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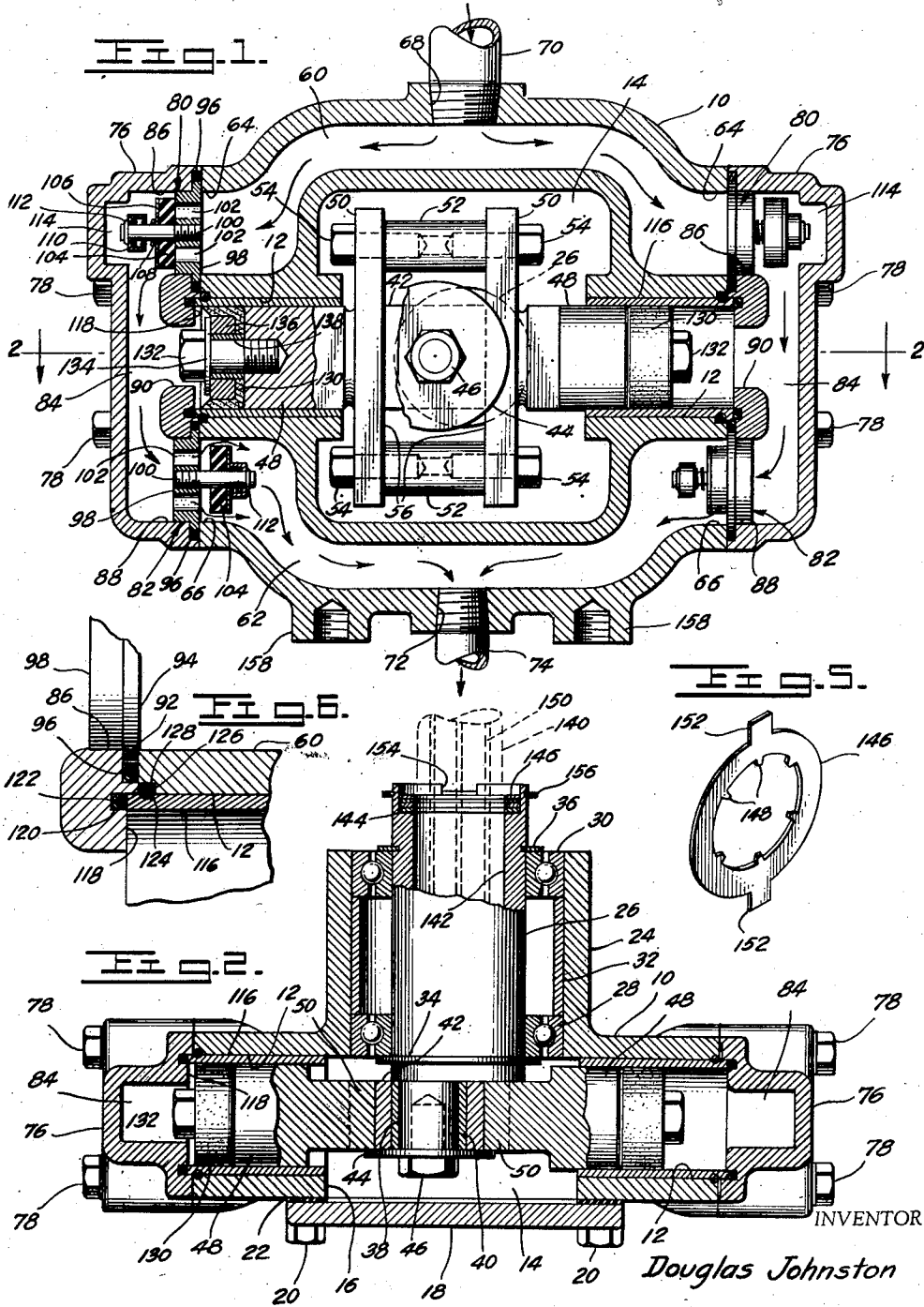
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TWIN CYLINDER SPRAY PUMP

Filed June 11, 1952

2 Sheets-Sheet 1



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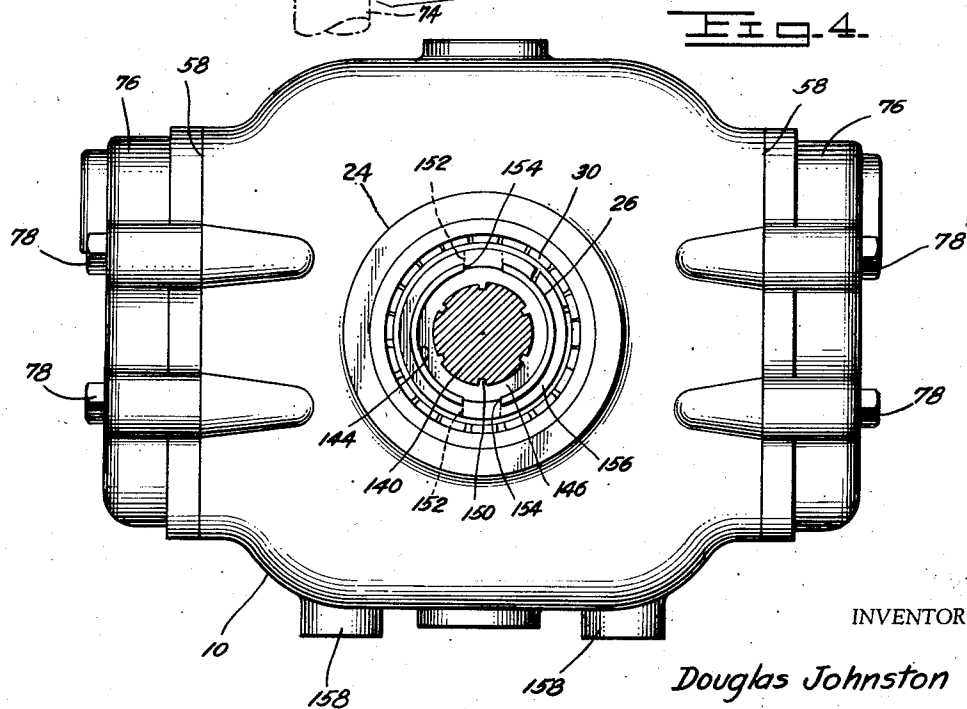
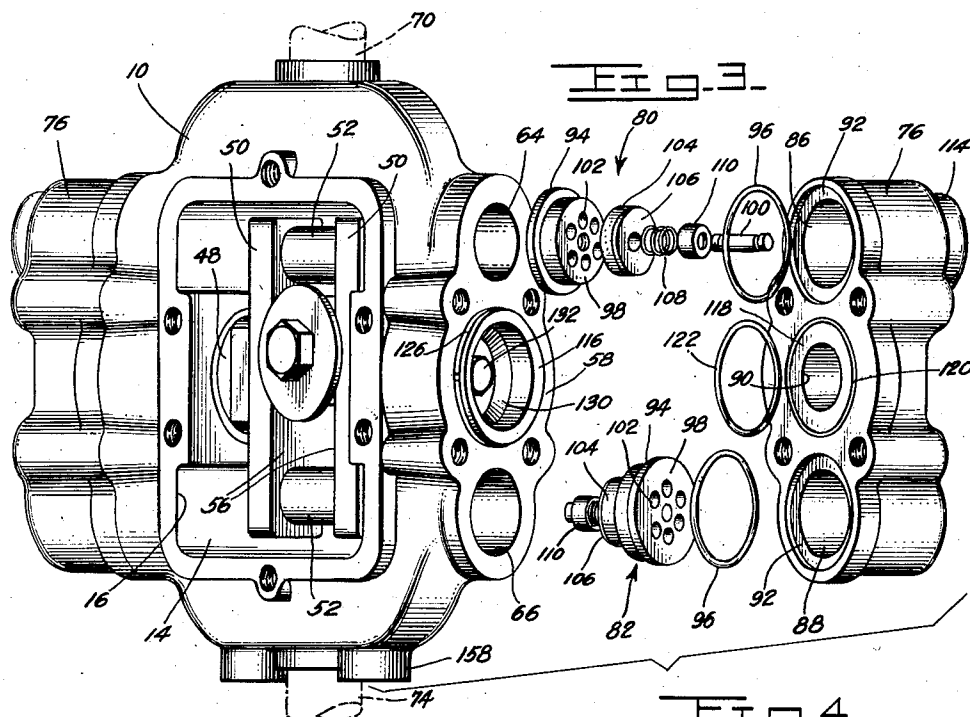
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TWIN CYLINDER SPRAY PUMP

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3 Claims. (Cl. 103—153)

This invention relates to reciprocating piston pumps, and more particularly to a single-acting pump of the opposed twin cylinder type which is especially adapted to be directly connected to a splined power takeoff shaft on a tractor for farm use in the high pressure pumping of insecticides and the like.

Pumps of this general nature are known, but are usually relatively large and complicated with resulting increase in manufacturing expense and difficulty in servicing. Moreover, pumps of this nature are not easily directly connectable to the power takeoff shaft of a tractor.

Accordingly, it is an object of this invention to provide a reciprocating piston pump of the single-acting opposed twin cylinder type that is compact, efficient, and involves a minimum of parts.

It is another object of this invention to provide a pump of the type described that is easily serviceable and in which the pump valves are readily removable from the pump for replacement or repair.

It is another object of this invention to provide a pump of the type described with improved cylinder head seals.

It is a further object of this invention to provide a pump of the type described with improved and simplified means for directly connecting such pump to various sizes of splined power takeoff shafts of tractors.

Other objects and advantages of the invention will be apparent from the following description and accompanying drawings, in which:

Figure 1 is a vertical sectional view through a pump embodying this invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a perspective partially exploded view of the pump shown in Figure 1 with the crank case cover removed therefrom.

Figure 4 is a plan view of the pump taken from the drive shaft side thereof.

Figure 5 is a perspective view of one of the replaceable annular members employed for connecting the pump to the splined power takeoff shaft of a tractor.

Figure 6 is an enlarged fragmentary view of certain portions of the pump as shown in Figure 1.

Referring now to the drawings, there is illustrated a pump of the double-acting, opposed twin cylinder type. The pump has a cylinder block 10 forming twin opposed open-ended cylinders 12 having an enclosed crank case 14 therebetween. One side of the crank case 14 has an access opening 16 that normally is covered by a closure plate 18 detachably connected to the cylinder block 10, as by machine screws 20, with an appropriate sealing gasket 22 (Figure 2) interposed therebetween. That side of the cylinder block 10 opposite the closure plate 18 is provided with a cylindrical tubular extension 24 within which a stub shaft 26 is rotatably mounted in inner and outer oil-tight anti-friction bearing assemblies 28 and 30, respectively. A spacer sleeve 32 snugly disposed in the extension 24 separates the bearing assemblies 28 and 30, while the stub shaft 26 is held against axial move-

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ment in the latter by inner and outer split rings 34 and 36, respectively, disposed in appropriate circumferential grooves in the shaft and engaged against the inner side of the inner bearing assembly 28 and the outer side of the outer bearing assembly 30, respectively.

The inner end of the stub shaft 26 is provided with an eccentric crank pin 38 upon which is journaled, by a bearing bushing 40, a slide block 42. The block 42 is retained upon the pin 38 by a washer 44 that is secured on the end of the pin by a machine screw 46. Mounted for reciprocation within each of the cylinders 12 is a piston 48, the inner end of each of which is provided with an integral cross bar 50. The opposed ends of the cross bars 50 are bridged by spacer elements 52 which are detachably connected to the bars by machine screws 54 projecting through clearance apertures in the bars and threaded into the opposite ends of the spacer elements. This construction provides a slideway 56 for the slide block 42, whereby rotation of the stub shaft 26 imparts reciprocating motion to the pistons 48 in the cylinders 12. When the pump is in use, the crank case 14 preferably contains oil which may be introduced and drained through appropriate plug-closed draining and filling holes (not shown) in the closure plate 18.

The opposite ends 58 of the cylinder block 10 preferably are substantially flat, as best shown in Figure 3, and have the outer end of the corresponding cylinder 12 opening directly through such end. Formed within the cylinder block 10 is a suction passageway 60 and a discharge passageway 62, the opposite ends of each of which terminate in ports 64 and 66, respectively, in the flat end faces 58 of the cylinder block. The ports 64 and 66 are preferably so located that they are arranged in a line with the open end of the corresponding cylinder 12. Intermediate its ends, the suction passageway 60 is provided with an interiorly threaded port 68 for direct connection of an inlet pipe 70 thereto, while the discharge passageway 62 has a like interiorly threaded port 72 for the direct connection of an outlet pipe 74 thereto.

Mounted on each of the flat end faces 58 of the cylinder block 10 is a cylinder head 76, detachably secured thereto as by machine screws 78. Since each of the cylinder heads 76, and their associated pump valves 80 and 82, is identical, a description of one will suffice for both. The cylinder head 76 is hollow to provide a chamber 84 therein having three ports 86, 88, and 90 aligned, respectively, with the two ports 64 and 66 and the open end of the cylinder 12 in the flat end face 58 of the cylinder block 10. Each of the two end ports 86 and 88 in the cylinder head 76 is provided with an annular recess 92 (Figure 6) within which is disposed a circumferential flange 94 on the corresponding check valve 80 or 82, so that the check valve is clamped between the cylinder head 76 and the cylinder block 10. Each recess 92 is of greater diameter than the diameter of the corresponding valve flange 94, to provide an annular space therebetween. Disposed in this space is an O-ring packing 96, preferably formed of rubber or the like. The depth of the recess 92 is somewhat less than the diameter of the O-ring 96 in radial section, as best shown in Figure 6, so that such ring is slightly compressed between the cylinder head 76 and the cylinder block 10 to thereby provide an effective seal that prevents fluid from leaking between the cylinder head and the cylinder block when passing through the cylinder head ports 86 and 88. The present common usage of O-ring packings renders it unnecessary to describe the same in greater detail.

The two valves 80 and 82, thus clamped in place, are substantially identical, save that the valve 80 serves as an inlet or suction check valve, while the valve 82 serves as an outlet or discharge check valve, so that their positions with respect to the suction and discharge passage-

ways 60 and 62 are, of course, reversed. Each valve 80 and 82 consists of a disc-like multi-ported member 98 having an axial stud 100 threaded therein. Slidably mounted on each stud 100 to engage and cover the ports 102 in the member 98 is a valve washer 104 backed by a metallic reinforcing disc 106. Each washer 104 is urged into closing position by a coil compression spring 108 encircling the stud 100 and interposed between the washer 104 and a small cap 110 which is retained on the stud by a split ring 112 fitting in an appropriate annular groove at the outer end of the stud.

Since the studs 100 of the inlet check valves 80 project into the cylinder head chambers 84, such chambers are appropriately enlarged, as at 114, to accommodate the studs and spring caps 110. The studs 100 of the outlet check valves 82 project into the terminal ends of the discharge passageway 62 in the cylinder block 10, so that enlargements of the chambers 84 are unnecessary at this end of the cylinder heads 76.

The cylinders 12 preferably are each provided with a liner 116 which extends somewhat outwardly beyond the flat end face 58 of the cylinder block 10. The corresponding cylinder head 76 is appropriately recessed, as at 118, to accommodate the projecting end of the liner 116. The cylinder head 76 is also provided with an annular groove 120 in alignment with the end of the liner 116. Disposed in this groove 120 is an O-ring packing 122, similar to those heretofore described, and of somewhat greater diameter in radial section than the depth of the annular groove, as best shown in Figure 6, so that such O-ring is slightly compressed between the bottom wall of the groove and the end of the cylinder liner 116. Hence, this O-ring 122 prevents fluid from leaking between the cylinder block 10 and the corresponding cylinder head 76 when passing through the port 90 and open end of the cylinder 12.

The use of the O-ring seals 96 and 122 for preventing leakage between the cylinder block 10 and the cylinder head 76 has been found to be particularly effective in this construction. When a conventional flat gasket type of seal (not shown) is used between the cylinder head and the cylinder block, it has been found that the impact and shock caused by the rapid opening and the rapid closing of the inlet and outlet check valves 80 and 82 quickly cut through a flat gasket and caused failure of the same, so that leakage soon results when a gasket of this nature is used. Since O-rings, however, effect seals principally by the exertion of fluid pressure thereagainst, and not by mechanical compression of the same, the repeated shocks of the pump valves not only are not imparted directly to the O-rings 96 and 122, but also do not detrimentally affect the sealing action of the O-rings.

Adjacent its outer end, each liner 116 is provided with an exterior circumferential groove 124 in which is mounted a split ring 126 that is received in an annular recess 128 in the flat outer end 58 of the cylinder block 10, as best shown in Figures 1, 2, and 6. This split ring 126 prevents axial displacement of the liner 116 into the crank case 14, while the engagement of the O-ring 122 with the outer end of the liner prevents axial displacement of the liner outwardly of the cylinder 12.

The outer end of each piston 48 has a conventional flexible cup washer 130 secured thereto by a headed machine screw 132 having a circumferential flange 134 at the base of its head. Disposed within the cup washer 130 is an annular yieldable member 136, preferably of neoprene, or the like. This member 136 is engaged and compressed by the flange 134 on the machine screw 132, in order to maintain the cup washer 130 constantly expanded firmly against the interior surface of the cylinder liner 116. A bushing 138, preferably is mounted on the screw 132 between the flange 134 and the outer end of the piston 48 in order to prevent excessive compression of the yieldable annular member 136 and thereby excessive expansion of the cup washer 130.

The operation of the pump when the shaft 26 is rotated is believed to be obvious, so no detailed explanation thereof is necessary. It will be seen, however, that the construction shown and described greatly facilitates servicing the pump. Merely by removing the four machine screws 78 which fasten a cylindrical head 76 to the block 10, access is provided to the outer end of the piston 12, its cup washer 130, and to the valves 80 and 82. Additionally, the unitary construction of such valves 80 and 82 renders their replacement an extremely simple operation. Furthermore, by clamping the valves in place by the cylinder head, possible points of leakage are minimized.

The pump, in use, is adapted to be directly connected to the splined end of a power takeoff shaft 140 on a tractor (not shown). The diameter of the splined end of such power takeoff shafts varies considerably between different makes of tractors, so that it is desirable to provide the pump with means whereby these different sizes of power takeoff shafts readily can be accommodated. Additionally, the machining of splines on the interior of tubular shafts is relatively expensive, so that in addition to the above accommodating feature, it is desirable to provide simple and inexpensive means for connecting the pump to the power takeoff shaft 140.

For this purpose, the outer end of the stub shaft 26 is provided with a coaxial cylindrical recess or bore 142 (closed at its inner end) for receiving the splined end of the power takeoff shaft 140. Preferably, the diameter of the recess 142 is only slightly greater than the diameter of the power takeoff shaft 140. The outer end of the recess 142 is provided with a counterbore 144 within which are stacked a plurality of washer-like elements 146, each having an inner diameter slightly greater than the diameter of the power takeoff shaft 140 and having an outer diameter equal to the inner diameter of the counterbore. Each washer-like element 146 is provided with a plurality of inwardly-directed key projections 148 (Figure 5) for interfitting engagement in the splines 150 of the power takeoff shaft 140. Each washer-like element 146 also is provided with one or more (two diametrically disposed, as shown in the drawings) radially-outwardly extending ears 152 which project through and extend somewhat beyond corresponding slots 154 through the side walls of the counterbore 144.

At its outer end, the stub shaft 26 is provided with an exterior circumferential groove within which is disposed a split ring 156 in overlying and retaining engagement with projecting ears 152 of the washerlike elements 146 in order to maintain the latter within the counterbore 144.

By means of this arrangement, it clearly will be seen that the stub shaft 26 is connected to the power takeoff shaft 140 for driven engagement thereby. Additionally, it clearly will be seen that if a power takeoff shaft is of less diameter than that of the shaft 140 illustrated, the elements 146 shown may be replaced by a plurality of washer-like elements having inner diameters corresponding to the lesser diameter of the shaft to which the pump is to be connected in order to effect such connection. Therefore, there is provided readily available, simple, and effective means for directly connecting the pump to substantially any size splined power takeoff shaft of a tractor.

In the event that the diameter of a tractor power takeoff shaft is substantially less than the inner diameter of the cylindrical recess 142 in the stub shaft 26, it may be desirable to dispose a bushing-like sleeve (not shown) within the recess inwardly of the counterbore 144, such sleeve snugly fitting both the power takeoff shaft and the recess. This construction obviously will prevent looseness of the power takeoff shaft within the stub shaft 26 to thereby eliminate any possibility of wobbling therebetween and vibration in the connection.

At one side, for example, adjacent the outlet connection of the pump, the cylinder block 10 may be

provided with interiorly threaded bosses 158 for connection of an appropriate supporting bracket (not shown) therein, the bracket also being adapted to be attached to the tractor. Such bracket, of course, is necessary to prevent rotation of the entire pump on the end of the power takeoff shaft 140 to prevent transmission of such rotational forces to the inlet and outlet pipes 70 and 74 of the pump, and to retain the stub shaft 26 in driven engagement with the power takeoff shaft.

It thus will be seen that the objects of this invention have been fully and effectively accomplished by a compact, easily serviceable pump which embodies a minimum of parts. It will be realized, however, that the specific embodiment of this invention illustrated and described for disclosing the principles thereof is susceptible of change without departing from such principles. Therefore, this invention includes all modifications encompassed by the spirit and scope of the following claims.

I claim:

1. In a pump the combination comprising: a cylinder block forming an open-ended cylinder for reciprocation of a piston therein, said block having suction and discharge passageways therein each having a terminal end opening to the exterior of said block adjacent an open end of said cylinder; means defining an annular recess in said block at said cylinder open end; a liner for said cylinder having a circumferential groove therein aligned with said block recess; a split ring disposed in said groove and recess; a cylinder head detachably connected to said block and covering said cylinder open end and said passageway ends and engaging said ring, said head having a chamber therein provided with ports aligned with said cylinder open end and said passageway ends; inlet and outlet check valves for said passageways; means defining an annular groove in said head aligned with the opposed end of said liner; and an O-ring packing disposed in said groove in engagement with said liner end.

2. In a pump the combination comprising: a cylinder block forming an open-ended cylinder for reciprocation of a piston therein, said block having suction and discharge passageways therein each having a terminal end opening to the exterior of said block adjacent an open end of said cylinder; a cylinder head detachably connected to said block and covering said cylinder open end and said passageway ends, said head having a chamber therein provided with ports aligned with said cylinder open end and said passageway ends; inlet and outlet check valves at said passageway terminal ends, each

of said valves comprising a unitary assembly having a ported member forming a seat and provided with a peripheral flange clamped between said block and head; means defining an annular groove between said block and head at each of said passageway ends, said grooves being of greater diameter than and receiving the corresponding valve member flange; and an O-ring packing disposed in each of said grooves in sealing engagement with said block and head and the periphery of the corresponding valve flange.

3. In a pump the combination comprising: a cylinder block forming an open-ended cylinder for reciprocation of a piston therein, said block having suction and discharge passageways therein each having a terminal end opening to the exterior of said block adjacent an open end of said cylinder; a cylinder head detachably connected to said block and covering said cylinder open end and said passageway ends, said head having a chamber therein provided with ports aligned with said cylinder open end and said passageway ends; means defining an annular recess between said block and head at each of said passageway ends; inlet and outlet check valves at said suction and discharge passageway terminal ends, respectively, each of said valves having a circumferential flange of smaller diameter than the corresponding recess, disposed therein, and clamped between said head and said block; and an O-ring packing disposed between the periphery of each of said flanges and the outer wall of their corresponding recesses.

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