Aug. 14, 1951 R. M. MAGNUSON 2,563,949

CYLINDER CONSTRUCTION

Filed Sept. 14, 1946 2 Sheets-Sheet 1

FIG_1_

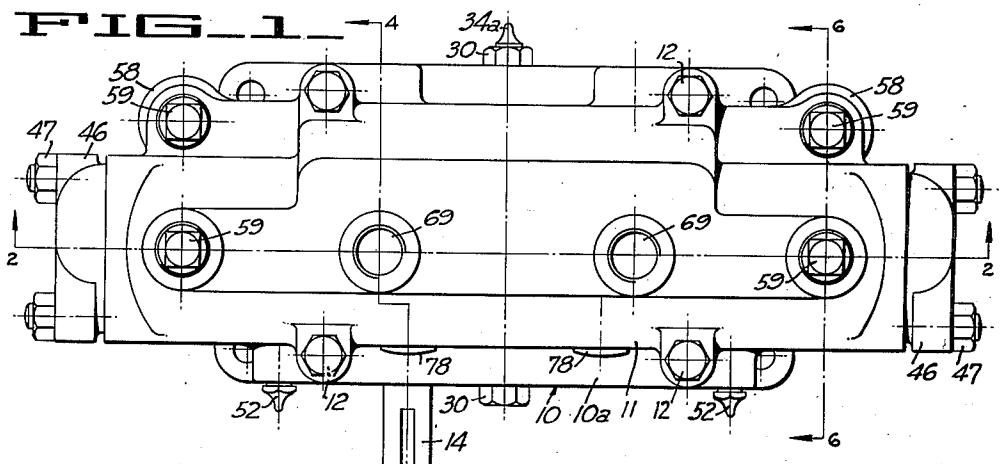


FIG_2_

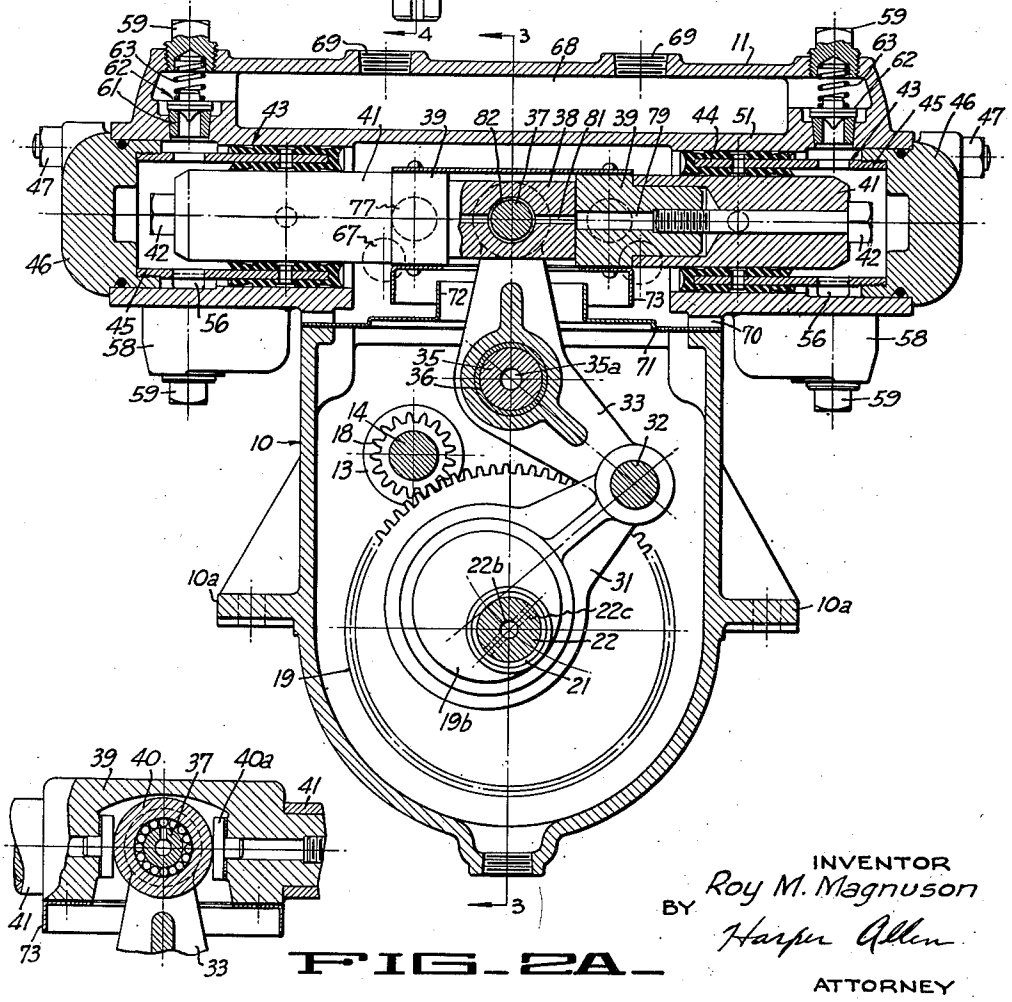


FIG_2A_

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FIG_4_

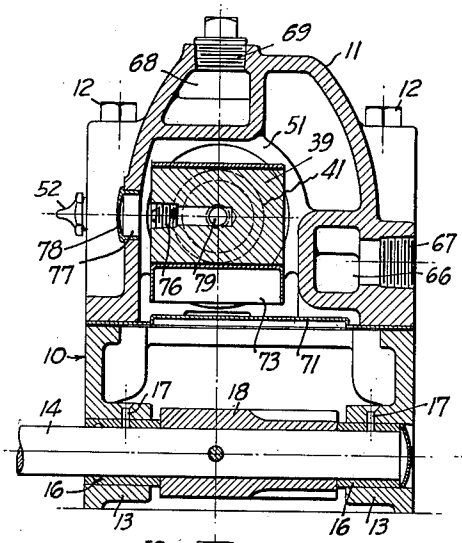


FIG_3_

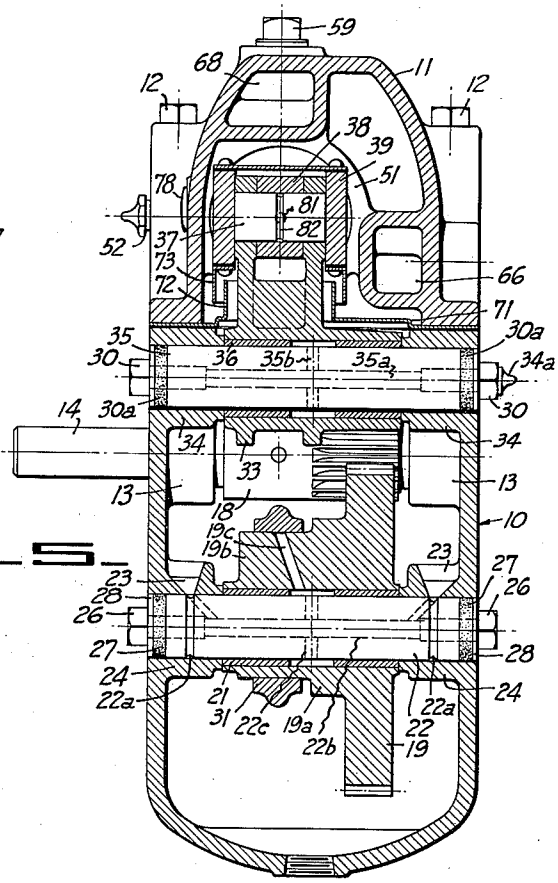


FIG_5_

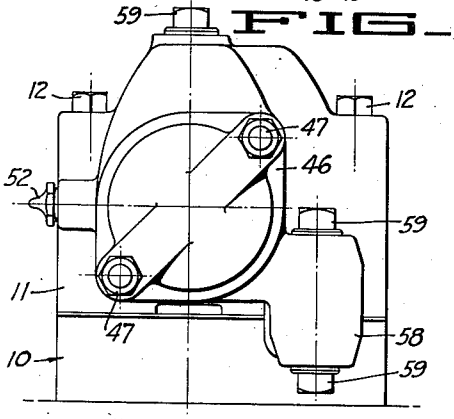


FIG_7_

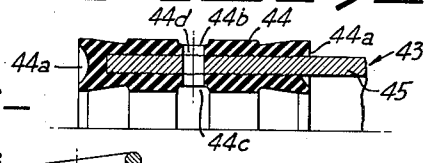
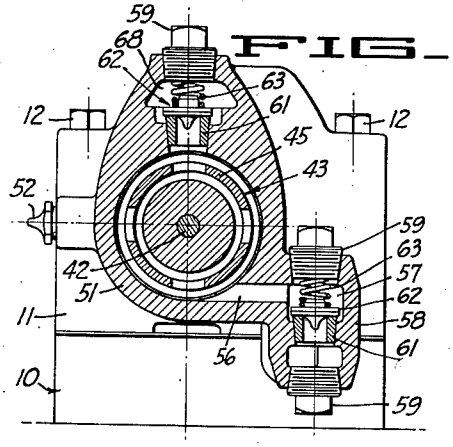


FIG_6_



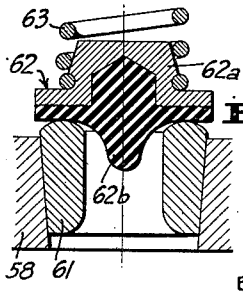


FIG_8

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UNITED STATES PATENT OFFICE

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CYLINDER CONSTRUCTION

Roy M. Magnuson, Campbell, Calif.

Application September 14, 1946, Serial No. 697,066

9 Claims. (Cl. 309—3)

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This invention relates to pumps and is concerned more particularly with pumps of the reciprocating type employing a piston especially adapted for high pressure operation with liquids containing abrasives.

It is a general object of the invention to provide an improved piston-type pump.

Another object of the invention is to provide an improved pump of the above character for use with abrasive-containing liquids.

A further object of the invention is to provide a pump of the above character having a quick replaceable pump packing.

Another object of the invention is to provide for lubrication of a pump packing of the type employing pressure sealing end faces.

Another object of the invention is to provide a pump of the above character in which the mechanical drive portion of the pump is shielded from leakage fluid of the hydraulic portion thereof.

A further object of the invention is to provide a hydraulic assembly of a piston pump which can be disassembled readily for cleaning.

Another object of the invention is to provide a pump of the opposed piston type in which the drive is transmitted to a pair of opposed pistons in a simple and advantageous manner.

Another object of the invention is to provide improved means for preventing contamination of the lubricating oil of a pump drive mechanism by the liquid being pumped.

A further object of the invention is to provide an improved check valve construction for the pump.

A further object of the invention is to provide an improved pump packing unit which is supported independently of the piston and the cylinder of the pump.

Other objects and advantages of the invention will be apparent from the following description of a preferred embodiment as illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of the pump.

Figure 2 is a vertical sectional view taken as indicated by the line 2—2 in Figure 1.

Figure 2-A is a fragmentary sectional view of a modified form of drive transmitting connection between the operating bellcrank and the opposed pistons of the pump.

Figure 3 is a vertical transverse sectional view of the pump taken as indicated by the line 3—3 in Figure 2.

Figure 4 is a fragmentary sectional view of the pump taken in planes indicated in line 4—4 in Figure 1.

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Figure 5 is an end elevational view of the upper or hydraulic portion of the pump.

Figure 6 is a fragmentary sectional view taken as indicated by the line 6—6 in Figure 1.

Figure 7 is a fragmentary sectional view showing an enlargement portion of the pump packing.

Figure 8 is an enlarged sectional view of the check valve and its mounting.

Referring to the drawings, the pump includes a crankcase 10 of cast construction which houses the pump drive mechanism and a cylinder case 11 of cast construction which houses the hydraulic mechanism and which is secured on the crankcase by four cap screws 12. The crankcase 10 (Figures 2, 3 and 4) is provided with opposite bosses 13 in which a drive shaft 14 is journalled by means of sleeve bearings 16. The bosses 13 are apertured at 17 for admission of splashed oil to the bearings. Between the bearings 16 a drive pinion 18 is pinned or otherwise secured on the shaft 14. The drive pinion 18 (Figures 2 and 3) meshes with a drive gear 19 whose integrally formed hub 19*a* is journalled by sleeve bearings 21 on a supporting shaft 22 which is secured in bosses 24 of the crankcase. The shaft 22 is grooved adjacent its ends at 22*a* to register with oil receiving pockets 23 in the bosses 24. The shaft 22 is threaded at each end to receive a cap screw 26 which serves to secure in place and tighten a rubber securing and sealing ring or washer 27 by means of a metallic washer 28. The sealing ring 27 is expanded for pressure engagement within the apertured boss 24 to effect a tight seal and frictionally hold the shaft 22 against rotative and endwise displacement. The shaft 22 is apertured axially at 22*b* and radially at 22*c* for feeding of lubricant to the bearings 21.

The drive from the drive gear 19 (Figures 2 and 3) is transmitted by means of an eccentric 19*b* formed integrally with the gear 19 and its hub 19*a*. Engaged about the eccentric 19*b* is an eccentric follower 31 which is lubricated through a passage 19*c* in the eccentric 19*b*. The eccentric follower 31 (Figure 2) is connected by a pivot pin 32 to a bellcrank drive element 33 which is mounted on a shaft 35 secured within opposed bosses 34 of the crankcase by securing nuts 30 and sealing and securing rings 30*a* similar to the nuts 26 and rings 27 previously referred to. In this case the right-hand nut 30, as viewed in Figure 3, is provided with a lubricant fitting 34*a* for introduction of lubricant into the axial passages 35*a* and the radial passages 35*b* and to the sleeve bearings 36 which journal the bellcrank 33 on the shaft 35.

The upper arm of the bellcrank 33 (Figures 2 and 3) carries a wrist pin 37 which is secured within transverse aligned apertures of a crosshead drive block 38 which is slidably disposed within an opening of a crosshead 39. The respective pistons are recessed to engage over and seat on respective cylindrical end extensions of the crosshead 39 to which they are secured by cap screws 42 which extend through central bores of the piston and have threaded engagement with the crosshead. If desired, the central bores of the pistons may be threaded to facilitate removal thereof from the crosshead.

Each of the pistons 41 (Figures 2 and 7) is slidably disposed within a packing member 43 including a cylindrical packing portion 44 of suitable oil and acid resistant rubber, such as synthetic rubber, bonded on a sleeve 45 which is provided with roughened or knurled outer and inner surfaces at one end to insure a firm bond. The sleeve 45 is threaded at its other end for engagement within a threaded portion of a cylinder head or closure 46 secured on the cylinder case 11 by suitable bolts 47 and with a suitable sealing ring interposed. There are two bolts in number for each head 46 as seen in Figure 5. Adjacent its threaded end, the sleeve 45 is provided with a suitable array of liquid transmitting holes. The packing element or portion 44, as seen clearly in Figure 7, is provided with a cup-faced end surface 44*a* at each end thereof to provide annular sets of opposite pressure-responsive sealing lips. The packing portion 44 is also provided with annular tapering recesses adjacent each end face 44*a*, and with centrally located outer and inner annular recesses 44*b* and 44*c*. The outer and inner annular recesses 44*b* and 44*c* are joined by a series of radial apertures 44*d* which extend through the sleeve 45. Preferably, the central or bearing surfaces of the packing portion 44 at either side of the annular recesses 44*b* and 44*c* are formed of resilient material of a harder type than the end or sealing surfaces 44*a*. The packing 44 fits within the cylinder wall 51 which at one side is apertured to receive a lubricant fitting 52 (Figures 1 and 4) so that lubricant can be introduced into the annular recesses 44*b* and 44*c* for lubrication of the packing.

Each cylinder space of the cylinder case 11 is provided with an inlet passage 56 (Figure 6) which leads to a check valve chamber 57 formed in a boss 58 in the casting and having the end openings therein closed by plugs 59. The reduced diameter within the boss 58 provides a tapered mounting or seat for a tapered annular valve seat member 61 of stainless steel or other suitable material having a rounded upper end surface on which a poppet valve 62 is seated normally under the urgency of a spring 63. As seen more clearly in Figure 8, the valve 62 is formed of a metal body member 62*a* having a central turned portion to receive the spring 63 with an annular spring seat at the base of the turned portion within which the end coil of the spring 63 engages. The spring 63 is seated at its other end in a recess of the adjacent plug 59 and serves to center the valve 62 on the valve seat 61 as well as to urge the valve against the seat. The valve 62 also includes a rubber facing or portion 62*b* which is bonded to a knurled face of the body portion 62*a* and also within a central recess therein. To guide the flow of liquid the rubber portion 62*b* is provided with a central conically shaped projection or tip which extends down within the valve seat 61 and is of streamlined contour to provide a smoothly and uniformly directed flow of liquid past the valve when it is lifted from the seat.

Each inlet check valve chamber 57 (Figures 2, 3 and 4) communicates below its valve 62 with a longitudinally extending intake passage 66 by means of which liquid can be introduced through one or more of a pair of tapped openings 67 leading to the passage 66. This passage 66 is common to both of the piston and cylinder arrangements of the pump.

To provide for discharge of liquid from each of the cylinders, a discharge passage 68 (Figures 2 and 3) is provided to which each of the cylinders has communication through a check valve 62 of the construction and previously described in connection with the intake check valve. The discharge passage or chamber 68 is provided with a pair of tapped outlet openings 69.

It will be noted with reference to Figures 2 and 3 that the crank case 10 is provided with oppositely disposed mounting pads 10*a* by means of which the pump is mounted in upright position, and means is provided for shielding the crankcase from leakage fluid from the hydraulic system so that the oil in the crankcase 10 will not be contaminated. The top of the crankcase 10 is provided with a sheetmetal cover 71 having an upturned baffle wall or shield 72 disposed about the upright arm of the bellcrank 33 and elongated in the direction of movement of the bellcrank. Cooperating with the shield 72 is a depending baffle or shield 73 secured beneath the crosshead 39 and freely telescoping or overlapping the shield 72 so that any drainage liquid from the hydraulic system is effectively baffled against entry within crankcase 10 by virtue of the tortuous path it would have to follow around the shields 73 and 72. Drainage liquid from the hydraulic system falls onto the cover 71 and is discharged through one or more drainage openings 70 (Figure 2).

To provide for lubrication of the crosshead block 38 in its relative movement with respect to both the wrist pin 37 and the crosshead 39, the crosshead 39 is provided with a recessed lubricant fitting 76 (Figure 4) adapted for alignment with an opening 77 in the cylinder case 11. The opening 77 normally is closed by a spring cap 78. The lubricant fitting 76 communicates with a passage 79 (Figures 2 and 4) within the crosshead 39 which in turn is continuously in communication with a passage 81 in the crosshead 38. The two sections of this passage 81 communicate with an annular passage 82 formed in the wrist pin 37.

In operation of the above pump, upon transmission of a drive to the drive pinion 18 and the drive gear 19, each piston 41 is operative during its suction stroke to draw liquid into the associated cylinder past its intake check valve 62 and then, upon the pressure stroke, to effect discharge of this liquid past its discharge valve 62. It will be noted that the cylinders alternately load and unload. In the dead center position of parts shown in Figure 2 the axis of the wrist pin 37 is slightly above the longitudinal axis of the pistons, and, at the end of its movement in either direction, the wrist pin axis moves slightly below the piston axis by an equal amount. This amount of movement is insufficient to interrupt lubrication between the lubricant passages 79 and 81.

During the suction stroke of a piston the cup-

faced end 44a of the packing element 44 remote from the sleeve 45 expands under atmospheric pressure to press the annular lips against the piston and cylinder wall, respectively, and prevent introduction of air into the cylinder. Upon the pressure stroke, the cup-faced end of the packing which is interrupted by the sleeve 45 is flattened out so that its lips prevent leakage of liquid during such pressure stroke.

It will be noted that the above replaceable packing construction provides for removal of the packing (by removing the two bolts 47) with the head 46. Then by unscrewing the sleeve 45 from the head 46 and replacing the worn packing assembly with a new one, the reverse operations can be performed to install the new packing and cylinder head.

The above pump construction is especially useful in high pressure handling of abrasive liquids, such as spray liquids for use against insect pests.

Figure 2–A shows a modified form of drive connection between the crosshead 39 and the operating bellcrank 33 therefor. In this construction, the wrist pin 37 carries a roller or ball bearing 40 which is interposed between a pair of hardened buttons 40a, and the buttons 40a are mounted preferably in offset or eccentric relation to the bearing 40. In this way the bearing will impart an oscillatory or rotative movement to the buttons to distribute the wear. If desired, one or more of the buttons 40a may be provided with a lubricant passage (not shown). The buttons 40a may also be employed in conjunction with the drive block 38 if desired. Also, shims may be employed beneath the buttons to compensate for wear.

While I have shown and described certain preferred embodiments of the invention, it can be embodied in other forms and its scope should be limited only by the claims appended hereto.

I claim:

1. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, and a packing member interposed between the cylinder wall and the piston in sealing relation therewith and connected to the closure for insertion and removal therewith.

2. In a pump, a cylinder, a cylinder head, a piston within the cylinder and spaced from the wall of the cylinder, and a packing member interposed between the cylinder wall and the piston in sealing relation therewith and mounted on the cylinder head for insertion and removal therewith.

3. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, and a packing member interposed between the cylinder wall and the piston in sealing relation therewith, said packing member comprising a sleeve detachably connected to the closure and a resilient packing element carried by the sleeve.

4. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, and a packing member interposed between the cylinder wall and the piston in sealing relation therewith, said packing member comprising a sleeve detachably connected to the closure and a resilient packing element bonded about one end of the sleeve.

5. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, and a packing member interposed between the cylinder wall and the piston in sealing relation therewith, said packing member comprising a sleeve detachably connected to the closure and a resilient packing element carried by the sleeve having cup-faced ends providing pressure-responsive sealing lips.

6. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, a packing member interposed between the cylinder wall and the piston in sealing relation therewith and connected to the closure for insertion and removal therewith, an annular groove on the inner surface of said packing member, and lubricating passage means leading through the wall of said cylinder and said packing member to said groove.

7. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, a packing member interposed between the cylinder wall and the piston in sealing relation therewith comprising a tubular support element connected to the closure and a resilient packing portion secured on the support element, an annular groove on the inner surface of said packing portion, and lubricating passage means leading through the wall of said cylinder and said packing member to said groove.

8. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, a packing member interposed between the cylinder wall and the piston in sealing relation therewith comprising a tubular support element connected to the closure and a resilient packing portion secured on the support element, respective annular grooves on the inner and outer surfaces of said packing portion, passage means in said packing member connecting said grooves, and means for supplying lubricant to the outer annular groove.

9. In a pump, a cylinder, a cylinder closure, a piston within the cylinder and spaced from the wall of the cylinder, and a packing structure detachably connected to said cylinder closure and including a sealing portion disposed inwardly from said cylinder closure and interposed between the cylinder wall and the piston in sealing relation therewith, said sealing portion including respective cup-faced ends of resilient material providing pressure responsive sealing lips engaging said cylinder wall and said piston at both ends of the packing structure.

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