Dec. 17, 1935. E. K. BENEDEK 2,024,420

PUMP

Original Filed April 25, 1932 2 Sheets-Sheet 1

Fig. 1.

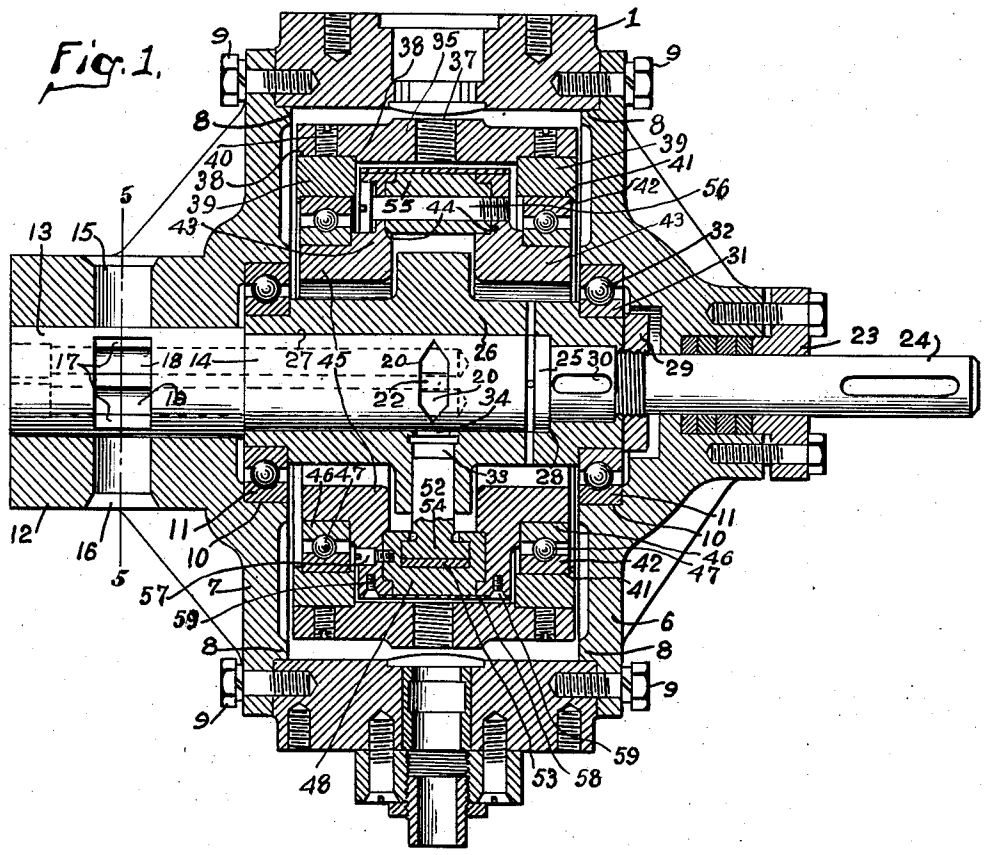


Fig. 5.

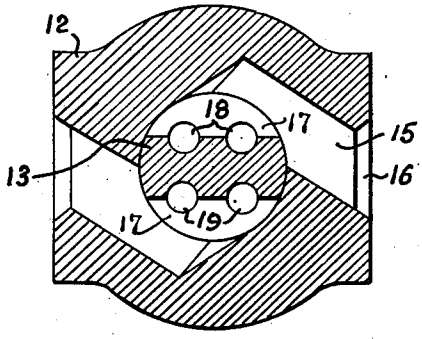
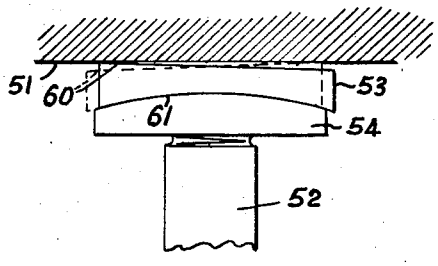


Fig. 6.



Inventor
ELEK K. BENEDEK,
By Rubin & Rubin
Attorneys

Dec. 17, 1935. E. K. BENEDEK 2,024,420

PUMP

Original Filed April 25, 1932 2 Sheets-Sheet 2

Fig. 2.

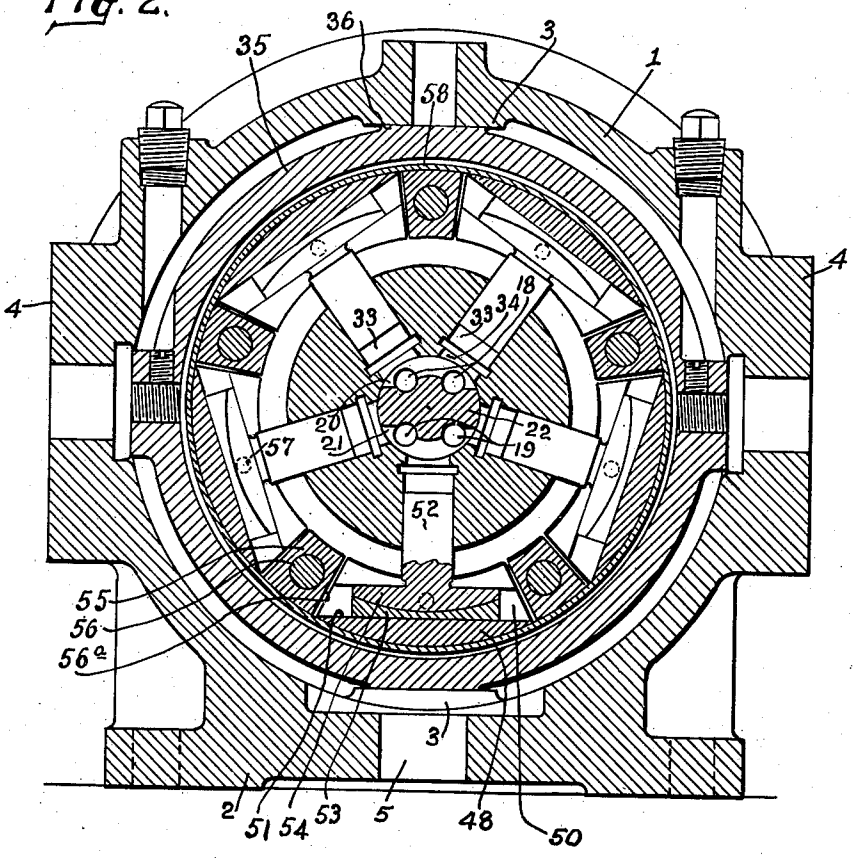


Fig. 3.

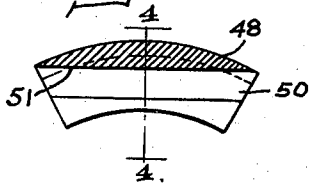
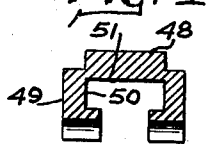


Fig. 4.



Inventor

ELEK K. BENEDEK,

By Paulmier & Paulmier

Attorneys

Patented Dec. 17, 1935 2,024,420

UNITED STATES PATENT OFFICE

2,024,420

PUMP

Elek K. Benedek, Mount Gilead, Ohio, assignor to The Hydraulic Press Mfg. Company, Mount Gilead, Ohio, a corporation of Ohio

Original application April 25, 1932, Serial No. 607,409. Divided and this application March 13, 1933, Serial No. 660,550

5 Claims. (Cl. 103—161)

This invention relates to rotary, multiple radial piston pumps or motors of the type operated by fluid pressure, and especially to variable delivery pumps or motors including pressure liquids in their operation.

The principal object of my invention is to provide a variable delivery rotary pump or motor having a simplified arrangement of the secondary rotor and the piston-crosshead guide blocks associated therewith.

Another object of my invention is to provide such an arrangement of the secondary rotor and piston-crosshead guide blocks that the latter will possess a certain amount of self-aligning mobility during assembly.

Another object of my invention is to provide a pump or motor of this type wherein the secondary rotor comprises half members having opposed grooves, which members are clamped together with piston-crosshead guide blocks therebetween, the clamping means being independent of the locking means of said guide blocks.

Another object of my invention is to provide a pump of this type with secondary rotor halves clamped together with piston-crosshead guide blocks therebetween, the said guide blocks being separated from each other by spacing elements which are clamped together with the rotor halves by means independent of the means clamping the guide blocks, thereby providing a certain amount of self-aligning of the guide blocks during assembly prior to locking them in place.

Another object of my invention is to provide a pump or motor of the type specified with secondary rotor halves clamped together by spacing elements separating piston-crosshead guide blocks which are independently clamped, combined with two-part pistons and crossheads arranged for reciprocatory movement in the guide blocks.

Another object of my invention is to provide such a pump or motor with a lubricant retaining shell surrounding and rotatable with the secondary rotor halves, the guide blocks and the clamping means.

With these and other objects in view, the nature of which will more fully appear, the invention will be understood from the following description taken in connection with the accompanying drawings and appended claims.

This application is a division of application Serial No. 607,409, filed April 25, 1932, which is now Patent No. 2,000,271 of May 7, 1935.

In the drawings:

Figure 1 is a central horizontal section of a form of pump embodying my invention.

Figure 2 is a vertical cross section taken through the plane of the pumping units of the pump shown in Figure 1.

Figure 3 is a central longitudinal section of a piston-crosshead guide block shown in assembled relationship in Figure 2.

Figure 4 is a detail cross section of the piston-crosshead guide block taken on the line 4—4 of Figure 3.

Figure 5 is a detailed cross section of the pintle taken on the line 5—5 of Figure 1, showing the intake and exit ports and conduits.

Figure 6 is a diagrammatic view showing the manner in which the two-part piston-crosshead is capable of shifting slightly during operation.

Referring to the drawings in detail, in the practical development of my improved pump or motor, I provide a casing comprising a cylindrical shell 1 which is equipped with a supporting base 2, upper and lower slide guide pads 3 and diametrical oppositely disposed hubs 4 apertured as shown to accommodate the usual eccentric or secondary rotor shifting rods. The usual drain port 5 may also be provided.

The casing shell is closed at its ends by end casing plates 6 and 7 provided with centering shoulders 8 and secured as at 9 to the respective ends of the casing ring. Each end plate is provided with a recess 10 for receiving a ball race 11 and the plate 7 is equipped with a hub extension 12 in which the enlarged head 13 of the valve pintle 14 is secured by employment of a key or other suitable equipment. The hub 12 includes the usual combined intake and exhaust ports 15 and 16, each of which communicates with pintle cut-outs 17, which cut-outs in turn communicate with upper and lower pairs of combined inlet and outlet bores respectively designated 18 and 19.

The portion of the pintle which projects into the pump chamber formed by the casing ring 1 and the end plates 6 and 7 is provided with upper and lower valve cut-outs respectively designated 20 and 21 through which the inlet and exhaust bore pairs 18 and 19 may communicate suitably with the cylinder bores formed in the cylinder barrel or primary rotor, to be referred to in detail hereinafter. The portion of the pintle remaining after the forming of and between the cut-outs 20 and 21 provides a pintle bridge 22 which serves a purpose well understood in the art.

The casing end plate 6 is provided with a bearing 23 for receiving the drive shaft section 24 which extends from the pump casing and to which power may be applied in any suitable manner. The portion of the drive shaft section projecting into the pump casing terminates in an abutment head 25, and the cylinder barrel or primary rotor 26 is axially bored to receive the extended end of the drive shaft section which carries said abutment head. The primary rotor 26 is also counter bored as at 27 to receive rotatably the portion of the pintle which projects into the pump casing, and in this manner an abutment shoulder 28 is formed against which the abutment head

25 is securely clamped by employment of a threaded clamp ring 29, as shown in Figure 1 of the drawings. The drive shaft section and the primary rotor 26 are also key-connected as at 30 for driving purposes.

The cylinder barrel or primary rotor 26 is in the nature of a long rigid hollow cylindrical body and is reduced at its ends to receive ball race rings 31 which cooperate with the previously described rings 11 and with ball bearings 32 interposed between said rings in the forming of anti-friction bearings for said primary rotor. In a plane disposed centrally between the bearing rings 31 and likewise disposed centrally between the casing plates 6 and 7, the primary rotor 26 is provided with a plurality, five being shown, of equidistantly spaced radial cylinder bores 33 which communicate through ports 34 with the pintle cut-outs 20 and 21.

A rigid single-piece shifter ring 35 is provided and equipped with guide pads 36 for engaging the guide pads 3 of the casing, and suitable provision generally designated 37 is made for connection with ordinary shifter rods or other suitable mechanical shifting equipment not shown. The shifter ring 35 is annularly recessed at its ends as at 38 to receive shoulder rings 39 which may be secured in position by set screws or other equipment as indicated at 40. Each shoulder ring includes a keeper flange 41 and serves as a mounting for a ball race 42.

The eccentric or secondary rotor comprises two plate-like half units 43 in the nature of parallel opposed flat rings or flanges, and surrounds the primary rotor 26. These halves or flanges are provided with opposed annular recesses 44 which are concentric to the axis of rotation of the secondary rotor.

The secondary rotor halves also include laterally extending flanges 45 likewise concentric with relation to the axis of rotation of the secondary rotor, and on which are mounted race rings 46 which with the rings 42, previously described, and interposed ball bearings 47, provide anti-friction bearings for the secondary rotor within the shifter ring 35. It will be observed that the secondary rotor is centered on the plane of the primary rotor bores 33, and that the anti-friction bearings for the secondary rotor are disposed equi-distantly at each side of that central plane and within the anti-friction bearings for the primary rotor 26, previously described.

Between the eccentric or secondary rotor halves 43, individual piston-crosshead guide blocks 48 are mounted, there being one such guide block for each primary rotor cylinder bore: these guide blocks are provided with arcuate ribs 49 which fit the annular recesses 44 of the secondary rotor halves, tangentially disposed groove-ways 50 forming reaction faces 51, and inwardly directed openings for permitting freedom of movement of the pistons 52 reciprocable in the bores 33 of the primary rotor 26, and which are connected with the secondary rotor 43 by engagement of the two-part piston-crossheads 53 and 54 hereinafter more particularly described. The two parts 53 and 54 of said piston-crosshead form a plate-like member which is reciprocable in the groove-ways 50 of the piston-crosshead guide blocks 48.

The secondary rotor half flanges 43 are clamped against and separated by intervening equi-distantly arranged spacer blocks 55 by screws 56 which pass through said flanges 43 and the spacer blocks 55. The piston-crosshead guide blocks 48 terminate at their ends slightly short of the spacer blocks 55, providing a clearance 56a therebetween, as indicated in Figure 2. By reason of this clearance 56a, the pump parts may be assembled and the piston-crosshead guide blocks 48 permitted to align themselves, the clearances 56a being sufficient to permit whatever slight movement may be necessary for this purpose, after which the piston-crosshead guide blocks 48 may be positively locked in their aligned positions by employment of set screws 57 or other suitable means, as indicated in Figures 1 and 2.

The pistons 52 are provided with two-part crossheads, namely, a part 54 formed integrally with the piston body 52 and a part 53 freely slidable thereon, the engaging faces of the parts 53 and 54 being curved on an arc 61, preferably struck from the pintle axis, that is, the axis of rotation of the primary rotor 26. For large pumps, this arc is preferably struck from a center lying between the crosshead and the primary rotor axis, in other words, having a radius shorter than the radius of the inter-face between the piston-crosshead parts 53 and 54, as above described. The reaction surface 60 of the sliding element 53 is perfectly flat like the opposing reaction surface 51 of the piston-crosshead guide block 48.

It will be observed that the ribs 49 of the piston-crosshead guide blocks and the secondary rotor groove-ways 44 are in concentric relationship with the axis of rotation of the secondary rotor. In order to insure this concentric relationship, I prefer to include in the manufacture of these blocks the turning of a laterally shouldered ring which contains all of the blocks and the ribs thereon, after which the individual guide blocks may be severed from the ring by radial saw cuts, and thereafter provided with the additional tangential groove-ways 50 and other recesses which characterize the piston-crosshead guide blocks 48.

It will be observed from Figure 1 that the spaced relationship of the secondary rotor halves 43 provides an annular space within which the piston-crosshead guide blocks 48 are mounted, and in which certain lubricant will be impounded constantly to engage and provide lubricant film bearing for the reciprocating piston-crossheads. In order to insure this impounding of lubricant, a lubricant retaining shell 58 surrounds the secondary rotor halves 43 and the guide blocks 48 clamped therebetween, and is secured as at 59 to said flanges.

In the operation of my invention as a pump, when the primary and secondary rotors are positioned with their axes of rotation coinciding as in Figure 2, and power is applied through the drive shaft 24, no reciprocation will be imparted to the pistons and crossheads. When, however, the secondary rotor is shifted by means of the shifting ring 35 so that its axis of rotation lies away from the axis of rotation of the primary rotor, the pistons 52 will be caused to reciprocate radially in their bores 33, and the piston-crosshead parts 53 and 54 forming a plate-like crosshead will reciprocate tangentially in the piston-crosshead guide block groove-ways 50, such piston reciprocation being occasioned by the relative movement of which the rotors partake because of their off-center relationship. The degree of reciprocation will, of course, vary with the degree of separation of the axis of rotation of the primary and secondary rotors. As a moving clearance is, of course, provided between the reaction face 60 of the piston-crosshead and the reaction face of

the piston-crosshead guide block 48: during operation of the pump and the resultant tangential reciprocation of the crossheads, the part 53 of each crosshead will slide back and forth slightly in the direction of reciprocation and on the curved surface 61, thus causing the reaction face 60 of the crosshead to tilt alternately with respect to the piston body 52 or the opposed flat reaction face of the piston-crosshead guide block. The alternating wedge-shaped clearance thus provided between the reaction surfaces is highly advantageous in creating a high pressure lubricant film bearing for the crosshead, as shown in Figures 2 and 6.

The foregoing description has been directed, for convenience, to the operation of my invention as a pump, when power is applied to the drive shaft thereof. It will be obvious to those skilled in the art, that supplying pressure fluid to the machine of my invention will cause it to operate as a motor, and thus deliver power from the shaft thereof.

Thus it will be seen that I have provided an improved pump or motor having two rotors, one surrounding and adjustable eccentrically relative to the other; cylinder and piston assemblies positively connecting these rotors for driving one from the other; means for systematically delivering pressure fluid to and from said cylinders; a rigid composite secondary rotor comprising a pair of flanged plates clamped against piston-crosshead guide blocks and spacer blocks separating said guide blocks one from another, said guide blocks being secured in position by means independent of the locking of said spacer blocks, and a slight amount of self-aligning movement is thereby provided for said guide blocks during the assembly of the machine; a two-part construction of the piston-crosshead, one part being integral with said piston, these parts being associated on a curved inter-face and reciprocable slightly relative to one another during operation whereby a high pressure lubricant film is created; and other features and constructions which appear from the foregoing description.

It will be understood that I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions and uses, and which are fairly included within the scope of my invention and claims.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a pump or motor, primary and secondary rotors rotatable about individual axes and movable relatively during rotation, and radial piston and cylinder assemblies connecting the rotors and including crossheads, said secondary rotor comprising half members having opposed grooves concentric with the axis of rotation of the secondary rotor, guide blocks clamped between the rotor halves and tangentially grooved to slidably receive the crossheads, clamping means between adjacent guide blocks for clamping the halves together and for spacing the guide blocks, and means other than the clamping means to secure said guide blocks against displacement after they have been properly aligned in assembly.

2. In a pump or motor, primary and secondary rotors rotatable about individual axes and movable relatively during rotation, and radial piston and cylinder assemblies connecting the rotors and including crossheads, said secondary rotor comprising half members having opposed grooves concentric with the axis of rotation of the secondary rotor, guide blocks clamped between the rotor halves and tangentially grooved to slidably receive the crossheads, and having arcuate primary reaction shoulders engaging the rotor half grooves, said blocks having clearance at their ends to permit a degree of self-aligning movement, clamping means between adjacent guide blocks for clamping the halves together and for spacing the guide blocks, and means other than the clamping means to secure said blocks against displacement after they have been properly aligned in assembly.

3. In a pump or motor, primary and secondary rotors rotatable about individual axes and movable relatively during rotation, and radial piston and cylinder assemblies connecting the rotors and including crossheads, said secondary rotor comprising half members having opposed grooves concentric with the axis of rotation of the secondary rotor, spacing elements separating the half members and disposed in equi-distantly spaced relationship in the opposed grooves, clamping means passing through the half members and into the spacing elements and serving to clamp said halves and spacers in rigid relationship, and guide blocks clamped together with the spacers between the halves and tangentially grooved to slidably receive the crossheads and having arcuate primary reaction shoulders engaging in the rotor half grooves.

4. In a pump or motor, primary and secondary rotors rotatable about individual axes and movable relatively during rotation, and radial piston and cylinder assemblies connecting the rotors and including crossheads, said secondary rotor comprising half members having opposed grooves concentric with the axis of rotation of the secondary rotor, spacing elements separating the half members and disposed in equi-distantly spaced relationship in the opposed grooves, clamping means passing through the half members and into the spacing elements and serving to clamp said halves and spacers in rigid relationship, guide blocks clamped together with the spacers between the halves and tangentially grooved to slidably receive the crossheads and having arcuate primary reaction shoulders engaging in the rotor half grooves, and means other than the clamping means to secure said blocks against displacement.

5. In a pump or motor, primary and secondary rotors rotatable about individual axes and movable relatively during rotation, and radial piston and cylinder assemblies connecting the rotors and including crossheads, said secondary rotor comprising half members having opposed grooves concentric with the axis of rotation of the secondary rotor, spacing elements separating the half members and disposed in equi-distantly spaced relationship in the opposed grooves, clamping means passing through the half members and into the spacing elements and serving to clamp said halves and spacers in rigid relationship, guide blocks clamped together with the spacers between the halves and tangentially grooved to slidably receive the crossheads and having arcuate primary reaction shoulders engaging in the rotor half grooves, one said block being disposed between each pair of spacers and terminating at its ends short of said spacers to permit a degree of self-aligning movement during assembly, and means other than the clamping means to secure said blocks against displacement after they have been properly aligned and assembled.

ELEK K. BENEDEK.