A. P. BEIJER.

PUMP.

APPLICATION FILED FEB. 13, 1918. RENEWED MAY 7, 1920.

1,358,504. Patented Nov. 9, 1920.

Fig. 1.

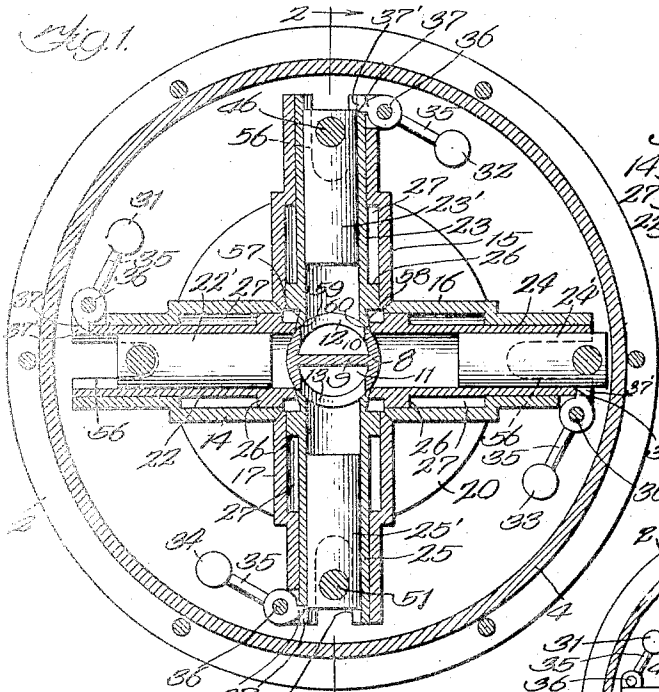


Fig. 3.

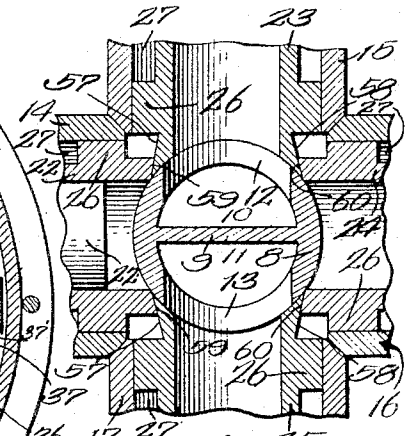


Fig. 4.

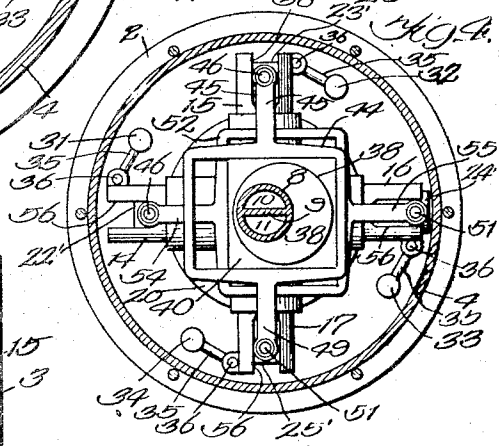


Fig. 2.

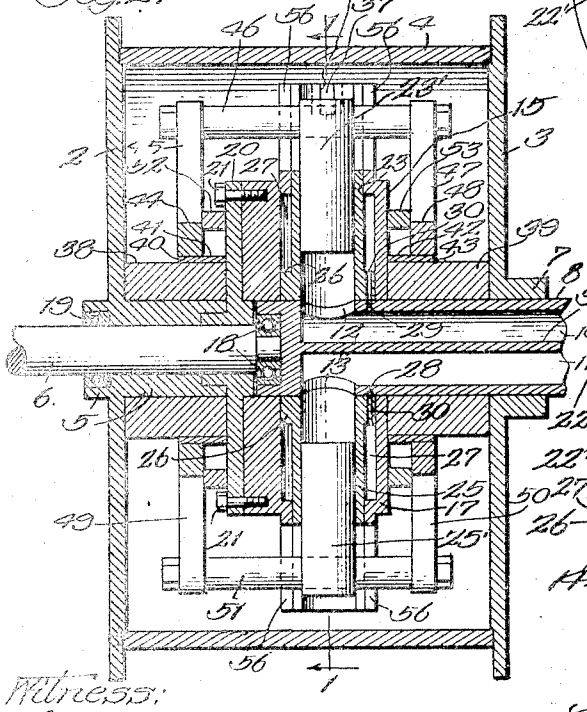
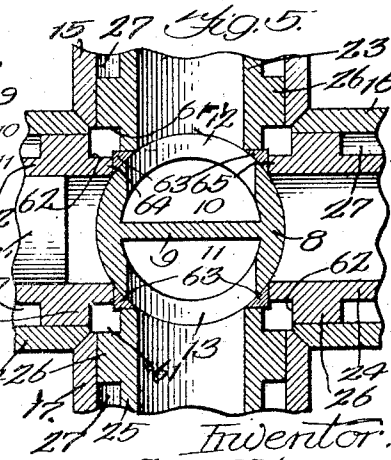


Fig. 5.



Witness:

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UNITED STATES PATENT OFFICE.

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PUMP.

1,358,504. Specification of Letters Patent. Patented Nov. 9, 1920.

Application filed February 13, 1918, Serial No. 216,920. Renewed May 7, 1920. Serial No. 379,687.

To all whom it may concern:

Be it known that I, ANDREW P. BEIJER, a subject of the King of Sweden, residing at Stevens Point, in the county of Portage and State of Wisconsin, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

My invention relates to machines for force-feeding fluids, or to be actuated by fluid under pressure, and has particular reference to improvements in rotary pumps.

The objects of the present invention are to provide improvements in radially disposed driving or driven cylinders and port or valve connections therefor and to reduce the cost of construction and complexities of arrangement between cylinders and their valve or valves; to insure fluid-tight connections, and to take up wear in an economical manner.

With these general objects in view my invention consists in the novel construction, combination and arrangement of parts, all as hereinafter described in detail, illustrated in the accompanying drawing, and more particularly pointed out in the appended claims.

In the drawing—

Figure 1 is a section taken substantially on the line 1—1 in Fig. 2.

Fig. 2 is a section taken substantially on the line 2—2, Fig. 1.

Fig. 3 is an enlarged view of the valve portion of Fig. 1 broken away.

Fig. 4 is a side elevation on a reduced scale and partly in section showing the piston-actuating mechanism.

Fig. 5 is a modification of the means for effecting a fluid-tight connection between cylinders and the valve-pipe axis therefor, particularly adapted to permit variation in the number of cylinders employed.

In my present improvement the piston cylinders converge upon a relatively rotatable valve pipe diametrically divided by an interior wall to form an inlet passage on one side and an outlet passage on the other. Side openings in the valve pipe place these passages in communication with the interiors of the piston cylinders, the convergent ends of which are open, to admit or exhaust the motive fluid, when either the cylinders are rotated about the valve pipe, or the latter is rotated between the cylinders. In the present embodiment the valve pipe is held stationary and the cylinders caused to rotate upon and about it. Means are provided for holding the bearing, or inner, ends of the piston cylinders closely against their valve pipe bearing-axis, for automatic readjustment relative to each other of said cylinders, and for taking up wear. The rotary movement of the pistons is caused to transmit reciprocating movements to their pistons by eccentric connections with the valve-pipe cylinder-axis.

Referring in detail to the several views, 2 and 3 are the side-plates of a drum-shaped, or cylindrical, casing for the battery of rotating cylinders and their individual casings or supports. The circular side of this casing is indicated by the numeral 4. On the side-plate 2 is a bearing hub 5 which serves as a bearing for a rotary shaft 6. On the side 3 is a substantially similar hub 7 in which is, in the present arrangement, held stationary a valve pipe 8, the interior space of which is divided longitudinally by a diametrical wall 9 on the opposite sides of which are inlet and outlet passages 10 and 11 with side openings 12 and 13 arranged in the cylinder's plane of rotation. A series of cylinder casings or supports 14, 15, 16 and 17 are rigidly connected with the shaft 6 which is preferably provided with ball-bearings 18 and 19. In the present showing, which may be modified in numerous ways, the cylindrical cylinder casings 14—17 are shown mounted on a single disk 20 with the aid of screws 21 or other suitable means, the disk 20 being keyed to the shaft 6. Within the casing cylinders are mounted for adjustable movement piston cylinders 22, 23, 24, and 25 each of which is enlarged at its inner end to provide a shoulder, or abutment, 26 against which a force may be applied to hold the piston cylinders closely seated on the bearing 8. For the enlarged portions of the piston cylinders the casing cylinders are enlarged or counterbored to provide pressure chambers or spaces 27. The latter are held open to the pressure side or passage of the valve-pipe 8 through a peripheral groove 28 on said pipe from which leads one or more radial bores 29 through the wall of the pipe 8, and a bore 30 through the enlarged portion of each piston cylinder, as shown. The inward pressure thus, or otherwise, brought to

bear upon the piston cylinders tends to hold their bearing-ends closely against the valve and bearing pipe 8. Other means to the same end are also shown in the form of weights 31, 32, 33, and 34, each of which is mounted on a stem 35, pivoted at 36 on its casing cylinder. Each of said stems is caused to act as a lever operated by centrifugal force, and to this end has a toe, short projection, or lug, 37 which bears against the outer end of the piston cylinder and for which a notch or recess 37′ is cut in the casing cylinder, or piston-cylinder support.

Within the piston-cylinders are cylindrical pistons 22′, 23′, 24′ and 25′ which are operated by eccentric bearing connections with the bearings for the cylinders, or their equivalent supporting means, 14—17 as follows: Each pair of oppositely disposed pistons is connected by a yoke consisting of a rectangular frame from which an arm extends to each piston and upon which the piston is mounted. The frame of each yoke slides upon a bearing block or disk of rectangular form that rotates upon an axis that is eccentric to the axis 8, and consists of a pair of eccentric rotary bearing bushings 38 and 39. The former is mounted on the bearing hub 5 and the latter is similarly mounted on the valve and bearing pipe 8. On the eccentric bushing 38 is rotatably mounted a rectangular bearing block 40 with a periphery 41 that is engaged for relative sliding movement by yoke-frames 44 and 52 at one side of the four piston cylinders shown. On the opposite side and on the eccentric bushing 39 is a similar slide-bearing block or rectangular disk 43 with a periphery 42 that is engaged by yokes 48 and 53 that are identical in construction and arrangement with the yoke-frames 44 and 52 a side view of which is shown in Fig. 4. From the yoke-frame 44 arms 45 and 49 extend as far as the outer ends of the cylinders 23′ and 25′, respectively, and similar arms 47 and 50 extend from the yoke-frame 48. The arms 45 and 47 are connected by a cross-bar or rod 46, movable in a casing cut-out 56, on which the cylinder 23′ is hung by passing said bar or rod through the cylinder as shown. The cylinder 25′ is similarly mounted on a cross-bar or rod 51 between the arms 49 and 50. The same yoke arrangement is provided for the cylinders 22′ and 24′, Fig. 4 showing similar arms 54 and 55 and cylinder rods 46 and 51, the arms 54 on the yoke frame 53 being similar to the same arms on the yoke frame 52 shown in side elevation in Fig. 4.

A fluid-tight connection or bearing between the bearing, or inner, ends of the piston cylinders and their axial bearing-pipe 8 is effected by fitting the bearing-end of the cylinder to the curvature of the pipe 8 in the manner shown on enlarged scales in Figs. 3 and 5. In Figs. 1 to 4, inclusive, the peripheries of the inner ends of the piston-cylinders 23 and 25 are cut-away or grooved V-shape to provide inclined or beveled surfaces 57, represented by the numeral 57 at one side and the numeral 58 at the opposite side in Figs. 1 and 3. The piston-cylinders 22 and 24 are somewhat similarly channeled or rabbeted, but their ends 59 and 60 are beveled in alinement with and partly engage the bevels 57 and 58 and the periphery of the bearing and valve pipe 8 to effect a fluid-tight juncture between the cylinder-ends as well as with the bearing pipe 8. Thus, as shown in Figs. 1 and 3, the cylinders 23 and 25 are free to move adjustably toward each other to take up wear and the cylinders 22 and 24 are always held closed against the surfaces 57 and 58 of their companion cylinders.

In Fig. 5 is shown a modification wherein cut-outs 61 are made to permit the inner ends of the cylinders to move toward their axis, but the ends of the cylinders are left "square" and do not bear against each other or against the bearing pipe 8. Instead of the interfitting cylinder-ends I provide bearing bars 63 which are substantially triangular in cross-section and form in each instance a right angle triangle. Against the sides of the right-angle the inner ends of the cylinders bear, as shown, and the remaining side of the bearing-bar, in each instance bears against the pipe 8 and is curved in conformity therewith in the same manner as the ends of cylinders in Figs. 1 and 3. In this modified form no sliding contact takes place between the cylinders and their axial pipe 8, worn out bearing bars 63 may be readily replaced, and the number of cylinders employed may be more readily varied.

For the purpose of providing the pressure spaces 26 the supports for the piston-cylinders are in the form of outer or relatively stationary cylinders, but it will be clear from the foregoing description that these piston-cylinder supports and the means for holding the piston-cylinders closely seated may be varied in numerous ways without departing from the spirit of my invention.

In operation, when the shaft 6 is rotated fluid will be drawn or sucked in through one of the ports 12 and 13 when the end of a cylinder is opposite that port and be expelled or forced out through the opposite port when the cylinder is opposite that port, the circumference of the pipe 8 relative to the degree of eccentricity of the eccentrics 38 and 39, or throw of the yokes and pistons thereon, being arranged to place the piston in each instance in communication with the inlet port at the moment that its outward movement begins, and to place it in communication with the outlet port when the

inward or expelling movement of the piston begins.

As to the movement imparted to each pair of pistons, and referring to Fig. 4 where this is best illustrated, when the block or disk 40, upon which the yokes 44 and 52 are permitted to move at right angles to the movement of their respective pairs of cylinders, is rotated about the eccentric axis 38 it will move the yoke 52 horizontally and with it the pistons 22′ and 24′. At the same time it will impart vertical movement to the yoke and yoke-frame 44 and its pistons 23′ and 25′. The rectangle of the yoke-frame 44 is elongated horizontally while the frame 52 is elongated to like extent vertically, the narrower dimension of each yoke being substantially the width of the eccentric slide block or disk between the sides of the yoke. Hence there is substantially no relative movement between the eccentric block or disk and the yoke in the direction of its arms, while the longer dimension of the yoke frame which is at right angles to said arms permits said frame to move self-adjustably to the eccentric movement and to slide to and fro upon the block to the extent of the throw of the eccentric.

In the foregoing construction I obviate extensive and more or less involved inlet and outlet passages and ports and valve-operating mechanisms therefor. Each pair of yoked together pistons and their yokes form substantially a single member without parts liable to breakage or becoming loose, or the adjustment and repair of which require mechanical skill.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a series of radially arranged cylinders having valve-openings therein, of a valve tube with inlet and outlet ports about which said cylinders rotate, and bearing-parts between said cylinders and valve tube for taking up wear and maintaining fluid-tight connections between said cylinders and valve tube.

2. The combination of a pair of concentric shafts, one rotatable relative to the other, and one thereof having inlet and outlet passages therein, with a casing cylinder rotatable relative to the last mentioned shaft and having an opening thereinto to be brought into communication with said passages, a piston cylinder, a piston, a rotary bearing support for said piston mounted eccentrically to said shafts, and a pressure chamber between said casing and piston cylinders.

3. The combination with a cylinder-supporting shaft, of cylinder casings fixedly connected with said shaft, cylinders adjustably movable within said casings, a hollow shaft having valve ports therein relative and on which said sleeves are rotatable, pistons in said cylinders, and means for imparting reciprocating movement to said pistons by the relative rotation of said cylinders and hollow shaft.

4. The combination with a shaft, of cylinder casings carried by said shaft, movable cylinders within said casings, a hollow valve shaft having ports therein adapted to register with the interiors of said cylinders, pistons within said cylinders, and rotary bearing supports for said pistons arranged eccentrically to the axis of rotation of said cylinder casings.

5. The combination of a cylinder-supporting shaft with a hollow valve shaft having ports therein, cylinder-supports on the cylinder-supporting shaft, cylinders closed at one end by and which rotate on said valve shaft and have port-openings to be brought into register with said hollow valve shaft ports, pistons movable in said cylinders, and eccentric rotary bearing supports for said pistons.

6. The combination of a rotary shaft, with a series of radially arranged supports connected to rotate with said shaft, a valve-pipe having inlet and outlet ports, cylinders on said supports which are relatively movable and have bearing ends which rotate about said pipe and are open to said ports, pistons within said cylinders, rotary bearings to which said pistons are connected and which are eccentric to the axis of said shaft, and means tending to force the bearing ends of said cylinders toward said pipe.

In testimony whereof I have hereunto signed my name.

ANDREW P. BEIJER.