

**July 4, 1961**

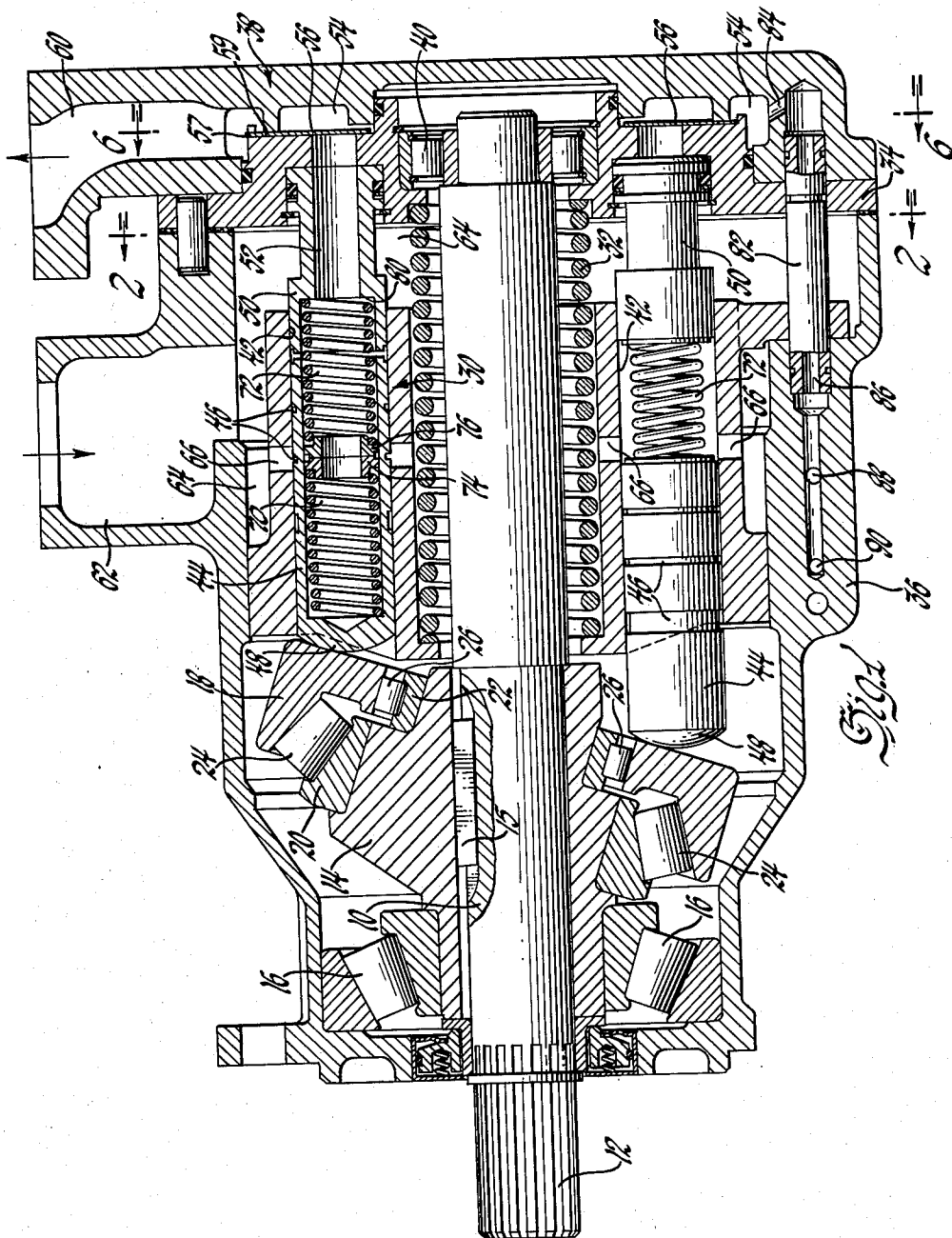
R. M. TUCK ET AL

**2,990,781**

WOBBLE PLATE PUMP

Filed Nov. 25, 1957

3 Sheets-Sheet 1



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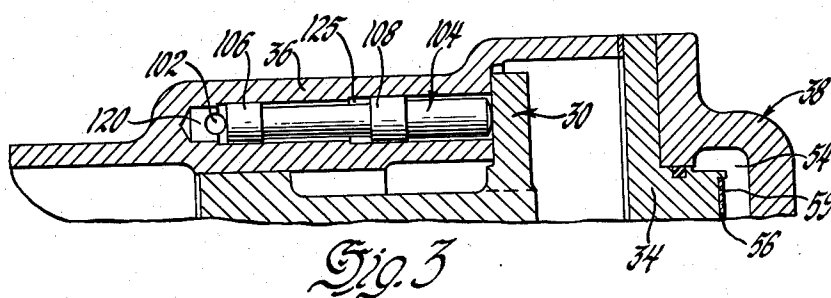
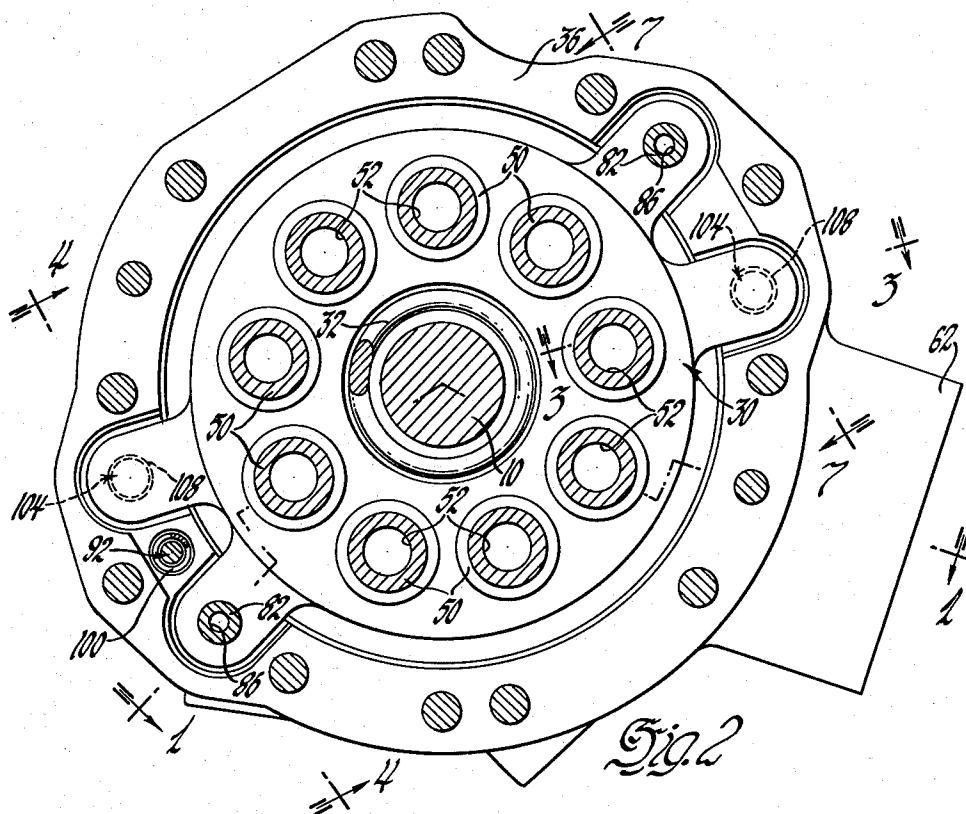
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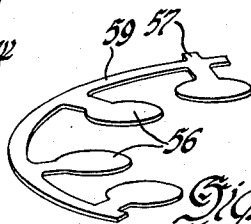
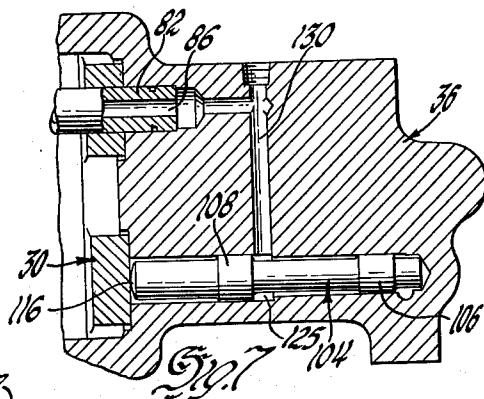
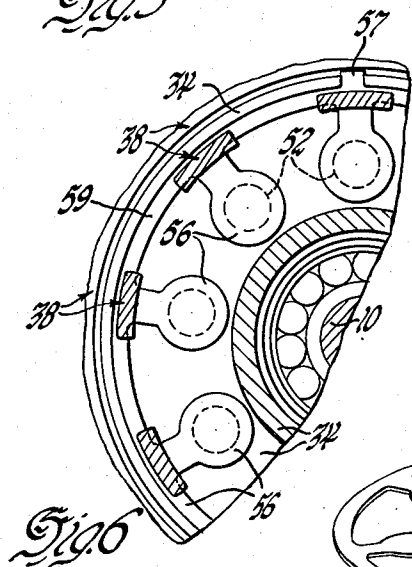
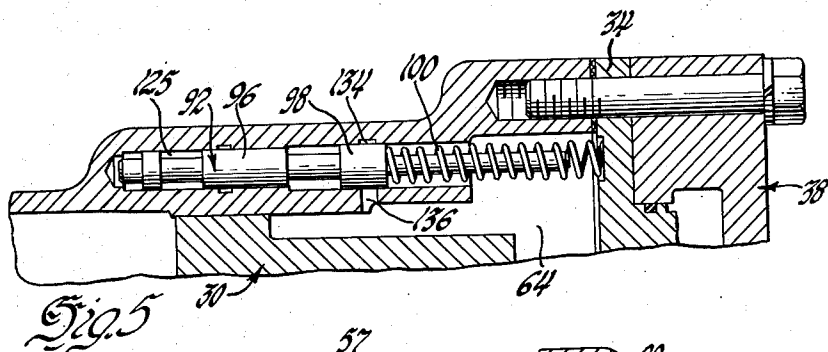
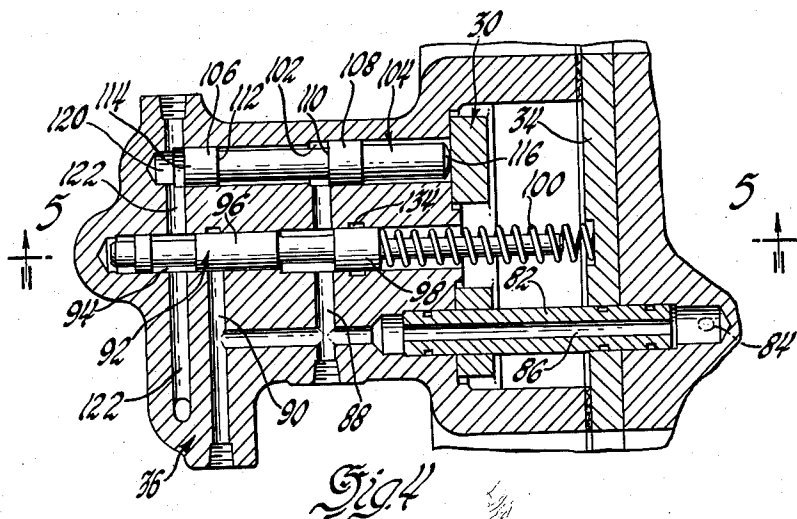
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3 Sheets-Sheet 3



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2,990,781

## WOBBLE PLATE PUMP

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Filed Nov. 25, 1957, Ser. No. 698,648

4 Claims. (Cl. 103—37)

This invention relates generally to fluid pumps and in its most particular aspect concerns a wobble plate pump of novel design and operating characteristics. In such pumps the cylinders and pistons are so arranged that their axes are disposed about and parallel to the axis of the drive shaft, with the pistons in engagement with the wobble plate.

The invention has as a principal object to provide a pump of the type indicated which is simple in construction, yet capable of providing fluid at the high pressure required, for example, in the operation of a dump mechanism or the like associated with a heavy off-the-road vehicle.

Another object is to provide a pump incorporating fluid actuated means whereby the effective displacement of the pump may be varied.

Still other objects and features of the invention will become apparent from the following description of a preferred embodiment thereof. The description will proceed with reference to the accompanying drawings illustrating such embodiment. In the drawings:

FIGURE 1 is a view taken on line 1—1 of FIGURE 2, with certain parts shown broken away or in section;

FIGURE 2 is a section on the line 2—2 in FIGURE 1;

FIGURE 3 is a section on the line 3—3 in FIGURE 2;

FIGURE 4 is a section on the line 4—4 in FIGURE 2;

FIGURE 5 is a section on the line 5—5 in FIGURE 4;

FIGURE 6 is a section on the line 6—6 in FIGURE 1;

FIGURE 6a is a detail perspective view of a valve component; and

FIGURE 7 is a section on the line 7—7 in FIGURE 2.

Referring first to FIGURE 1, the numeral 10 denotes a drive shaft which will be seen as splined at 12, the splines enabling connection of the shaft to the output member of the power source contemplated.

A wobble member 14 shown as secured to the shaft 10 through a key 15 turns in roller bearings 16 and carries a thrust plate 18 spaced from the wobble member by races 20 and 22 for rollers 24 and 26, respectively.

Inward of the wobble member 14 is a cylinder block 30 maintained in its normal position shown by means of a coil spring 32 reacting against a plate 34 disposed between casing members 36 and 38. Plate 34 will be observed as confining a roller bearing 40 for the drive shaft 10.

Within each of the cylinders 42 provided by the block 30 is a piston 44 formed, as is conventional, with annular grooves 46 serving to entrap foreign matter which might interfere with proper operation of the pump. Each piston has a rounded nose portion 48 through which it engages the thrust plate 18.

In addition to the piston, each cylinder 42 partly confines a tubular member 50 disposed in axial alignment with the piston. These tubular members provide fluid conduits 52 extending to a common discharge chamber 54 delineated by casing member 38 and plate 34. Mediate each conduit 52 and the discharge chamber is a valve 56 shown as of the reed or flap type. As shown by FIGS. 6 and 6a the valves 56 are integral with a ring 59 which carries a lug 57, accommodated in a slot in the plate 34, whereby at assembly the valves are located in proper orientation with reference to the conduits 52.

The discharge chamber 54 opens to an outlet port 60.

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Fluid entering the pump via inlet port 62 is received in an inlet chamber 64 common to inlet ports 66 in the cylinder block 30.

Within each cylinder 42 a pair of springs 70, 72, housed by the corresponding piston 44 and tubular member 50, seat against washers 74, 76 respectively. At its end opposite the seat 74, spring 70 reacts against the head of the piston while spring 72 at its end opposite the washer 76 reacts against an annular shoulder 80 formed by the reduction in the diameter of the tubular member 50.

With the arrangement as so far described and illustrated, it should be clear that on rotation of the drive shaft 10 and the wobble member 14 pistons 44, which are held in engagement with the thrust plate 18 by the springs 70 and 72, are caused to reciprocate in the cylinders 42, this action being accompanied by entry of fluid into the cylinders via the inert port 66 and by the discharge of fluid through the conduits 52 past the reed valves 56 into the common discharge chamber 54. In FIGURE 1 the upper piston 44 is in discharge position while the lower piston has just completed its expansion or intake stroke.

To control the operation of the pump there is provided inter alia a bridging sleeve 82 connecting with the discharge chamber 54 via a passage 84. The bore 86 of the sleeve opens to drilled passages 88 and 90 extending to a control valve 92 (FIG. 4) located in a bore 94 in the casing member 36.

Valve 92 comprises lands 96 and 98 and has associated therewith a spring 100 tending to maintain the valve in its shown position. As illustrated, spring 100 reacts against plate 34, the plate being recessed to accommodate the end of the spring.

With the valve 92 in its normal position shown, discharge fluid entering the passage 88 is allowed to pass into a bore 102 confining a plunger 104 comprising lands 106 and 108. These lands provide annular reaction surfaces 110 and 112 and a third reaction surface 114. The rounded nose 116 of the plunger 104 will be seen as bearing against a flange or projection integral with the cylinder block 30, so that when the pressure in the bore 102 between the lands 106 and 108 reaches a predetermined value the plunger is displaced rightwardly to carry the cylinder block in that direction. Such displacement of the cylinder block operates to delay the point in the pumping cycle of each piston at which compression may take place. In other words, the effective stroke of the pistons becomes shortened with corresponding reduction in the output from the cylinders.

When the discharge pressure becomes reduced to a value below the predetermined value the cylinder block 30 is restored to its normal position by the action of spring 32. On the other hand, should the discharge pressure further increase plunger 104 becomes further displaced rightwardly to further shorten the effective stroke of the pistons 44 and, depending on the magnitude of the increased pressure, valve 92 may be shifted rightwardly against the resistance of spring 100 to allow discharge fluid in the passage 90 to enter chamber 120 behind the reaction surface 114. In this way, the effective area of the plunger 104, i.e. the area thereof responsive to the pressure of the discharge fluid, becomes the area of the surface 114 plus the area of the annular surface 110 minus the area of the annular surface 112, whereas prior to the displacement of the valve 92 the effective area of the plunger had been the difference between the areas of annular surfaces 110 and 112.

Passage 122 through which discharge fluid enters chamber 120 leads to a bore 125 (FIG. 3) located diametrically opposite the bore 102 and confining a second plunger 104 which operates in all respects just as the first de-

scribed plunger 104. As illustrated by FIGURE 7, the bore 125 between the lands 106 and 108 is at all times filled with discharge fluid, such fluid, being supplied through a second bridging sleeve 82. Bore 86 of the sleeve 82 (FIG. 7) will be seen as communicating with the bore 125 through a drill passage 130.

On the foregoing it should be understood that the two plungers 104 act simultaneously and conjointly to displace the cylinder block 30 as governed by the discharge pressure, both plungers being under the control of the valve 92 (FIGURES 4 and 5).

Only one stage of displacement of the control valve 92 has been described, this being the condition when passage 90 becomes open to passage 122 leading to the chamber 120. Should the discharge pressure now still further increase with the valve 92 in the indicated position, the valve will be shifted further rightwardly so that passage 88 and an annular channel 134 become interconnected allowing the discharge fluid to enter the intake chamber 64 via a short passage 136 extending radially of the channel 134. Thus, valve 92 acts not only to regulate or control the flow of discharge fluid to the chambers 120 but also as a relief valve.

What is claimed is:

1. In a pump comprising a housing, a drive shaft received within said housing, a wobble plate carried by said shaft, and a plurality of radially arranged pistons disposed with their axes paralleling that of said drive shaft and having portions in engagement at all times with said wobble plate, the combination of a slidable member providing cylinders for said pistons, said member having therein a plurality of inlet ports opening radially to the cylinders intermediate the ends thereof, means associated with said member tending normally to maintain it in a predetermined position, and a pair of plungers carried by said housing in diametrically opposed relation and abutting said member, said plungers being subject to the pressure of the fluid discharged by the pump and serving when such pressure reaches a predetermined value to axially displace said member to change the positions of said ports relative to said pistons thereby to reduce the output of the pump by delaying the point in the pumping cycle of each cylinder at which compression may take place.

2. A pump as defined by claim 1 further comprising a valve carried in said housing to control flow of discharge

fluid to said plungers, said valve serving additionally as a relief valve.

3. In a pump comprising a housing, a drive shaft received within said housing, a wobble plate carried by said shaft, and a plurality of radially arranged pistons disposed with their axes paralleling that of said drive shaft and having portions maintained in engagement with said wobble plate, the combination of a partition within said housing at one end thereof and serving with said housing to provide a discharge chamber, a slidable block providing cylinders for said pistons and having therein a plurality of inlet ports corresponding in number to the number of said cylinders, such ports opening radially to the cylinders intermediate the ends thereof, yieldable means reacting against said housing through said partition and urging said block in a direction toward said wobble plate, means including a plurality of passages in said partition for conveying fluid from said cylinders to said discharge chamber, valve means in said passages, and a pair of plungers carried by said housing in diametrically opposed relation and abutting said block, said plungers being subject to the pressure of the fluid discharged by the pump and serving when said pressure reaches a predetermined value to axially displace said block to change the positions of said ports relative to said pistons thereby to reduce the output of the pump by delaying the point in the pumping cycle of each cylinder at which compression may take place.

4. A pump as defined by claim 3 further comprising a valve carried in said housing to control flow of discharge fluid to said plungers, said valve serving additionally as a relief valve.

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