

June 21, 1960

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HYDRAULIC PUMP

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2 Sheets-Sheet 1

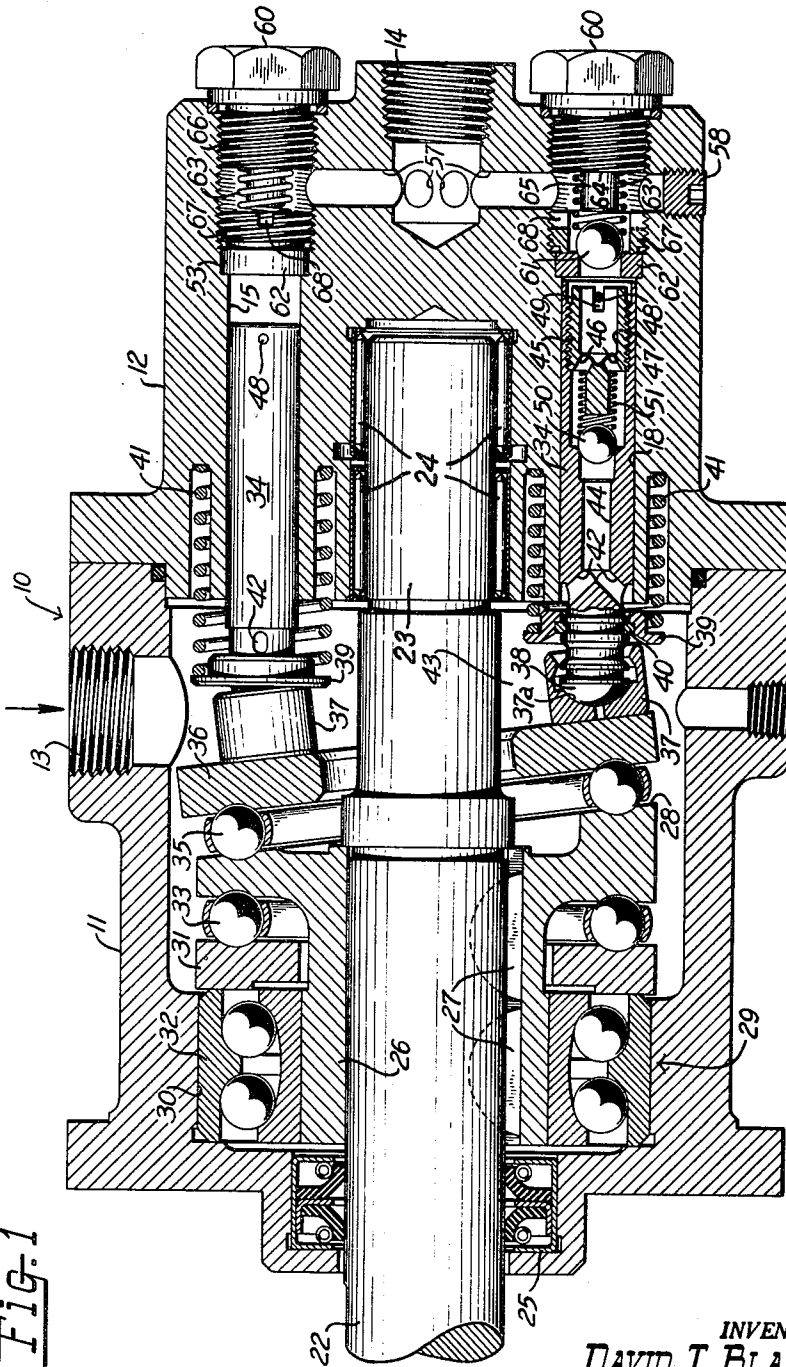


Fig. 1

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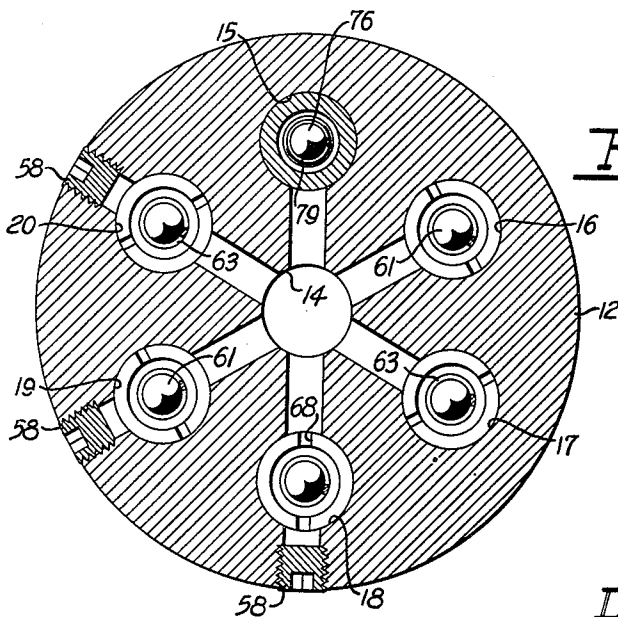
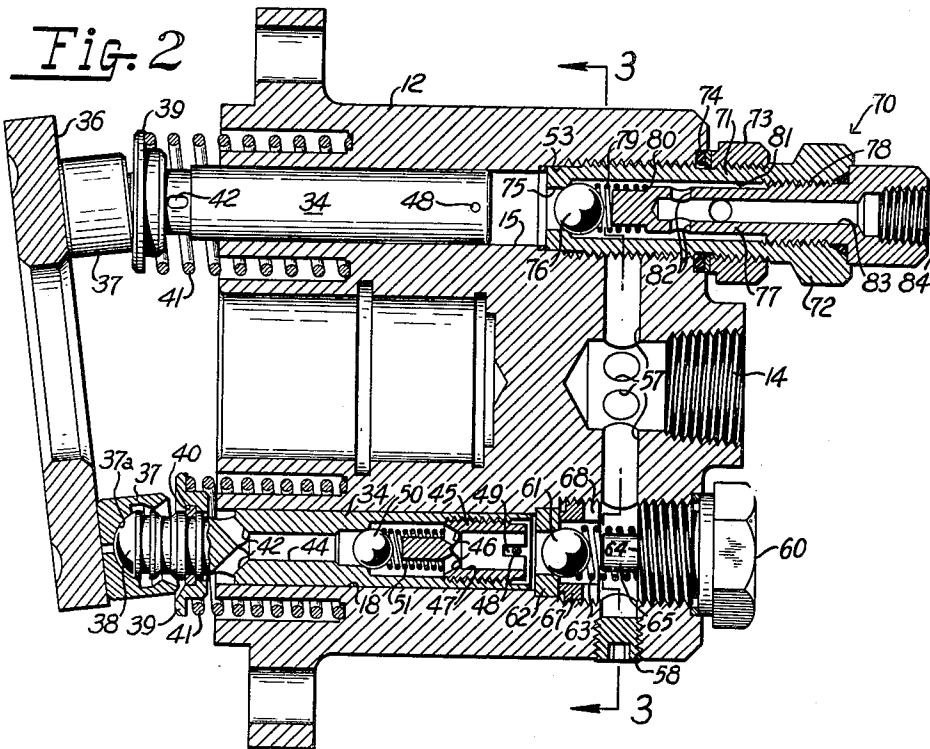
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HYDRAULIC PUMP

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7 Claims. (Cl. 103—10)

The present invention relates generally to improvements in the art of hydraulics, and relates more particularly to improvements in the construction and operation of multiple piston hydraulic pumps.

A primary object of this invention is to provide an improved hydraulic pump which is extremely simple and compact in construction and which is moreover highly efficient in use and exceedingly flexible in its adaptations.

It has heretofore been proposed to provide pumps of the type having a plurality of pistons or plungers driven by an eccentric and adapted to deliver the entire output of all of the pistons or pumping units to a common source of utilization. In other instances, it has been proposed to bypass a certain amount of the liquid pumped for use at other than the primary source in cases wherein the demand of the primary source of utilization is less than the total output or capacity of the pump. However, it is frequently desirable to utilize an independent predetermined proportion of the output or capacity of the pump at one selected locality and to use the output of one or more of the pumping pistons at an entirely independent locality.

It is therefore a more specific object of my present invention to provide an improved hydraulic pump of the multiple piston type which successfully accomplishes this desirable result in a simple and efficient manner and which may be readily converted at will to pump at the desired capacities to one or more entirely independent sources.

Another specific object of the invention is to provide a hydraulic pump of the above type in which the discharge of any of the individual pumping plungers may be selectively and independently diverted to provide secondary sources of fluid pressure, or, alternatively the entire output of the pump may be through a common discharge port.

Still another specific object of the invention is to provide a hydraulic pump of the above type which is economical to manufacture and in which flow diverting isolating valves may be readily installed and removed as required.

A general object of the invention is to provide an improved multiple piston type hydraulic pump which is highly flexible as to the uses to which it may be put.

Other objects and advantages of the invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings in which:

Figure 1 is a longitudinal cross sectional view of a pump utilizing this invention.

Figure 2 is a similar view showing only the pumping chamber end of the pump and with one of the isolating valves inserted in the pump.

Figure 3 is a sectional view taken on line 3—3 in Figure 2 and showing the discharge passageways from each of the pumping chambers into the common outlet port.

For purposes of illustration, the invention will be shown and described as applicable to a multiple piston

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type pump in which the pistons or plungers are arranged in parallelism and circumferentially spaced around the axis of the pump. However, the invention is applicable to other types, such as radial piston pumps.

Referring more particularly to the drawings, the pump housing 10 is comprised of a drive section 11 and a cylinder block 12 suitably secured together. The drive section 11 has an inlet port 13 and the cylinder block 12 has an outlet port 14 through which the discharge from all of the pumping chambers 15—20 passes when the arrangement shown in Figure 1 is used.

A drive shaft 22 extends through the drive section and has a reduced end portion 23 piloted in cylinder block 12 in the anti-friction bearings 24. A shaft seal 25 is located between the shaft and housing.

A swash or wobble plate 26 is secured to the drive shaft by keys 27 and is shown here as being of fixed eccentricity, having an inclined surface 28. An anti-friction bearing assembly 29 is seated in the bore 30 of the housing and rotatably supports the wobble plate and drive shaft.

A bearing race plate 31 bears against the outer race 32 of bearing assembly 29 to support the anti-friction balls 33. The swash plate 26 forms the other race surface for balls 33 which absorb the axial thrust imposed by the pumping action of the pistons 34.

Anti-friction balls 35 are also located between the carrier ring 36 and the inclined surface 28 of the swash plate 26. Universally tiltable slippers 37 bear against the ring 36 and each have a hemispherical socket 37a which receives the corresponding hemispherical head 38 of the pistons. A collar 39 is held on each of the pistons by a snap ring 40, and a spring 41 reacts between each collar and the cylinder block to urge the piston to the left to hold the slippers against the carrier ring.

At the drive end of each piston, cross ports 42 place the inlet space 43 of the housing drive section in fluid communication with an axial bore 44 of the piston. The other end of the piston has a plug 45 threadably engaged therein having cross ports 46 and axial bore 47 which are in communication with bore 44 to permit fluid to flow through the axial length of the piston. A lock pin 48 extends through the piston and through a slot 49 in plug 45 and prevents plug 45 from being accidentally unthreaded.

A check valve is located in each piston to permit the intake of fluid into the pumping chamber when the pistons are retracted, or moved to the left as viewed in the figures. On the pumping stroke, i.e., to the right, the check valve prevents return flow through the pistons. The piston check valves each comprise a ball 50 which is urged to its seated position by the reaction of spring 51 on the plug 45.

The particular locking connection between each piston 34 and the corresponding plug 45 permits the pressure of the spring 51 to be readily varied so as to adjust the pressure required to draw fluid into the pumping chamber on the suction stroke and to provide an adjustable stop for the ball 50. In other words, the plug may be turned within the piston in increments of one-half turns and the pin 48 still registers with the slot 49.

Valve chambers are formed by counterbore 53 which are of larger diameter than the pumping chambers 15—20 and are bored from the end of the cylinder block and coaxial with their respective pumping cylinders. The outlet port 14 is placed in fluid communication with each of the valve chambers 53 by the radial passages 57. These passages 57 are easily formed by drilling from the periphery of the block 12. The drilled passageways are then sealed from the outside by the threaded Allen head plugs 58.

The counterbores are tapped for the major portion of their depth to threadably receive check-valve plug assemblies 60. The assembly includes a ball 61 which is urged to its seated position against the washer 62 by the reaction of spring 63 against the internal surface 64. The spring 63 is held in centered position by embracing the post 65 formed on the plug body 66. An externally threaded ring 67 is threaded into the tapped bore 53 by means of a slot 68 across its outer end. A space is provided between ring 67 and plug body 66 to permit flow of fluid therebetween.

The fluid delivered by the pistons passes the ball check 61, through washer 62, ring 67, passages 57 and out through the common discharge port 14.

With the arrangement as shown in Figure 1, all of the fluid is directed out the common outlet 14 to a single point of utilization. Six pumping piston-cylinder units have been shown although, of course, any number may be used.

In accordance with this invention, means are provided for directing the discharge from any one or more of the pumping chambers to separate sources of utilization.

As shown in Figure 2, the plug assembly has been removed from the valve chamber of chamber 15 and replaced with an isolating valve 70. This valve serves to block the flow of fluid from the pumping chamber 15 to the common outlet 14 and directs it separately from the pump.

A separate isolating valve may be used for each of the pumping chambers so as to give as many separate sources of pressure fluid as there are chambers. Because of the pump construction, the interchange between plug assemblies and isolating valves can be quickly and easily made. At the same time, the cylinder block is easily machined and the entire pump economical to produce.

The isolating valve 70 comprises a sleeve member 71 threadably engaged in the valve chamber 53 and having a head 72 for receiving a wrench. A jam nut 73 holds the sleeve in position and also serves to cause the O ring 74 to seal against leakage. The sleeve has a reduced bore 75 at its inner end against which the check ball 76 abuts to prevent return flow of fluid.

An inner member 77 extends into the sleeve 71 and is threadably engaged therewith at 78. A spring 79 urges ball 76 into sealing position in bore 75, the spring being seated on the shoulder 80 of the inner member. This construction also permits adjustment of the pressure on the spring 79 as well as adjustment of the stop for the ball 76. An annular discharge space 81 exists between member 77 and sleeve 71 and is connected by cross ports 82 to the axial bore 83. A secondary outlet port is provided in the form of a threaded connection 84 for attachment of a discharge conduit, not shown, leading to the secondary source of pressure fluid utilization.

When the pump is used, as shown in Figure 1, all of the output of the pump is directed through the common outlet 14. When separate sources of fluid pressure are desired any number of isolating valves may be easily substituted for the plugs 60, with conventional tools and at a convenient location on the pump.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A hydraulic pump comprising housing means having a plurality of cylinders therein, a piston mounted to reciprocate in each cylinder, means to reciprocate said pistons, said housing means defining a valve chamber in fluid communication with at least one of said cylinders, a common outlet port, said housing defining a passageway placing said valve chamber in fluid communication

with said outlet port, passage means from each of said cylinders to said common port, and an isolating valve including a sleeve insertable in said valve chamber and a portion of said sleeve blocking said passageway from said chamber to said common outlet port and for diverting said fluid from the pump and separately from the common port.

2. In combination with a hydraulic pump having multiple pumping units, each unit having a valve chamber and a passage through which pressure fluid is delivered to a common discharge port, an isolating valve comprising, an externally threaded sleeve for threadable engagement in said chamber for blocking flow to said common port of fluid pumped by the corresponding pumping unit, said sleeve having an inlet bore at one of its ends in fluid communication with the discharge side of the corresponding pumping unit, an inner member extending into said sleeve through the other end thereof and threadably engaged therewith, and a check valve between said bore and said member, said member having an outlet passageway therethrough for the delivery of pressure fluid independently of said common port, and a portion of said sleeve blocking its passage from said chamber to said common outlet port.

3. A hydraulic pump comprising, housing means having an annularly disposed plurality of cylinders therein, a piston mounted to reciprocate in each cylinder, means to reciprocate said pistons, means defining a fluid chamber in communication at one end with said pistons, means defining an outlet port at the other end of each of said pistons, said pistons each having a passageway extending therethrough and communicating with said fluid chamber and with said outlet, a valve housed within each of said passageways, means threadably and adjustably secured in said passageways and having a projecting mechanical stop to limit the ball movement and coacting with each of said valves for resiliently urging the same to closed position, and means for adjusting the pressure of each of said resilient valve urging means and for locking the same in adjusted position.

4. A hydraulic pump comprising housing means having a plurality of cylinders therein, a piston mounted to reciprocate in each cylinder, means to reciprocate said pistons, said housing means defining a valve chamber in fluid communication with at least one of said cylinders, common outlet means including passages in fluid communication with said cylinders, one of said passages also extending to said valve chamber, and an isolating valve insertable in said valve chamber and in fluid blocking engagement with the passage of said chamber for diverting fluid separately from the pump via said isolating valve.

5. The device as defined in claim 4 including a fluid seal between said isolating valve and said housing and located between said common outlet means and the outside of said housing.

6. A hydraulic pump comprising housing means having a plurality of pumping units therein, each unit including a reciprocable piston and means for reciprocating said pistons, a common discharge outlet in said housing means, passageway means in said housing means and placing said units in fluid delivering communication with said common outlet port, and at least one isolating valve including a sleeve insertable in said housing means and in fluid receiving communication with one of said reciprocable pistons and also in fluid blocking position between said one piston and said passageway means whereby the fluid pumped by said one piston is diverted separately through said sleeve and from said pump.

7. A device as defined in claim 6 including a movable outlet check valve element in said sleeve and through which the discharge fluid from said one piston passes.

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