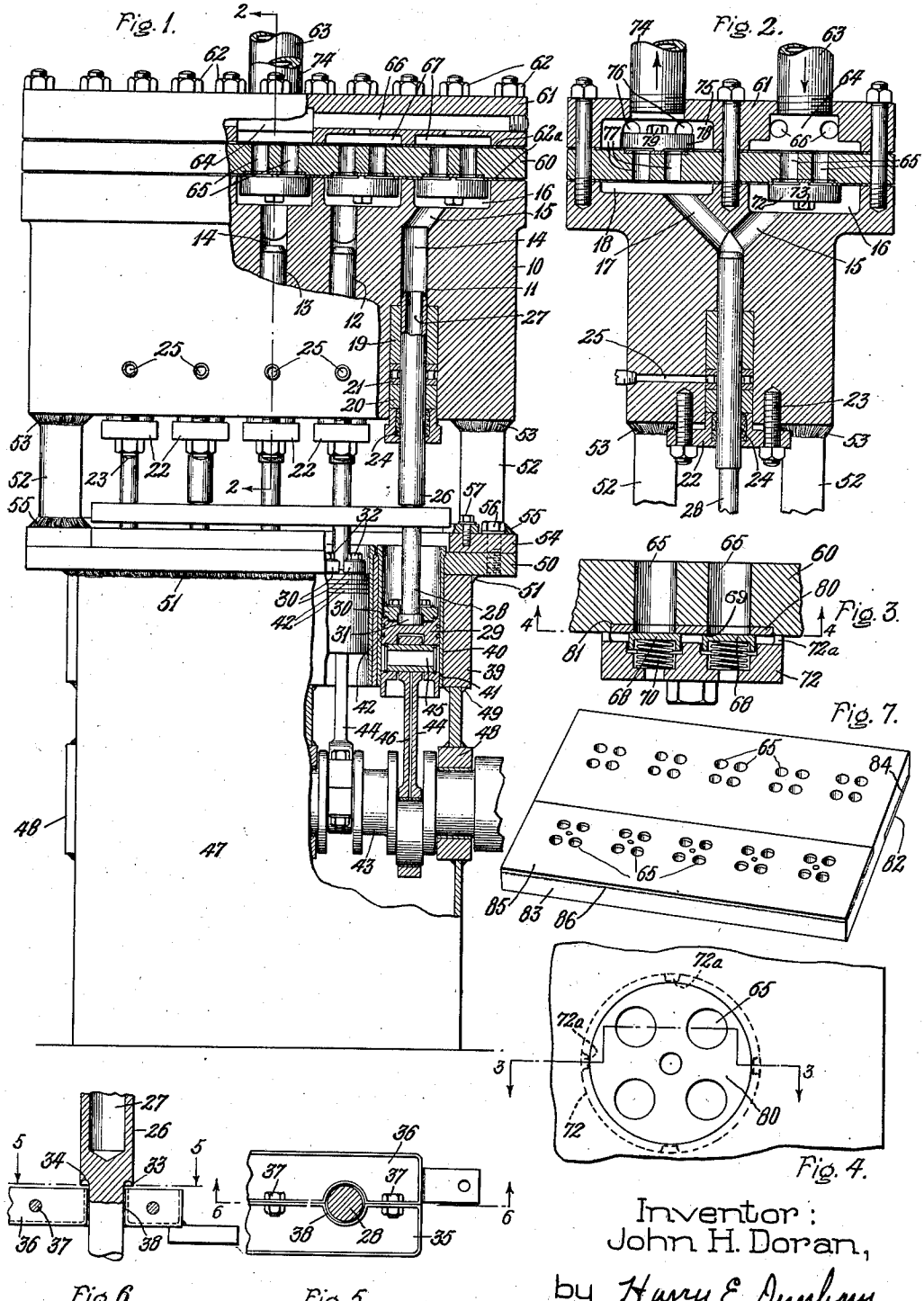
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RECIPROCATING PUMP

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RECIPROCATING PUMP

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1 Claim. (Cl. 103—169)

The present invention relates to reciprocating pumps for compressing a fluid or for forcing a fluid, such as water, from a point of low pressure to a point of high pressure. Such pumps may be used, for instance, as an auxiliary in elastic fluid power plants to supply feed water to a boiler, as is described more fully in the application of Glenn B. Warren, Serial No. 37,704, filed on the same date as the present application and assigned to the same assignee.

The present invention has for its object an improved arrangement and method of manufacturing multi-cylinder reciprocating pumps whereby a simple, compact design, reliable in operation, can be produced at comparatively low cost.

For a consideration of what I believe to be novel and my invention, attention is directed to the following description and the claim appended thereto in connection with the accompanying drawing.

Fig. 1 of the drawing illustrates a front view, partly in section, of a reciprocating pump embodying my invention; Fig. 2 is a sectional view along the line 2—2 of Fig. 1; Fig. 3 is an enlarged sectional view of a part of Fig. 1 and a view along line 3—3 of Fig. 4; Fig. 4 is a view along line 4—4 of Fig. 3; Fig. 5 is an enlarged view along line 5—5 of Fig. 6; Fig. 6 is a view along line 6—6 of Fig. 5; and Fig. 7 is a perspective view of a part of Fig. 1.

The pump has a cylinder structure including a block 10 made, preferably forged, from a solid piece of material such as steel. A plurality of parallel bores 11, 12 and 13 are formed in the block 10 to define cylinders or compression and suction chambers 14. The upper face of the block 10 has two rows of recesses. Each chamber 14 communicates through a channel 15 with a recess 16 of one row and through a channel 17 with a recess 18 of the other row. In the present instance, in which I have shown a five-cylinder pump, the channel 15 for the central pump, if viewed from the front, is centrally connected to the corresponding recess 16 (Fig. 1). The channel 15 with respect to the bore 12 is connected to the left-hand end of the corresponding recess 16 (Fig. 2), whereas the channel 15 for the bore 11 is also connected to the left-hand end of the corresponding recesses 16 and at the same time inclined with respect to the center line of the bore 11 (Fig. 1). I prefer this particular connection in that it reduces the distance between the adjacent bores 11, 12, 13, permitting a considerable reduction of the length of the crank shaft, described hereinafter. The channels 15 with the recesses 16 form intake or suction conduits, whereas the channels 17 with the recesses 18 form outlet or discharge conduits as will be more fully explained hereinafter. Each cylinder includes a packing of considerable length formed by two sleeves 19 and 20 and an intermediate or spacing member 21. The sleeves and the spacing member are disposed in a recessed portion of the bore 11 and held in position by a gland 22 fastened to the lower face of the cylinder block by screws 23 (Fig. 2). The bracket 22 also serves to accommodate a packing 24. The packings are preferably made from a material including a phenolic condensation product united by an artificial resin. I have found that such packing gives good results when used in boiler feed water pumps. In the present instance the spacing member 21 forms a plurality of lateral openings communicating with a channel 25 for draining fluid leaking along the cylinder. A plunger 26 is provided for each cylinder. The plunger has a central bore 27 extending substantially through the entire length of the plunger in order to reduce its weight and to permit effective cooling. An extension 28 of the plunger 26 is connected to a cylindrical crosshead 29. The connection is accomplished by means of two substantially half-circular clamps 30 engaging an abutment 31 of the plunger and being fastened to the upper face of the cylindrical crosshead 29 by means of bolts 32. The extension 28 is reduced in diameter as compared with the diameter of the plunger 26 to form a shoulder 33. The shoulder has an undercut groove 34 (Fig. 6) to reduce any possible flow of leakage from the plunger 26 along its extension 28. Liquid, such as water, flowing along the plunger 28 drops therefrom at the sharp edge defined by the undercut shouldered portion. Such liquid is collected in a pan (Figs. 5 and 6) comprising two halves 35 and 36 secured together by bolts 37 and forming openings 38 through which the plunger extensions 28 pass.

The crossheads 29 are guided in a guide block 39 made, preferably forged, from a solid piece of material and having a plurality of cylindrical bores 40. Each bore is provided with a sleeve 41 for guiding the crossheads 29. The latter have cylindrical grooves for accommodating packing rings 42 to reduce leakage of lubricant, such as oil, along the guide sleeves 40. The crossheads are reciprocated by a crank shaft 43 connected thereto by arms 44 and pins 45. The arms 44 are provided in known manner with central bores 46 for conducting lubricant to the pins 45 and the cylindrical surface of the crossheads. The crank shaft 43 is disposed in a fabricated crank casing 47 and supported thereon by suitable bearings 48 welded to the walls of the crank casing. The crosshead block 39 is fastened to the crank casing by wells 49. Lubricant supplied to the crossheads during operation is returned to an oil chamber defined within the crank casing. The oil is prevented from leaking upwardly along the cylindrical crossheads by the packing rings 42. A flange 50 is secured by a weld 51 to the upper ends of the

crosshead block 39 and the crank casing 47. The cylinder block 10 is spaced from and secured to the crosshead block 39. In the present instance this is accomplished by means including spacing members 52 secured at their upper ends to the lower face of the cylinder block 10 by welds 53 and secured at their lower ends to a flange 54 by welds 55. The flange 54, thus forming an integral part of the cylinder block, is secured to the flange 50 forming an integral part of the crosshead block and the crank casing by means of bolts 56.

The aforementioned pan 35, 36 for collecting leakage is fastened to the flange 54 by bolts 57.

A head comprising a valve plate 60 and a top plate 61 is fastened to the upper recessed surface of the cylinder block by means of a plurality of bolts 62. A gasket 62a which may be in the form of a copper wire is provided on each side of the valve plate 60. Fluid is conducted to the inlet channel 15 of the central cylinder bore 13 by means including an inlet or suction conduit 63 secured to the top plate 61 and communicating with a recess or chamber 64 formed therein. This chamber 64 communicates with the recess 16 through four openings 65 in the valve plate 60. The supply to the recesses 16 for the outer cylinder bores 11 and 12 is similar but includes two horizontal channels 66 and recesses 67 formed in the top plate 61 and registering with the openings or bores 65. The flow of fluid from the suction conduit 63 through the openings 65 to the recesses 16 is controlled by suction valve means. The suction valve means for each cylinder comprises four valve plates or members 68 (Figs. 3 and 4) in cooperative relation with valve seats 69 and biased towards the valve seats by means including a spring 70 for each valve plate. The four springs 70 of each suction valve means are disposed in a cage 72 having legs 72a secured to the lower face of the valve plate 60 by a bolt 73. The legs 72a define passages for the flow of fluid into the recess 16 from the openings 65. The cage 72 forms at the same time a guide for the valve plates 68. The valve seats 69 are uniformly spaced about a common axis which is the center line of the bolt 73. Experience has shown that the provision of a plurality of suction valves controlling the flow through comparatively small individual bores is preferable over the provision of a single large valve plate controlling the flow through a comparatively large bore.

The means for discharging fluid from the channels 17 and the recesses 18 are similar to the means just described for supplying fluid to the inlet channels 15. The discharge means comprise a discharge conduit 74 secured to the top plate and a recess 75 for each cylinder in the lower surface of the top plate 61. The recesses 75 are connected by channels 76 and communicate with the recesses 18 through openings 77, there being four openings with respect to each cylinder. The flow of fluid from the recesses 18 to the recesses 75 is controlled by discharge valve means 78, similar to the valve means just described above but disposed in the recesses 75, that is, on the opposite side of the valve plate 60 as compared with the provision of the suction valve means. Otherwise the discharge valve means are the same as the inlet valve means including four valve plates uniformly spaced about a common center and biased towards seats by means including springs and a cage secured to the upper surface of the valve plate 60 by a bolt 79.

All of the valve seats defined on the valve plate are flat and disposed in the same plane. This is an important feature of my invention because it reduces considerably the cost of manufacture and repair. Grinding and regrinding of individual valve seats is no longer necessary. All of the valve seats for the inlet and outlet valves respectively may be formed by a single grinding, milling, or like machining operation. Wear of valve seats is reduced if they are formed on a hard material. To this end a disk 80 of hard material, such as hardened steel, is provided for each group of valves. The disks 80 are securely held in annular recesses 81 formed in the valve plate 60.

In the modification shown in Fig. 7, the valve seats for the inlet valves are formed by a single plate 82 of hard material secured to one side of a valve plate 83 corresponding to the plate 60 of Fig. 1 by means of a weld 84, and the seats for the outlet valves are formed in a single plane by another single plane plate 85 secured to the opposite side of the plate 83 by a weld 86.

During operation, downward or suction strokes of the plungers 26 create a vacuum within the cylinders, permitting the inlet valve plates 68 to open, thereby admitting fluid to the cylinders. During the upward stroke of the plungers the inlet valve means are closed and as the fluid reaches a certain pressure the outlet valve means 78 open, thereby permitting discharge of fluid from the discharge recesses 18, through the openings 77 into the recesses 75, whence the fluid flows through the horizontal bores 76 to the central recess 75 to be discharged through the discharge conduit 74.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

A reciprocating pump including a cylinder block having a plurality of uniformly spaced bores defining cylinders and a plurality of uniformly spaced intake recesses communicating with corresponding cylinders, the central distance between adjacent cylinders being less than that of the corresponding adjacent recesses, means including a plurality of other recesses formed in the block for receiving fluid discharged from the cylinders, intake and discharge valves associated with said recesses, a plunger for each cylinder, and means including a crank shaft for reciprocating the plungers, the crank shaft being of comparatively short length due to the close spacing of the cylinders, the intake and discharge recesses being arranged in two adjacent rows on the upper surface of the cylinder block, oppositely inclined channels for connecting the upper ends of the cylinders with corresponding intake and discharge recesses.

JOHN H. DORAN.