

May 25, 1937.

C. J. COBERLY ET AL

2,081,221

HIGH PRESSURE PUMP

Filed Jan. 31, 1933

3 Sheets-Sheet 1

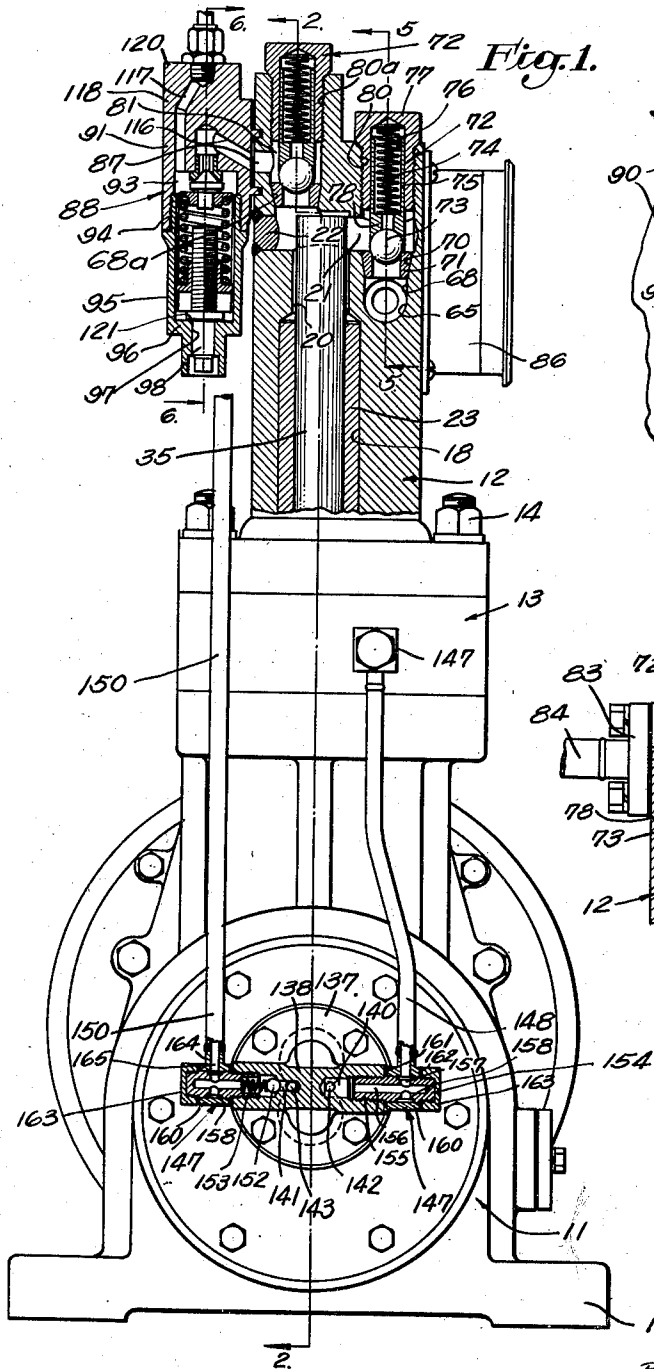


Fig. 1.

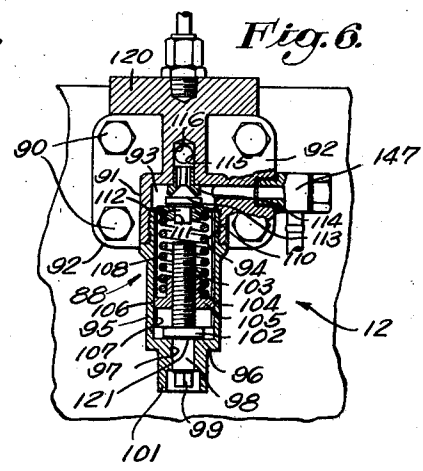


Fig. 6.

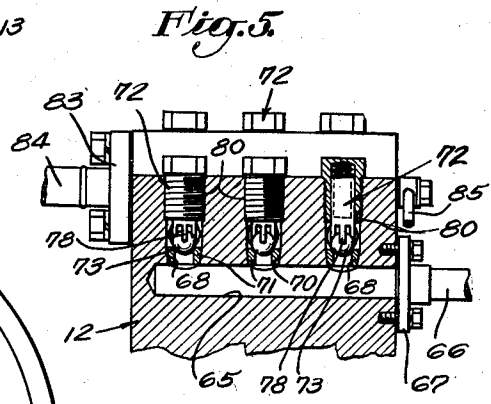


Fig. 5.

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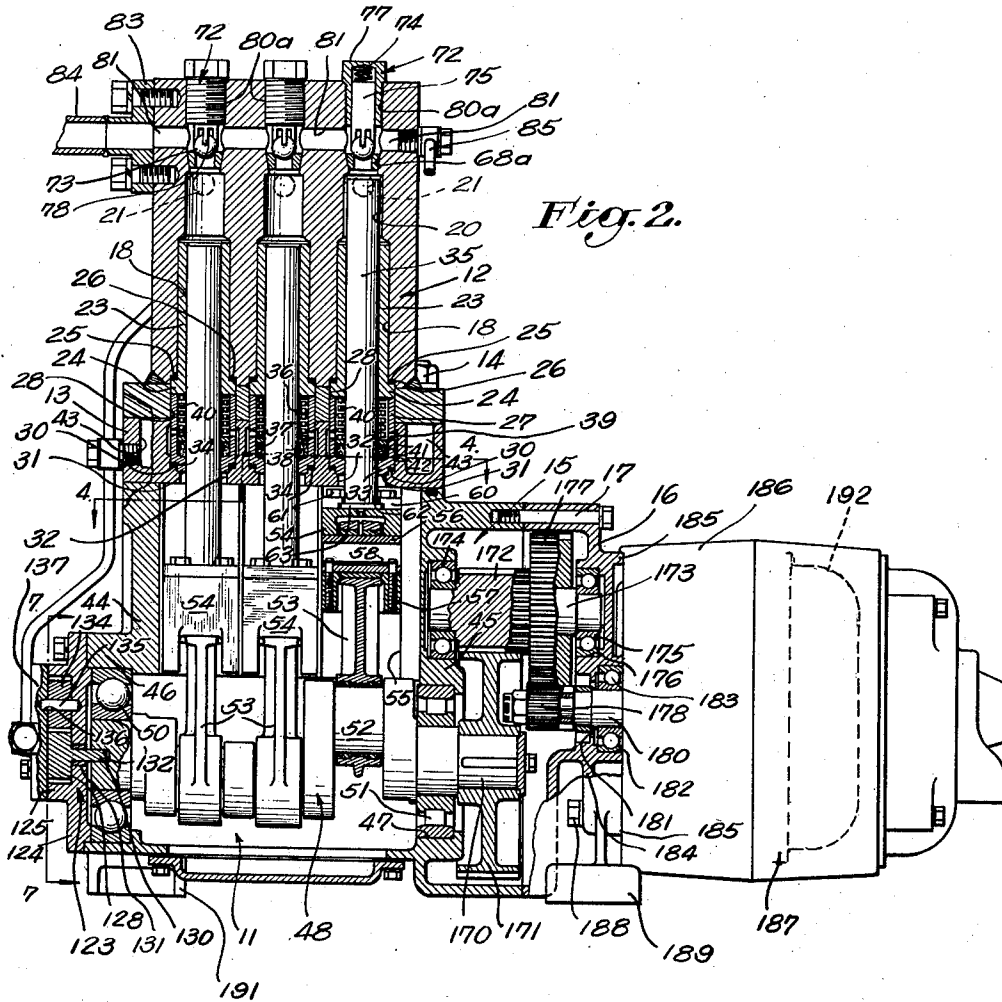
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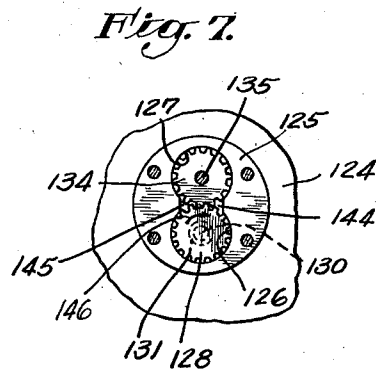
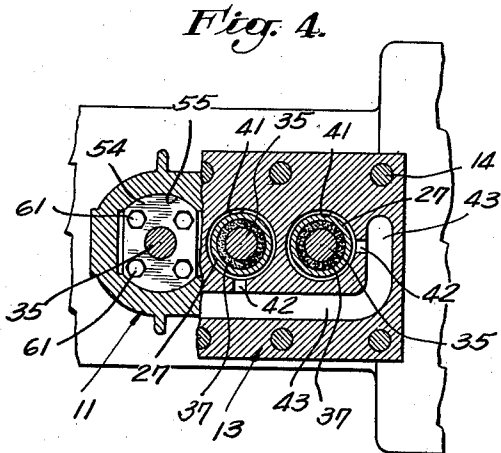
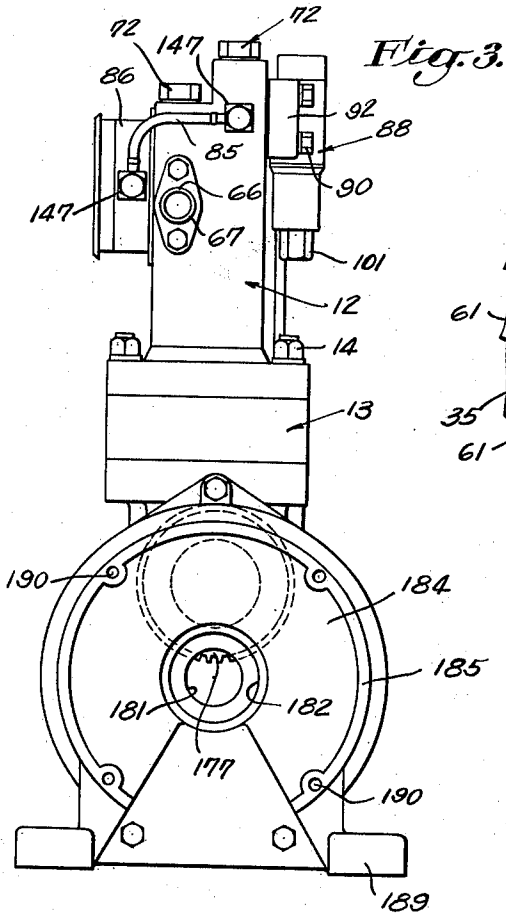
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2,081,221

HIGH PRESSURE PUMP

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4 Claims. (Cl. 103—153)

Our invention relates to a power operated pumping unit adapted to pump fluids at high pressures.

It is an object of the invention to provide a pump of simple and durable form which may be operated through long periods of use without attention owing to features embodied therein, and which may be readily changed in capacity and pressure characteristics within a limited range.

In pumps of high pressure, for instance, those capable of operating under pressures of four thousand to six thousand pounds per square inch, there is a marked tendency toward leakage past the piston of the pump, this leakage increasing as the piston and pump barrel become worn. Our invention provides a means of simple and effective form for preventing pollution of the oil in the crankcase of the pump, or the accumulation of a quantity of fluid in the crankcase, thereby keeping the bearings of the crank-shaft and connecting rods free from harmful substances. The invention is especially valuable for pumping petroleum oils such as produced from wells, and accordingly the invention may be advantageously used for pumping oil under high pressures to devices of hydraulic character, such as fluid operated pumps employed in oil wells for pumping oil therefrom.

It is an object of the invention to provide a high pressure pump in which the pistons may be exchanged for pistons of other diameters so as to vary the piston displacement, and wherein the power unit of the pump may be easily and relatively economically replaced by a power unit of other characteristics so as to vary the driving torque and speed of rotation of the crank-shaft as conditions may require.

It is an object of the invention to provide, in a pump of the character set forth in the preceding paragraph, easily removable cooperating piston and liner members and simple and effective means for operatively securing these members in the pump structure.

A further object of the invention is to provide a simple means for securing a piston or plunger member to a cross-head in a pump of the above character in a manner to permit a slight lateral or axial movement between the plunger and the cross-head as they reciprocate.

A further object of the invention is to provide in a pumping device a simple and readily replaceable, yet durable, valve structure for use in the intake and discharge passages of the pump.

A further object of the invention is to provide a simple, externally adjustable pressure relief

valve for connection to the high pressure passages of the pump.

It is a further object of the invention to provide a simple auxiliary pumping mechanism for disposing of the fluid which leaks past the pump pistons but is prevented from entering the crankcase of the high pressure pump, and it is a further object of the invention to provide a simple, readily assembled and detached connecting means for external tubular parts of the pump structure.

Further objects and advantages of the invention will be made evident throughout the following part of the specification.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a partly sectioned end elevation of a preferred form of our invention.

Fig. 2 is a vertical section taken as indicated by the line 2—2 of Fig. 1.

Fig. 3 is an elevational view of the rightward end of Fig. 2 with the power unit of the device removed.

Fig. 4 is a horizontally sectioned view taken on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary section taken as indicated by the line 5—5 of Fig. 1.

Fig. 6 is an enlarged fragmentary section through the pressure relief valve of the device, taken on the plane represented by the line 6—6 of Fig. 1.

Fig. 7 is a slightly enlarged sectional view on a plane represented by the line 7—7 of Fig. 2.

As shown in the drawings, the preferred form of our pump includes a crankcase 11 to which a cylinder block 12 is secured, there being a flat spacer member 13 disposed between the crankcase 11 and the block 12 through which bolts 14 pass for securing the block 12 to the crankcase 11. On the rightward end of the crankcase 11 are walls forming a gear case 15 against which a gear case cover 16 is secured by screws 17. The pump disclosed, being triplex, has three vertical bores 18 in the cylinder block 12, the upper ends 20 of these bores 18 being diametrically reduced and communicating with three laterally drilled openings 21, the ends of which are closed by welded plugs 22. In the main portion of each bore 18 below the diametrically restricted upper end thereof is a liner 23 which slides readily into the bore 18 and has a flange 24 at its lower end which is spaced from a shoulder 25 formed near the lower end of the bore 18 and is externally sealed by a packing ring 26. The flange 24 is forced upwardly tightly against the pack-

ing ring 26 when the block 12 is bolted in place on the case 11 by a cup-shaped member 27 which projects downwardly into a recess 28 formed in the member 13 in alignment with the bore 18.

The lower end of the recess 28 has offset shoulders 30 and 31 adjacent an opening 32 which communicates with the upper end of the crankcase 11. The lower end of the cup-shaped member has a reduced portion 33 which rests upon the shoulder 31, and around the reduced portion a packing ring 34 is placed which is compressed against the shoulder 30 when the block 12 is bolted in place. A piston member or plunger 35 extends within the liner 23 and projects downwardly through the member 27 into the crankcase 11. The member 27 has an upwardly opening annular space 36 around the plunger 35, and in the lower end of this space 36 an annular packing body 37 is held by a gland ring 38 forced downwardly by a compression spring 40, the upper end of which bears against the lower end of the liner 23. In the side wall of each member 27 are one or more oil drainage openings 39 which connect the space 36 with an annular space 41 formed in the recess 28, which annular space communicates through an opening 42 with a channel 43 formed down one side and across the end of the member 13. The liners 23 and plungers 35 are ground to a close working fit and engage through a considerable length so that a good liquid seal is formed therebetween. However, there is more or less leakage through the liners 23 around the plungers 35 due to the extremely high pressures exerted in the lateral passages 21 of the block 12 when the pump is in operation. This leakage passes into the spaces 36 of the members 27, through the openings 39, spaces 41, and openings 42 into the channel 43 from which the fluid leakage is removed by means which will be later described.

The crankcase 11 has end walls 44 and 45 equipped with annular bearing-receiving walls 46 and 47 in which bearings for a crank-shaft 48 are supported. On the leftward end of the crank-shaft 48 a heavy ball bearing 50 is employed. On the rightward end of the crank-shaft 48 a roller type bearing 51 is used. On the crank pins 52 of the shaft 48, connecting rods 53 are mounted, each of which extends upwardly to a cross-head 54 operating in a cross-head guide 55 substantially in vertical alignment with a bore 18 of the block 12. The upper ends of the connecting rods 53 engage tubular wrist pins 56 which are set transversely in the cross-heads 54 and are secured by screws 57 which project upwardly through the lower end walls of the wrist pins and are held against displacement by securing wires 58 tied through holes in the upper ends of the screws 57. On the upper flat face of each cross-head 54 is a plate 60 secured by screws 61. Each plate 60 has a central opening 62 into which the lower end of a plunger 35 passes, and the lower part of each opening 62 is counterbored or diametrically enlarged to receive the flange 63 formed on the lower extremity of the plunger 35. Each plunger 35 rests directly upon the upper face of its associated cross-head, and the openings 62 of the plates 60 are larger in diameter than the plungers 35, and likewise the counterbores at the lower ends of the openings 62 are of larger diameter than the flanges 63 so that a limited lateral or axial movement between the cross-heads and the plungers is permitted, thereby avoiding possibility of heavy strains and excessive wear on the side walls of

the plungers 35 and the cross-heads 54 should the cross-head guides and the bores of the liners 23 be slightly disaligned.

As shown in Figs. 1 and 5, a horizontal passage 65 is formed in the block 12 below the planes of the lateral passages 21 and adjacent the upper ends of the bores 18 to provide a fluid inlet passage for the pump into which fluid to be pumped may be conducted through piping 66 secured to the rightward end of the block 12 by a flange 67. Connecting each of the lateral passages 21 with the passage 65 is an opening 68 which is outwardly flared at its upper portion to provide a seat 70 for a replaceable valve seat 71 forming part of a valve unit 72 which further includes a closure member in the form of a steel ball 73 and means for resiliently holding the ball 73 in engagement with the seat 71, such means comprising a spring 74 and a tubular member 75 which is slidably received in a vertical, downwardly facing recess 76 of a threaded member 77, there being four downwardly extending legs 78 on the lower end of the tubular member 75, the lower ends of which legs are curved to fit the upper face of the ball 73 so that when the spring 74 holds the member 75 downwardly, the engagement of the legs 78 with the ball 73 will resist lateral movement of the ball 73 when it is raised from the seat 71. The members 77 screw into threaded openings 80 which are vertically aligned with the valve seat 71 and accordingly provide removable vertical guides for the ball-retaining means represented by the members 75.

A high pressure discharge passage 81 for the pump is drilled longitudinally in the block 12 above the plane of the lateral passages 21 and rearwardly with respect to the inlet passage 65, or to the left of the block 12 as shown in Fig. 1. As further shown in Figs. 1 and 2, vertical openings 68a connect the leftward ends of the passages 21 with the passage 81, and above the openings 68a threaded openings 80a are extended from the passage 81 to the upper end of the block 12. In the openings 68a and 80a valve units 72 are operatively secured so as to prevent reverse flow of fluid under pressure from the passage 81 into the lateral passages 21. One end of the passage 81 is connected through a flange fitting 83 with piping 84 for carrying the fluid under pressure to a desired point of utility. The end of the passage 81 opposite the fitting 83 is connected through a pipe 85 with a pressure gauge 86 which may be conveniently secured to the front face of the block 12. An intermediate portion of the passage 81 connects through an opening 87 with a pressure relief valve 88 secured to the rearward face of the block 12 by bolts 90.

As shown in Figs. 1 and 6, the relief valve 88 includes a cylindrical body 91 having laterally projecting flanges 92 formed thereon through which bolts 90 may be passed to secure the device 88 to the rear face of the block 12. The cylindrical body 91 has a downwardly facing recess 93 which is threaded at 94 to receive a downwardly extending cylindrical shell 95 having a lower end wall 96 with an opening 97 therein through which a shaft 98 extends, the lower extremity 99 thereof being squared to receive a wrench and being protected by a downwardly extending cylindrical apron wall 101 which prevents turning of the shaft 98 except by use of the proper wrench therefor. The shaft 98 has a flange 102 thereon which rests against the upper face of the wall 96, and the upper portion 103 of the shaft is threaded to receive a spring compressor 104 having a flange 75

105 equipped with projections 106 engaging vertical guide grooves 107 in the interior wall of the shell 95. Supported on the flange 105 is a spring 108, the upper end of which engages a circular plate 110 having a central opening 111 adapted to receive the downwardly projecting cylindrical stem 112 of a conical valve member 113. The conical valve member 113 engages a tubular seat member 114 which threads into an opening 115 extending upwardly from the recess 93. The upper end of the opening 115 connects with the opening 87, Fig. 1, through a downwardly sloping passage 116. From the upper part of the recess 93, to one side of the opening 115, a passage 117 extends through a vertical wall 118 into communication with the upper face of a flange 120 formed at the upper end of the wall 118, to which flange piping may be attached for carrying off the fluid which is forced from the passage 81 of the pump past the pressure-retained valve element 113 into the recess 93 and the interior of the shell 95. A gasket 121 may be placed between the flange 102 of the member 98 and the wall 96 to prevent leakage of fluid through the opening 97 in the lower end of the shell 95. The seating of the pressure relief valve mechanism may be readily accomplished by rotating the shaft 98 so as to screw the spring compressor upwardly or downwardly, thereby suitably changing the pressure with which the valve element 113 engages the seat 114.

The invention provides simple means for automatically removing the leakage oil from the channel 43 in the member 13, such means consisting of a gear pump 123 formed in conjunction with a cover plate 124 secured to the annular wall 46 which holds the bearing 50. As shown in Figs. 2 and 7, the outer face of the plate 124 is provided with a leftward or outwardly extending boss 125 having a pair of overlapped circular recesses 126 and 127 therein, the recess 126 being aligned with the axis of rotation of the crank-shaft 48. A pump gear 128 of spur type operates in the recess 126 and has a shaft portion 130 extending therefrom through a bushed opening 131 in the cover plate 124 into driving engagement with an opening 132 in the crank-shaft 48. In the recess 127 is a gear 134 which meshes with the gear 128 and rotates on an axle 135, the outer end of which is seated in a pocket 136 in a circular plate 137 which is secured to the boss 125 in position to cover the recesses 126 and 127. As shown in Figs. 1 and 2, the plate 137 has a laterally extending and outwardly projecting metal body 138 formed thereon in which openings 140 and 141 are bored in radial direction, and the inner ends of these openings 140 and 141 are connected with the inner face of the plate 137 through holes 142 and 143 which are respectively positioned so as to communicate with the spaces 144 and 145, Fig. 7, which are respectively the intake and discharge passages of the gear pump when the gear 128 is rotated in the direction of the arrow 146 of Fig. 7. By use of fittings 147, a pipe 148 connects the channel 43 with the opening 140, Fig. 1, and a pipe 150 connects the opening 141 with the recess or chamber 93 of the pressure relief valve 88; accordingly, whenever the device is in operation, the leakage from the pistons and cylinders accumulating in the channel 43 drains through the pipe 148 into the opening 140 and is conducted through the opening 142 into the space 144 of the gear pump 123 and is delivered therefrom under pressure through the openings 143 and 141 and the

pipe 150 into the space 93 in the pressure relief valve, from which space 93 it is conducted through the outlet passage 117 to piping which may be connected to the flange 120 so as to be from there carried into a fluid supply tank or other means of disposal. The piston and cylinder leakage is accordingly kept from entering the crankcase 11. In the opening 141 a check valve may be employed in the form of a ball 152 held in closure position by a spring 153. The fittings 147 are of simple construction and are of such character that the pipes 148 and 150 may be readily removed whenever it is desired to dismantle the parts of the pump, and each of such fittings comprises a bar or stem 154 having a threaded inner end 155 so as to be screwed into an opening. Extending outwardly from the inner end of the member 154 is an opening 156 which connects through radial openings 157 with an external circular member 158 formed on the member 154. Around the projecting cylindrical portion of the member 154, a bored block 160 is placed, such block being clamped between gaskets 161 and 162 by means of a cap nut 163. One side of the block 160 has a projection 164 through which an opening 165 extends into communication with the peripheral channel 158 of the bar 154. To this projection 164 an interconnecting pipe, such as the pipe 148, may be welded so that the block 160 of the connecting means then becomes the end part of the pipe 148. By removing the nut 163, removal of the block 160 from the projecting portion of the bar 154 is permitted, and reassembly of these parts may be readily accomplished by placing the block on the projecting bar or stem 154 between the gaskets 161 and 162 and then replacing the nut 163. In Fig. 3 the pipe 85 is shown connected to the high pressure passage 21 of the pump and to the pressure gauge 86 by use of connecting devices 147.

The capacity of the high pressure pump may be adapted for a selected pumping operation by selecting motors of different speeds within reasonable limits and by replacing the pistons and the cooperating liners 23 with pistons and liners of different diameters. The liners 23 may be made with bores of different sizes, and the pistons or plungers 35 may be readily made to fit the same, and such parts may be interchanged without the necessity of replacing the block 12 and its valve parts. Likewise, the maximum pressure against which the pump may operate may be determined by the size of the motor employed, and our invention provides for the easy replacement of motors without disturbing the reduction gears of the pump.

In Fig. 2 the gear case 15 and the cover 16 therefor enclose a space in which reduction gears are operatively held. Keyed to the rightwardly projecting end 170 of the crankshaft 48 is a gear 171 adapted to be driven by a pinion 172 formed on a shaft 173 which is carried in a ball bearing 174 mounted in the outer face of the wall 45, and a bearing 175 mounted in a recess 176 in the inner face of the gear case cover member 16. On the rightward portion of the shaft 173 a gear 177 is mounted, adapted to be driven by a small pinion 178 secured to the end of a motor shaft 180 which projects into the gear case cover 16 through an opening 181 which is counterbored at its outer end to provide an annular bearing recess 182 to receive a ball bearing 183 for the motor shaft 180. The gear case cover 16 has a disc-shaped wall 184 providing a

circular lip 185 for engaging the cylindrical frame or case 186 of a motor 187, the wall 184 forming the leftward end bell or end wall of the motor 187 when the frame 186 thereof is secured against the wall 184 by bolts 188 which pass through openings 190. Feet 189 for the rightward end of the pumping device may be conveniently formed on the gear case cover 16, and feet 191 for the leftward end of the pumping device may be cast on the crankcase 11. The opening 191 in the gear case cover 16 is of such size that the pinion 178 will readily pass therethrough, thereby making it possible to remove the motor 187, its armature, its shaft 180, and the pinion 178. The power of the motor 187 may be varied by changing the length of the field and armature; accordingly, where the pump is intended for light duty, a relatively short motor, as indicated by dotted lines 192, may be mounted thereon. The changing of the power unit of the pumping device may be accomplished without disturbing the gears in the gear case 15 other than by the removal and replacement of the pinion 178.

Although we have herein shown and described our invention in simple and practical form, it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be used in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention is not to be limited to the details disclosed herein but is to be accorded the full scope of the following claims.

We claim as our invention:

1. A device of the character described, including: a cylinder block having a bore with intake and discharge valve means at the outer end thereof and a counterbore at the inner end thereof; a tubular liner adapted to fit said bore, said liner having a flange at the inner end thereof to pass into said counterbore and limit the outward movement of said liner in said bore; a body adapted to be secured against the inner end of said cylinder block, said body having an opening aligned with said bore, there being a shoulder adjacent said opening; securing means for forcing said body against the inner end of said cylinder block; an annular member in said opening and engaging said shoulder of said body and the inner end of said liner; and sealing means for preventing a flow of fluid through said bore outside of said liner, said sealing means being actuated in response to the forcing of said body against said cylinder block.

2. A device of the character described, including: a cylinder block having a bore with intake and discharge valve means at the outer end thereof and a counterbore at the inner end thereof; a tubular liner adapted to fit said bore, said liner having a flange at the inner end thereof to pass into said counterbore and limit the outward movement of said liner in said bore; a body adapted to be secured against the inner end of said cylinder block, said body having an opening aligned with said bore, there being a shoulder in said opening and a passage in said body communicating with said opening; screw means for

forcing said body against the inner end of said cylinder block; an annular member in said opening and engaging said shoulder of said body and the inner end of said liner; sealing means for preventing a flow of fluid through said bore outside of said liner, said sealing means being actuated in response to the forcing of said body against said cylinder block; reciprocating means adjacent said body; a piston member in said bore of said liner; a part extending from said piston member through said annular member, said counterbore, and said opening to said reciprocating means for reciprocating said piston member in said liner; and sealing means for resisting escape of fluid from the lower end of said opening, the leakage fluid which passes said piston member in said liner being removed from said opening through said passage in said body.

3. A high pressure pump of the character described, including: a cylinder block having a bore adapted to receive a liner in the inner end thereof; a liner to fit said bore, said liner having an opening selected in accordance with the pumping capacity desired; an actuating element having reciprocating means disposed adjacent the inner end of said block; a piston member operative within the bore of said liner, said piston member having a part extending therefrom into operative connection with the reciprocating means of said actuating element; and means for preventing leakage of fluid from the bore of said liner into said actuating element, comprising a wall having an opening corresponding to the diameter of said cylinder block bore, and a reducer fitted into said opening, said reducer having a bore corresponding to the size of said extending part of said piston member and having sealing means for preventing leakage along said part, there being a fluid escape passage extending from said opening in a plane between said sealing means and the inner end of said liner.

4. A high pressure pump of the character described, including: a cylinder block having a bore adapted to receive a liner in the inner end thereof; a liner to fit said bore, said liner having an opening selected in accordance with the pumping capacity desired; an actuating element having reciprocating means disposed adjacent the inner end of said block; a piston member operative within the bore of said liner, said piston member having a part extending therefrom into operative connection with the reciprocating means of said actuating element; and means for preventing leakage of fluid from the bore of said liner into said actuating element, comprising a wall having an opening corresponding to the diameter of said cylinder block bore, and a cup-shaped reducer fitted into said opening, said reducer having a bore corresponding to the size of said extending part of said piston member and having a lip at the outer end thereof engaging said liner, and said reducer having sealing means for preventing leakage along said part, there being a fluid escape passage extending from said opening in a plane between said sealing means and the inner end of said liner.

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