation as indicated by arrow 66, the reaction of fluid against the vanes 67 forces them against the back or trailing wall surfaces 76 of the slots 68, thereby producing a good fluid seal between the vanes, at the trailing wall surfaces of the slots. I provide sealing means between the outer portions 77 of the leading surface of each slot 68 and the associated vane 67 to minimize leakage along the surfaces of the vanes, such sealing means being effected by providing in the leading surfaces of the slots channels 78 of rectangular cross-section and which extend from one radial face to the other radial face of the rotor, near the outer ends of the slots 68. In each of these channels 78, there is a sealing member 79 in the form of a bar of a width corresponding to the width of the slot 78 which it occupies. Each sealing member 79, as shown in Fig. 4, is provided

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with a leaf spring 80 disposed in a shallow recess 81 in the sealing member and bearing against the bottom wall of the slots 78 so as to urge the sealing member 79 into engagement with the surface of the contiguous vane 67.

The chamber 75 within the rotor 44, and its shafts 45 and 47, are connected to the high pressure space or outlet passage 16 of the pump through a passage 82 in the annular wall 17 of the housing body 11, a passage 82a, a pressure reducing valve 82b, and a passage 83 in the housing cover 12 and passages 84 and 85 in the parts 40, 48 and 47, as shown in Fig. 1. As shown in Figs. 7 and 8, the pressure reducing valve 82b is disposed in a stepped bore 130 forming a cavity entering the cover 12 from the radial face of the flange 36 which confronts the annular wall 17 of the body 11. The pressure reducing valve 82b comprises a barrel 131 and a plunger 132. The barrel 131 has a relatively large front bore 133 aligned with the relatively smaller rear bore 134. The smaller bore 134 communicates with a space 135 at the rearward end of the barrel 131, to which space 135 the passage 82a connects as shown in Fig. 7, thereby delivering high pressure fluid from the outlet passage 16 so that it will be applied to the small end of the plunger or valve piston 132. The exterior of the barrel 131 is stepped in cooperation with the bore 130 so as to provide an annular space 136 which communicates with the upper end of the passage 83. As shown in Fig. 8, a valve port 137 in the wall of the barrel 131, connects the annular space 136 with the smaller bore 134 of the barrel 131. An opening 138 in the wall of the barrel 131 communicates with the larger bore 133, and a branch passage 139 in the cover 12 connects the opening 138 with the passage 83, for a purpose which will be hereinafter explained.

The plunger 132 includes a small piston 140 which slides in the smaller bore 134, and a large piston portion 141 which slides in the larger bore 133 of the barrel 131, there being an annular space 142 within the barrel 131 and at the end of the large piston 121, this annular space 142 communicating with the low pressure space 59 through a passage 143 in the cover 12 and an opening 144 in the wall of the barrel 131. Arranged within the smaller bore 134 and in cooperative relation to the port 137, is an annular channel 145 on the small piston 140. This channel 145 is defined in part by a shoulder 146 which functions as a closure for the port 137 when the piston 140 is moved to the left (Fig. 1) against the action of a spring 147 disposed in the space 135 and bearing against the smaller end of the plunger 132. The channel 145 communicates with the high pressure space 135 through an opening 138 in the piston 140. A plug 149 closes the end of the barrel 131 and defines therein a pressure chamber 150 at the outer end of the large piston 141 of the plunger 132.

High pressure fluid entering the space 135 from the outlet passage 16 of the pump is applied to the end of the piston 140, and urges the piston in the same direction as the pressure exerted by the spring 147, moving the shoulder 146 so as to open the port 137 and allow high pressure fluid to flow into the passage 83 and to the spaces in the pump with which the passage 83 communicates. Pressure in the passage 83 is transmitted through the branch passage 139 and the opening 138 to the chamber 150, to act on the plunger 132 in opposition to the pressure which fluid in the space 135 exerts against the small end of the plunger 132. When the pressure in the passage 83 builds up to such value that the force in the chamber 150, exerted against the large end of the plunger 132, exceeds the force exerted by fluid pressure against the small end of the plunger 132, the plunger 132 will be moved against the force of the spring 147, moving the shoulder or closure 146 so as to reduce the extent of opening of the valve port 137. In the specific valve structure disclosed in the drawings, the area of the large piston 141 is twice the area of the small piston 140,

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and with the pump operating against a pressure of 600 p. s. i. the pressure reducing valve 82b will maintain in the passage 83 and against the inner ends of the vanes 67 a pressure substantially 306 p. s. i. When the pump is employed against a lower head pressure, the proportions of the pressure reducing valve 82b are changed or the valve 82b is eliminated and the passage 82 is connected directly to the passage 83, as conditions may require.

In the face of the annular wall 17, as shown in Fig. 1, confronting the flange 36, there are annular channels 61a surrounding the outer ends of the passages 61 and 82, to hold sealing rings 82' in sealing relation to the radial face of the flange 36. An annular channel 86 in the outer face of the bearing sleeve 48 communicates with the passages 84 and 85 and fluid under pressure therefrom passes into the bearing space between the bearing members 40 and 48, leakage from this bearing space passing into the annular chamber 59 and being conducted through the passages 60 and 61 to the low pressure inlet space or passage 15 of the pump. Passages 87 and 88 in the members 25 and 46 connect the chamber 75 with an annular channel 89 in the outer surface of the bearing 46, so that liquid under high pressure will be conveyed into the bearing space between the bearing members 24 and 46. The leakage from this bearing space passes into the space 35 and is conducted through passage 34 into the inlet passage 15. Likewise, liquid under high pressure, or under the pressure existing in the outlet passage 16, passes through the ducts 74 into the inner ends of the slots 68, wherein this liquid acts outwardly against the inner ends of the vanes 67 to urge them outwardly. Springs 90 are disposed between the rightward end (Fig. 1) of the bearing member 25 and the end wall 19, to initially urge the bearing member leftward when the pump is idle and during the initial starting of the pump. As pressure builds up in the outlet passage 16, the pressure against the rightward face of the flange 26 correspondingly increases and the leftward face of the bearing member 25 is brought into engagement with the rightward face of the rotor 44 under fluid control pressure. Likewise, the rotor 44 is shifted leftward so that its leftward end face will engage the rightward face of the bearing member 40 with the same fluid pressure.

Without disturbing the circular form of the end faces of the rotor 44 which have bearing and sealing engagement with flanges 26 and 41, means are provided for increasing the freedom of flow of liquid from the inlet passage 15 into the pumping space 64 as the approaching blade or vane 67 nears the inlet end of the pumping space 64. For this purpose, depressions or recesses 64a, four in number, are formed in the circumferential wall of the rotor 44 between the outer ends of the vane slots 68 and with the lateral margins thereof spaced from the end faces of the rotor 44 so as to leave walls 44a (Fig. 3) at the extremes of the depressions 64a. These walls 44a also have the function of reinforcing ribs for the wall portions 76a of the rotor 44 lying outwardly of the slots 68 and defining the back wall surfaces 76 of the slots 68.

In the form of the invention shown in Figs. 5 and 6, I employ parts which are substantially the same as those described with relation to Figs. 1 to 4 inclusive. Such parts are indicated by the same numerals as previously employed with prime marks supplied. This pump has a housing body 11' and a housing cover 12', with an inlet port 13' in the upper part of the body 11' and an outlet port 14' in the lower portion of the cover 12'. Sleeve bearings 24' and 40' are carried respectively in the body 11' and cover 12' to receive shafts 45' and 47' which project from a rotor 44'. This rotor 44' carries vanes 67'.

In this alternative form of the invention there is a cylinder 22', but it is not supported directly by the housing body 11', but is carried by an adjustable member 91 comprising a pair of rings 92, disposed in spaced relation

and merging with a hollow yoke 93 embracing arcuate walls 94 which engage opposite sides of the cylinder 22'. The cylinder 22' has inlet port means 27' communicating with the internal space 15' of the body 11', which in turn communicates with the inlet port 13'. The outlet port means 29', in the lower part of the cylinder 22', communicates with the discharge space or passage 16' formed within the hollow yoke 93. This space 16' communicates with the interior of a tube 95 through openings 96 in such tube, and the lumen 97 of the tube 95 communicates with the outlet port 14' of the housing cover 12', as shown in Fig. 5. The tube 95 forms hollow trunnions for the adjustable member 91 which project respectively into axially aligned openings 98 and 99 in the members 11' and 12'.

Circular plates 100 and 101 are disposed within the housing of the pump on opposite sides of the inner adjustable casing member 91 and one of these plates is adjusted into operative position by fluid pressure. In this form of the invention, the plate 100 has therein a chamber 102 which receives liquid at pump outlet pressure through a duct 103, in the housing body 11', which is connected to the opening 98 through an annular chamber or channel 104 on the outer surface of the bearing member 24' and a duct 105. Fluid pressure acting against the leftward face of the plate 100 urges the plate rightwardly into operative relation to the leftward face of the rotor 44', and shifts the rotor 44' and the adjustable member 91 rightward into operative position against the plate 101. A duct 106 in the bearing member 24' connects the channel 104 with an internal channel 107 which is in turn connected to the chamber 75' of the rotor 44' and its shafts. This internal chamber 75' is connected through radial openings 74' to the spaces at the inner ends of the vanes 67' and radial opening 108 in the shaft member 47' connects the chamber 75' with an annular channel 109 in the internal space of the bearing member 40'. Liquid under pressure, accordingly, is conducted into the channels 107 and 109 from which the liquid is fed into the bearing spaces. Leakage from the bearing 40' passes into the space 110, from whence it is conducted to the low pressure inlet chamber 15' by a duct 111 in the housing cover 12' and ducts 112 and 113 in the plate 101. Leakage of fluid from the bearing 24' passes into a chamber 114 formed within the housing body 11' adjacent the leftward end of the bearing 24', and a diagonal duct 115 carries this leakage into the inlet port 13'. The pump is provided with a drive coupling 50' which passes through a low pressure sealing device 53' carried by the housing body 11'.

The adjustable inner housing member 91 may be swung on the axis of the tube 95 so as to move the cylinder 22' from a position concentric to the rotor 24' through various positions of eccentricity within the range of movement provided for the cylinder 22'. For adjusting the member 91 a shaft 118 is extended into the pump housing through the cover member 12'. On the shaft 118 there is an eccentric 119 which engages opposite sides of a frame 120 which is secured to the member 91. Stops 121 and 122 are provided in the housing 11' to limit the adjusting movement of the member 91 by the cam 119.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

I claim:

1. In a rotary pump: a housing body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, inlet and outlet passages communicating with different circumferentially spaced parts of said cavity; a housing cover secured to said annular wall of said body to cover said cavity, said housing cover having a bearing recess therein; a rotor in said cavity to move fluid from said inlet

passage to said outlet passage, said rotor having closed end shaft members extending therefrom into said bearing recesses of said body and said cover; a cylinder in said cavity, having peripheral side wall openings therein communicating with said inlet and outlet passages; first and second sleeves respectively in said bearing recesses having flanges forming plates extending out within and closing the ends of said cylinder; walls forming a passage in said body to deliver fluid under pressure to the outer face of one of said plates to force the same against the contiguous face of said rotor; walls forming balancing chambers at the ends of said shaft members; and means for connecting said chambers with a common source of fluid pressure so that the pressures acting against the ends of said shaft members will be substantially balanced.

2. In a rotary pump: a housing body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, inlet and outlet passages communicating with different circumferentially spaced parts of said cavity; a housing cover secured to said annular wall of said body to cover said cavity, said housing cover having a bearing recess therein; a rotor in said cavity to move fluid from said inlet passage to said outlet passage, said rotor having shaft members extending therefrom into said bearing recesses of said body and said cover; a cylinder in said cavity, having therein peripheral side wall openings communicating with said inlet and outlet passages; first and second sleeves respectively in said bearing recesses having flanges forming plates extending out within and closing the ends of said cylinder; walls forming a passage in said body to deliver fluid under pressure to the outer face of one of said plates to force the same against the contiguous face of said rotor; and walls in said body forming a passage to apply the fluid pressure of said inlet passage to the end faces of the sleeves.

3. In a rotary pump: a housing comprising a body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, inlet and outlet passages communicating with different circumferentially spaced parts of said cavity, and a housing cover secured to said annular wall of said body to cover said cavity, said housing cover having a bearing recess therein; a rotor in said cavity to move fluid from said inlet passage to said outlet passage, said rotor having shaft members extending therefrom into said bearing recesses of said body and said cover, there being passage means, including an axial passage, in said rotor communicating with the exteriors of said shaft members; walls forming a passage arranged to deliver fluid under pressure from said outlet passage to said passage means in said rotor; walls forming fluid receiving spaces contiguous the ends of said shaft members; and wall means forming passages connecting said fluid receiving spaces with said inlet passage.

4. In a rotary pump: a housing body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, inlet and outlet passages communicating with different circumferentially spaced parts of said cavity; a housing cover secured to said annular wall of said body to cover said cavity, said housing cover having a bearing recess therein; a rotor in said cavity having slots disposed in planes which are radially spaced from and substantially parallel to the axis of rotation of said rotor, and extend from end to end of said rotor, each slot being substantially perpendicular to the slot next adjacent thereto circumferentially of the rotor, channels in the front walls of and spaced from the outer ends of said slots, and vanes slidable in said slots adapted to move fluid from said inlet passage in said outlet passage, said rotor having shaft members extending therefrom into said bearing recesses of said body and said cover; and sealing means in said channels comprising bars resting in said channels and means to

urge said bars against the adjacent faces of the vanes disposed in said slots.

5. In a rotary pump: a housing having therein a pump cavity with an annular wall at one end thereof, axially aligned and spaced bearing recesses extending from the opposite portions of said cavity, and inlet and outlet passages communicating with said cavity; a rotor in said cavity having slots disposed in planes which are radially spaced from and substantially parallel to the axis of rotation of said rotor, and extend from end to end of said rotor, each slot being substantially perpendicular to the slot next adjacent thereto circumferentially of the rotor, channels in the leading surfaces of and spaced from the outer ends of said slots, and vanes slidable in said slots adapted to move fluid from said inlet passage in said outlet passage, said rotor having shaft members extending therefrom into said bearing recesses; and sealing means in said channels comprising bars resting in said channels and means to urge said bars against the adjacent faces of the vanes disposed in said slots.

6. In a rotary pump: a housing comprising a body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, inlet and outlet passages communicating with different circumferentially spaced parts of said cavity, and a housing cover secured to said annular wall of said body to cover said cavity, said housing cover having a bearing recess therein; a rotor in said cavity to move fluid from said inlet passage to said outlet passage, said rotor having shaft members extending therefrom into said bearing recesses of said body and said cover, there being spaced radial passage means in said rotor communicating with the exteriors of said shaft members and interconnected by axial passage means in said rotor; walls forming a ducting arranged to deliver fluid under pressure from said outlet passage to one of said radial passage means in said rotor; and pressure reducing valve means connected to said ducting and being adapted to reduce the pressure of the fluid delivered from said outlet passage to said passage means in said rotor.

7. In a rotary pump: a housing body having a cylindrical cavity with an annular wall at one end thereof, a bearing recess in the opposite wall thereof, and inlet and outlet passages communicating with circumferentially spaced parts of the cavity; a cover secured to said annular wall to close said cavity, and having a bearing recess therein; a rotor having bearing support in said recesses and rotatable in said cavity to pump fluid from said inlet passage to said outlet passage, said rotor having a sealing fluid passage therein; passage means formed through said annular wall, said cover, and said rotor eccentrically of said cavity, and interconnecting said outlet passage and said sealing fluid passage in said rotor; a pair of annular channels in the outer face of said annular wall respectively radially inwardly and radially out-

wardly of said passage means and substantially concentric with said cavity; annular sealing rings disposed in said annular channels in engagement with said cover; and passage means in said rotor connecting said sealing fluid passage to said bearing recesses.

8. In a rotary pump: housing means having fluid inlet and outlet passages; a ported pump cylinder in said housing means in communication with said passages; a substantially cylindrical rotor within said cylinder and having vane receiving slots formed therein in planes radially spaced from and substantially parallel to the axis of rotation of the rotor, the slots extending throughout the axial length of the rotor and each slot being substantially perpendicular to the slot next adjacent thereto circumferentially of the rotor; vanes slidably mounted in said slots to move fluid from the inlet to the outlet passage during rotation of the rotor; sealing means closing the axially spaced ends of each slot; an axial passage in said rotor in communication with the inner end of each slot; and means connecting said axial passage to said outlet passage to apply fluid pressure to the inner ends of said vanes.

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