Aug. 25, 1953 K. H. HOEN ET AL 2,649,737

HYDRAULIC PUMP

Filed March 22, 1948 4 Sheets-Sheet 1

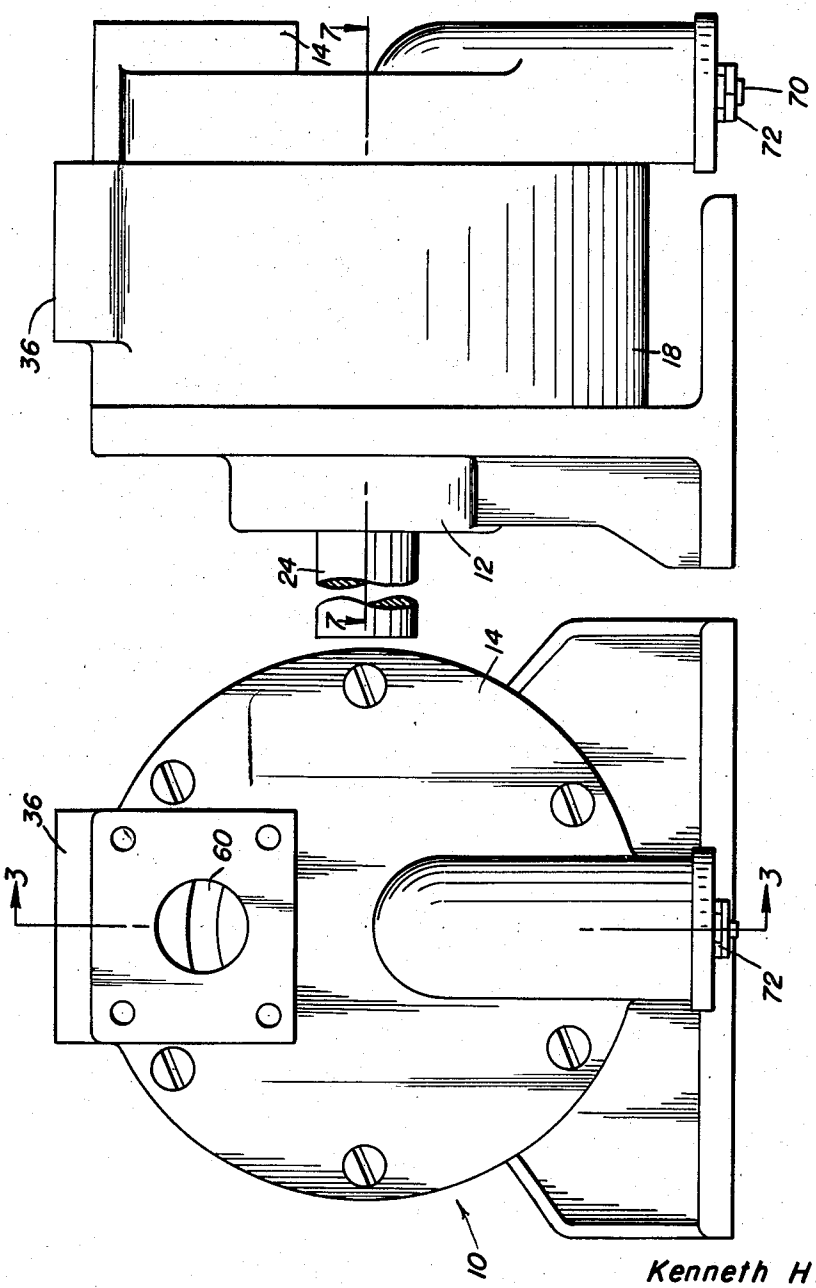


Fig. 2.

Fig. 1.

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HYDRAULIC PUMP

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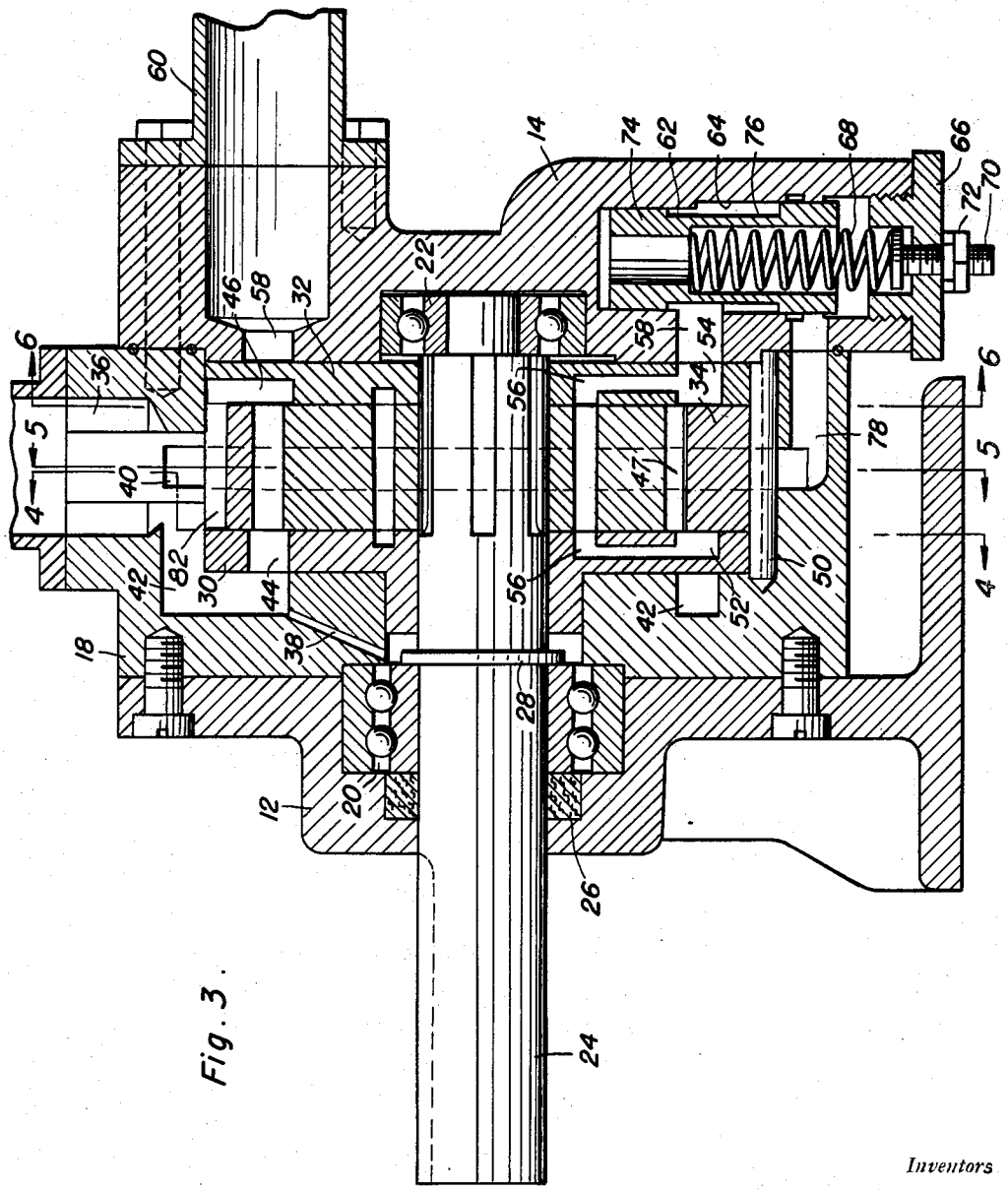


Fig. 3.

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Fig. 5

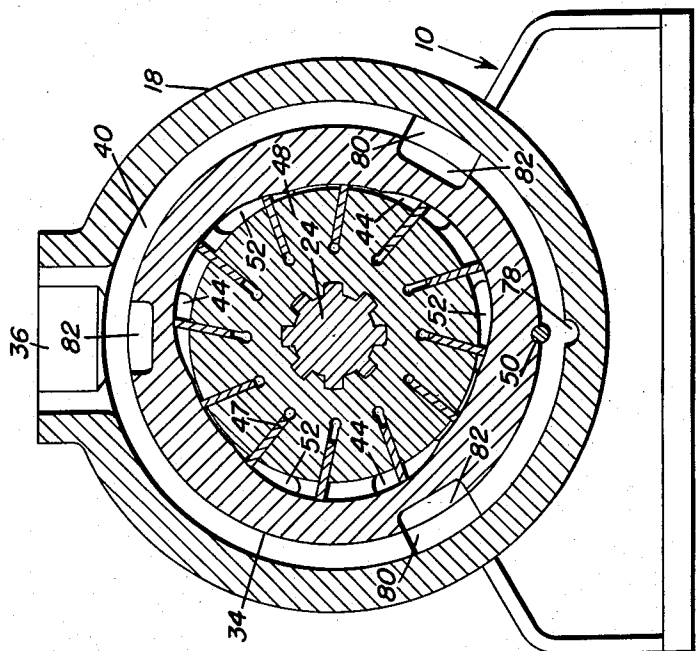
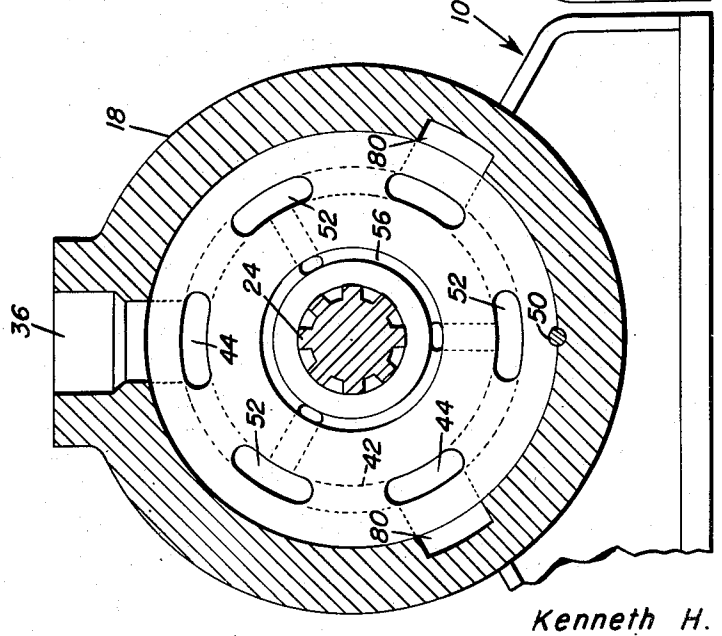


Fig. 4



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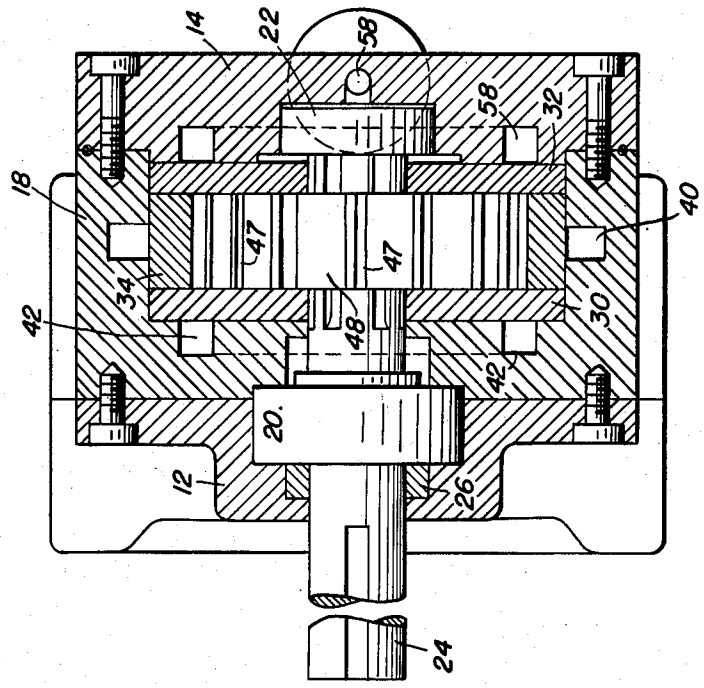


Fig. 7.

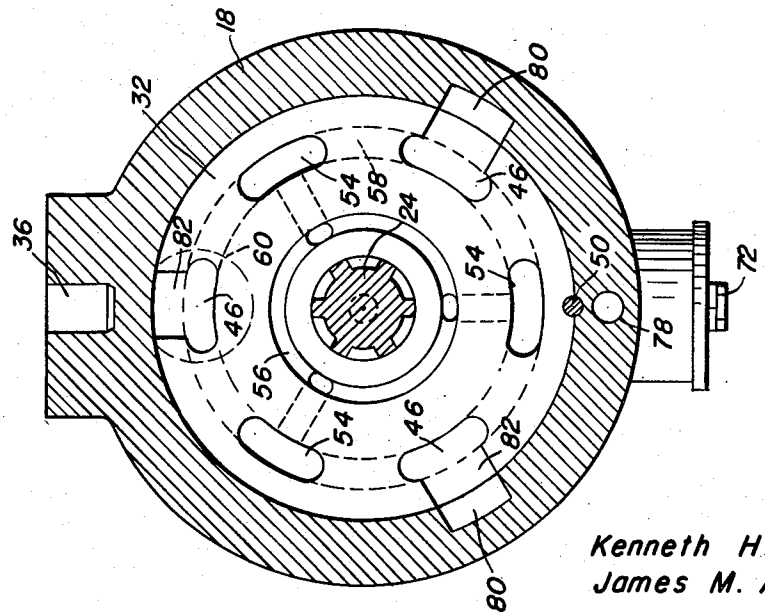


Fig. 6.

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UNITED STATES PATENT OFFICE

2,649,737

HYDRAULIC PUMP

Kenneth H. Hoen and James M. Archer, Billings, Mont.; Ruby E. Archer, administratrix, de bonis non, of said James M. Archer, deceased

Application March 22, 1948, Serial No. 16,354

4 Claims. (Cl. 103—42)

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This invention appertains to novel and useful improvements in fluid motors or pumps.

An object of this invention is to transfer torque from a driven shaft to kinetic energy in an improved manner.

Another object of this invention is to provide means for carrying out the above mentioned function.

A further purpose of this invention is to provide an improved housing having a channel therein, a pair of spaced juxtaposed stationary plates with inlet ports therein and a rotor having slidable vanes positioned between said plates.

Another purpose of this invention is to provide improved bypass means for use in association with the above mentioned plates, whereby liquid is directed to the free sides of the vanes to facilitate in the slidable actuation thereof.

Another purpose of this invention is to provide improved valve means which is pressure-responsive for directing fluid to the said channel under a predetermined pressure.

Another object of this invention is to provide improved lubrication means for the bearings in the present invention.

Another object of this invention is to provide a smoothly operative pump which is relatively inexpensive to manufacture.

Ancillary objects and features of novelty will become apparent to those skilled in the art, in following the description of the preferred form of the invention, illustrated in the accompanying drawings, wherein:

Figure 1 is an end view of the invention;

Figure 2 is a side view of the invention shown in Figure 1;

Figure 3 is a sectional view taken substantially on the line 3—3 of Figure 1 and in the direction of the arrows;

Figure 4 is a sectional view taken substantially on the line 4—4 of Figure 3 and in the direction of the arrows;

Figure 5 is a sectional view taken substantially on the line 5—5 of Figure 3 and in the direction of the arrows;

Figure 6 is a sectional view taken on the line 6—6 of Figure 3 and in the direction of the arrows; and

Figure 7 is a sectional view taken substantially on the line 7—7 of Figure 2 and in the direction of the arrows.

Referring now in detail to the illustrated preferred form of the invention, like reference characters are used throughout to indicate similar elements. This invention has been conceived and

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developed for the purpose of providing a smoothly operative device for converting torque to kinetic energy of an hydraulic fluid. A housing, generally indicated at 10, is provided with end plates 12 and 14, respectively, which are detachably secured to a center piece 18. Screws or the like may be utilized for securing these end plates to the center piece. Conventional anti-friction bearings 20 are supplied for use in association with a shaft 24. A second set of bearings 22 is also utilized in association with the said shaft 24, the bearings 22 being positioned at the terminal portion thereof and in the end plate 14 while the aforementioned bearings 20 are positioned in the said end plate 12. Suitable bushing material or oil seals 26 may be associated with the shaft wherever desirable, as illustrated in Figure 3. A collar 28 may also be used in association with the said shaft and the bearings 20, serving the purpose of a thrust bearing.

A first plate 30 is secured to the center piece 18 and is held immovable relative thereto. A second plate 32 is also rigidly associated with the center piece and a stator 34 is interposed therebetween. The said shaft 24 extends through the said plates 30 and 32 and also through the stator 34. A rotor is splined or otherwise secured to the said shaft 24 and is positioned between the said plates 30 and 32 respectively.

A hydraulic fluid inlet 36 is formed in the said housing, and more specifically in the said center piece 18 for the purpose of receiving fluid from a reservoir. A small bore 38 extends through said center piece and communicates with the anti-friction bearings 20 for lubrication thereof.

A channel 40 is formed in the said center piece 18 and extends peripherally therearound. This channel will be referred to more in detail as the description proceeds, it being noted at this point that the inlet 36 may receive fluid from a reservoir, which fluid may extend and flow around and in the housing within the said channel 40. Another portion of the fluid is received in an annular chamber 42, whence it is directed through an inlet port 44 formed in the said plate 30.

The said inlet port 44 is one of several about the said plate 30 and complemental inlet ports 46 are provided in the said plate 32. The ports 44 and 46 are aligned relative to each other.

The specific rotor construction may be seen best in Figure 5, wherein the stator 34 is illustrated as having cam surfaces therein. These cam surfaces engage a plurality of vanes 47 which are in the rotor block 48. The said block is, of

course, splined to the said shaft 24 to prevent mutual rotation between these elements.

It is now readily apparent that the rotor used in association with this invention is of the sliding vane type. Also, it is seen that the stator 34 has a pin 50 extending through a suitable slot therein and also through the center piece 18. This holds the stator relatively immovable relative to the rotation of the rotor.

Referring now again to Figure 3, it will be seen that after the fluid is conducted through the said inlet ports 44 and 46, it is then impelled for emission at the opposite ends of the plates 30 and 32, respectively.

A passage 52 is provided in said plate 30 and has a pair of openings therein (in said passage) communicating with the rotor chamber. A similar passage 54 is provided in the said plate 32 and opposite the said passage 52. In operation, the fluid is urged through the lower ends of the said passages 52 and returned to the free or non-working sides of the vanes or blades 47. The passage at 54, however, receives fluid from the rotor chamber and directs the same to a pressure-responsive valve means.

Returning again to the passages 52 and 54, it will be seen that the upper portions thereof terminate in the openings (aforementioned) which are numbered at 56. These openings are in the form of annular slots which communicate with the lower portions of the said blades or vanes 47. This directs the fluid to the roots of each of the blades and on the free or non-working faces thereof for assisting in sliding the blades to the proper position relative to the rotor block 48. The fluid is, of course, directed to both the working side and the free side. However, the pressure of the working side is always of such value as to prohibit entry of the bypassed liquid or fluid, the said liquid or fluid assuming the path of least resistance or the free sides thereof.

It is further noted that the passage 54 not only directs its fluid to the outlets 56, but also directs a portion of it to the pressure-responsive valve means. Further, another portion of the fluid extends through the annular outlet 58 which is in the end plate 14. Of course, a suitable outlet nozzle 60 may be associated with the said outlet for conducting fluid to the device requiring fluid under pressure.

A cylinder 62 having an enlarged bore at 64 is provided in the end plate 14. The said enlarged bore portion 64 communicates with the outlet 58 which obviously communicates with the said channel 54. A detachable plug 66 may be provided in the end of the said cylinder 62 and a spring or other suitable resilient biasing means 68 may be seated on the said plug 66. A means for adjusting the efficacy of the said spring is provided. This means is preferably simply a threaded lug 70 slidably received in a threaded bore in the said plug 66 and a pair of nuts for locking purposes associated with the said threaded lug. A piston 74 is slidably received in the said cylinder and has a reduced portion 76 in the walls thereof. Of course, the spring 68 seats on a suitable portion of the said piston, and the reduced portion 76 cooperating with the enlarged bore 64 forms a channel or passage. Fluid being forced through the outlet 58 has a component of force exerted thereon, as influenced by the back pressure of the machine to which the outlet 60 is attached. This back pressure is transmitted through the outlet 58 to the

piston 74. Under predetermined values of back pressure, the piston will be slid to a position whereby the reduced portion 76 thereof communicates with a conduit 78 which is formed in the end plate 14 and center piece 18. This conduit 78 then communicates with the groove 40 for the return of fluid to be simply recirculated in the pump housing.

In order to conduct fluid to the inlet ports 46, the following structure is provided. Notches 80 are supplied in the said center piece 18 and also complemental notches 82 extend axially of the stator 34. Fluid is then conducted from the channel 40 through these notches which communicate with the fluid inlets 46. Fluid is also conducted through these notches into the annular chamber 40 which communicates with the fluid inlets 44.

The general operation of the invention is as follows: Fluid enters the inlet 36 and flows simultaneously into the circular passage 40 and enters the ports 44 and 46. Oil is picked up from the ports by the rotor and pressure is applied to the fluid when it is squeezed out of or emitted from the rotor chamber by the blades as they pass into the smaller diameter of the housing or stator, due to the cam surface construction.

Fluid is forced under pressure into the passages 52 and 54, thence routed back to the outlets 56 thereof. This oil flows back into the rotor chamber behind the blades and pushes them out as they get into the larger diameter of the rotor chamber. This action balances the action of the blades and makes them come out evenly and quickly.

The remainder of the fluid passes into the circular passage or outlet 58 and to the pressure-responsive valve means. The fluid in the pressure-responsive valve means then actuates as described above, that is, after a predetermined back pressure is built up in the system. This small portion of the fluid for relieving the back pressure is then recirculated through the channel 40. Of course, the pressure-responsive valve means may be regulated in accordance with the capacity of the pump and other engineering and design factors. Also, the pressure-responsive valve means may be regulated to prohibit excessive pressure applied to an instrument or machine to be actuated by the pump.

It will be noted that there has been provided a hydraulic pump with inlets and pressure exhaust so arranged around the rotor and rotor housing that hydraulic balance is attained. The fluid pressure is the same at points equally distributed about the shaft or points diametrically opposed in lobe pumps, thereby cancelling fluid pressure on the shaft. Further, there is a combined suction inlet ring and suction inlet ports in the rotor housing to insure a full volume of fluid in the rotor blade zones.

Of course, the number of lobes in a single unit may be varied for different uses, as for an increase or decrease in output. The volume of output per revolution may be varied in this manner.

Careful inspection of the figures of the drawings clearly illustrates that the direction of rotation may be changed by turning the rotor and rotor housing over in a main pump housing and then aligning the pertinent elements with a conventional dowel pin. Further, the above described fluid being fed under output pressure to the back edge of the blades to make a close seal between the blades and rotor housing increases

the efficiency of the pump. The specific arrangement of the elements and design of the parts also substantially obviates pressure against the shaft oil seals and gaskets, this feature being self explanatory in importance.

These and other features of importance are believed to be readily understandable from the foregoing description and drawings pertinent thereto. It is apparent also that variations may be made without departing from the spirit of the invention. Accordingly, limitation is sought only in accordance with the scope of the following claims.

Having described the invention, what is claimed as new is:

1. In a hydraulic pump, a housing including end plates and a center piece, said center piece being positioned between said end plates and having an enlarged circular opening therethrough, a stator positioned in a central portion of said opening, fluid control plates mounted in said circular opening on opposite sides of said stator, an opening in said stator, a rotor mounted on a shaft carried by said end plates, said rotor being positioned within the opening in said stator and having movable vanes engaging the walls of the opening in said stator, a fluid inlet in said center piece, an annular inlet fluid passage in said center piece communicating with said fluid inlet, said annular fluid passage being located centrally of the axial center of said center piece with the radial inner wall thereof closed by said stator, axially aligned inlet ports in said fluid control plates, axially extending passages in the outer portion of said stator communicating said inlet ports with said annular fluid passage, axially aligned outlet ports in said fluid control plates communicating with an annular outlet passage in one of said end plates.

2. The hydraulic pump of claim 1 wherein there are a plurality of said inlet and outlet ports in each fluid control plate, said inlet and outlet ports being alternated and equally circumferentially spaced.

3. The hydraulic pump of claim 1 wherein the outlet ports of one of said fluid control plates conduct all fluid pumped therein through said rotor behind the inner ends of said vanes and into the outlet ports of the other of said fluid control plates.

4. The hydraulic pump of claim 1 wherein said pump is provided with a pressure relief valve mechanism in said one end plate, said pressure relief valve being communicated with said annular outlet passage, a return passage communicating said pressure relief valve with said annular inlet fluid passage for circulating excess fluid therethrough.

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