

July 12, 1966

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3,260,217

PUMP HAVING RADIAL DISCHARGE VALVE

Filed Aug. 5, 1964

2 Sheets-Sheet 1

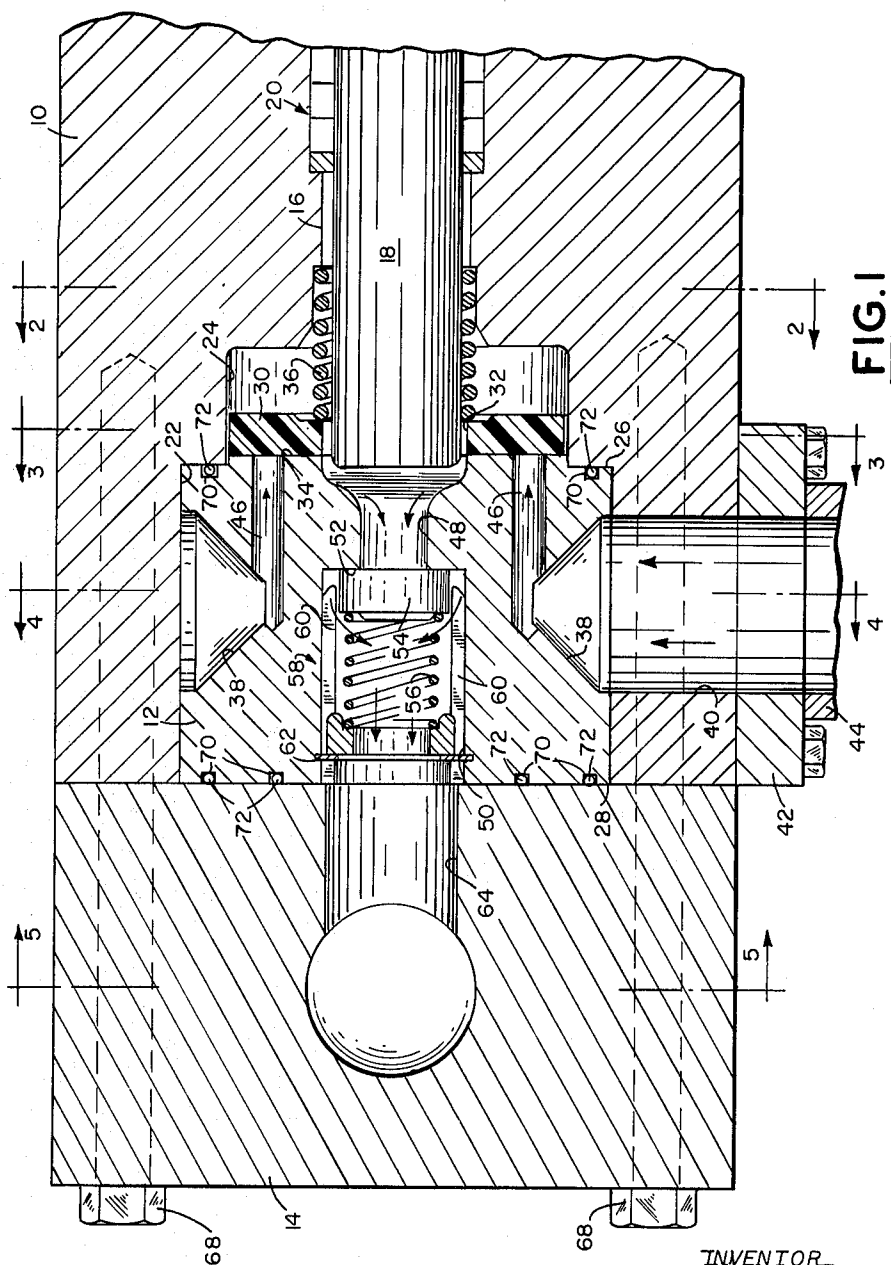


FIG. 1

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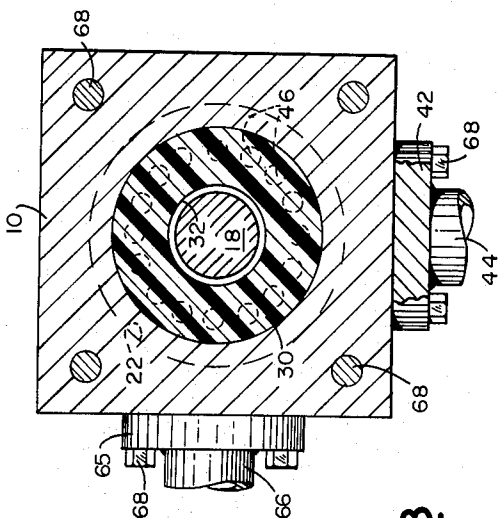


FIG. 3

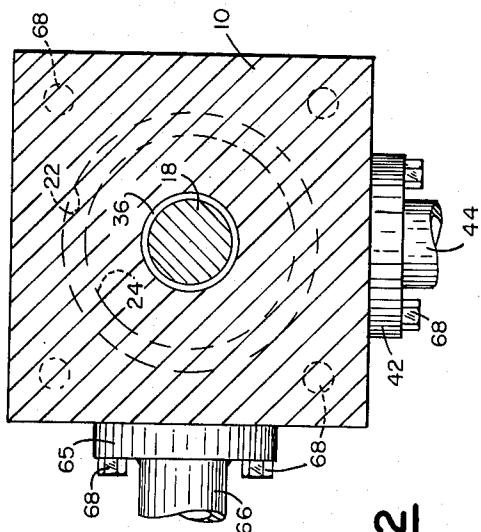


FIG. 2

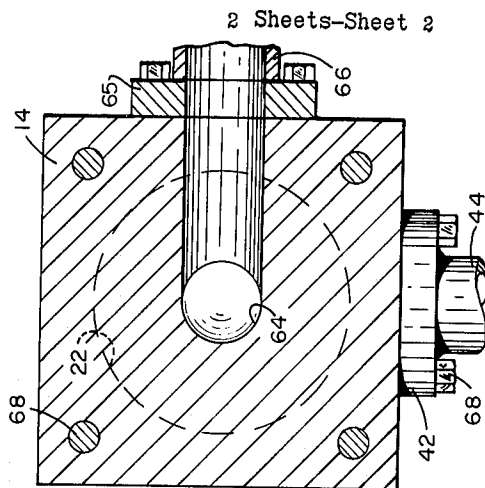


FIG. 5

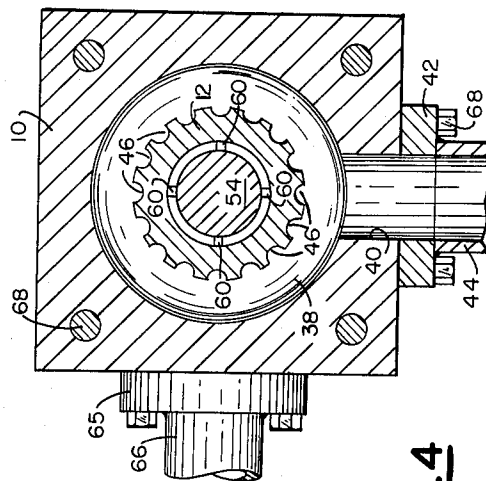


FIG. 4

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1

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3 Claims. (Cl. 103-153)

This invention relates to a reciprocating pump. More particularly, the invention relates to a radial discharge valve type reciprocating pump particularly characterized by simplicity of construction and economy of manufacture.

This is a continuation-in-part of pending application Serial Number 263,473, filed March 7, 1963, for a "Valve System for Reciprocating Pump," now Patent No. 3,180,277.

In the above mentioned pending application, a radial discharge valve system for reciprocating pumps is disclosed. The advantages of the radial discharge valve are fully set forth therein. The valve system disclosed in this prior co-pending application sets forth a basic radial discharge pump arrangement but contemplates the utilization of relatively complex components, the major ones of which can be constructed, from a practical standpoint, only by casting. The disadvantages of the use of castings in high pressure work, especially high pressures subject to continuous pulsation and the shock inherent in reciprocating pumps, is well known.

The primary object of this invention is to provide a reciprocating pump having a radial discharge valve in a unique arrangement wherein the components making up the pump are extremely simple to manufacture and particularly wherein the components are adaptable to be manufactured exclusively by machining processes.

Another object of this invention is to provide a pump characterized by close clearance in the valving structure wherein the piston displaces an increased percentage of the total piston intake valve area on each stroke.

Another object of this invention is to provide a high pressure pump of a design wherein the high pressure cavity is very small in proportion to the total displacement of the pump.

Another object of this invention is to provide a pump characterized by relatively large cross-sectional intake valve areas but wherein the high pressure cavity is at the same time small compared to the pump displacement.

Another object of this invention is to provide a radial discharge pump having, in the fluid end, only three major components in addition to the valves and piston and wherein all components of the pump are easily manufactured, assembled and disassembled.

Another object of this invention is to provide a radial discharge pump particularly adapted for pumping, at high pressures, compressible fluids characterized by a type of construction wherein the major components are arranged so that gasketing is entirely achieved by gasket compression and wherein no machine tolerance fits are required to accomplish gasketing between components.

Another object of this invention is to provide a radial discharge pump characterized by a type of construction wherein a single, integral component affords the intake and outlet ports and further affords both the intake and discharge valve seating surfaces.

These and other objects will be fulfilled and a better

2

understanding of the invention will be had by referring to the following description and claims, taken in conjunction with the attached drawings, in which:

FIGURE 1 is a cross-sectional view of the fluid end portion of the high pressure pump of this invention.

FIGURES 2, 3, 4 and 5 are cross-sectional views taken along the lines indicated by the figure numerals of FIGURE 1 showing the fluid end portion of the pump in various cross-sections.

This invention may be described as a radial discharge reciprocating pump characterized by simplicity and economy of construction. More particularly, but not by way of limitation, the invention may be described as a radial discharge pump characterized by three basic components, that is:

- (1) A fluid end block,
- (2) A valve seat block, and
- (3) A cylinder head, which,

along with the secondary components of a piston, intake and discharge valves, and intake and discharge springs, will be described in detail, together form an economically manufactured pump having the capacity to pump compressible fluid with a high degree of efficiency.

Referring now to the drawings and first to FIGURE 1, the fluid end portion of the pump is shown in cross-section. The three basic portions of the pump are a fluid end block 10, a valve seat block 12 and a cylinder head 14. The fluid end block 10 has a cylindrical opening 16 in which a piston 18 is reciprocated. A stuffing box of typical design, generally indicated by the numeral 20, is provided to prevent the escape of liquid along the piston.

The cylindrical opening 16 in the fluid end block 10 terminates in a larger diameter cylindrical valve block cavity 22. An intermediate intake valve cavity 24 is provided between the cylindrical opening 16 and the cylindrical valve block cavity 22. The valve seat block 12 is positioned in the cylindrical valve block cavity 22. In application the valve seat block 12 engages the fluid end block 10 with a light push fit so that the valve seat block 12 is easily removed for repair of the pump.

The valve seat block 12 is cylindrical and has a seating surface 26 at the forward end thereof and an opposing rearward seating surface 28. The forward end of the valve seat block 12 provides one boundary of the intake valve cavity 24. Positioned in the intake valve cavity 24 is a flat cylindrical disc shaped intake valve 30 having a diameter slightly less than the internal diameter of the intake valve cavity. The intake valve 30 has an axial opening 32 slightly larger in diameter than the diameter of piston 18. A portion of the forward face of the valve seat block 12 forms the intake valve seating surface 34. Means is provided for normally urging intake valve 30 into sealed engagement with the intake valve seating surface 34, such means being preferably a coiled spring 36 pressed between the valve 30 and a portion of the fluid end block 10.

Formed in the external cylindrical surface of the valve seat block 12 is a deep annular groove 38 which functions as a portion of the intake fluid passage. A fluid intake opening 40 is provided in the fluid end block 10 which communicates with the annular groove 38. Flange 42 provides means of connecting piping 44 to conduct fluid into the pump. The intake fluid passage of the pump is completed by a multiplicity of radially spaced fluid

passages 46 which communicate groove 38 with the intake valve cavity 24. In its normal position intake valve 30 closes fluid passages 46 as it seats against the intake valve seating surface 34.

An axial discharge valve inlet opening 48 is provided in the valve seat block 12. A discharge valve opening 50, being larger in diameter than the discharge valve inlet opening 48, and coaxial with it, extends to the rearward seating surface 28 of the valve seat block 12. The juncture of the larger diameter discharge valve opening 50 with the smaller diameter inlet opening 48 provides the discharge valve seating surface 52. Reciprocally positioned within the discharge valve opening 50 is a flat cylindrical disc shaped discharge valve 54. Normally urging discharge valve 54 into seating engagement with the seating surface 52 is a spring 56 which is preferably a coiled spring under compression. In addition, in the preferred arrangement, the discharge valve 54 is supported in and reciprocally positioned by a discharge valve guide member, generally indicated by the numeral 58. The guide member 58 has at least three (four are shown in FIGURE 4) guide fingers 60. The guide fingers 60 are relatively narrow radially spaced paralleled members which provide means whereby the discharge valve 54 is held in proper radial position but at the same time permits a substantially unobstructed passageway around the exterior periphery of the valve as fluid flows past it and out the discharge valve opening 50. The guide member 58 is held in position, such as by means of a circular keeper 62.

The cylinder head 14 has a discharge passage 64 which communicates directly with the discharge valve opening 50 in the valve seat block 12. A flange 65 and discharge piping 66 are (see FIGURES 2 through 4) fixed to the cylinder head 14 to conduct fluid out of the pump.

The complete disassembly of the pump of this invention requires only the removal of the cylinder head 14 which is held in place such as by means of bolts 68. After the cylinder head 14 is removed, the valve seat block 12 can be easily withdrawn. It will be noted that the complete construction of the basic components of the pump of this invention can be manufactured by machining processes without requiring expensive castings. In addition, both the intake and exhaust valve seats are part of the same integral component, that is, the valve seat block 12. When the pump of this invention is to be repaired, the replacement of the valve seat block 12 with the valves will in all practical effects produce a new pump.

Provided in the forward and rearward seating surfaces 26 and 28 of the valve seat block 12 are grooves 70 having gaskets 72 therein. The gaskets are preferably of the O-ring type. It will be noted that due to the unique arrangement of this pump all gaskets required are under compression, that is, compression imparted by the bolt 68 holding the cylinder head 14 in place. No requirement exists of a machine fit to achieve pressure sealing between pump components.

The pump of this invention, as disclosed in the drawings and description, fulfills the objects set forth above. The unique design provides a pump which is very economically constructed, is easily repaired, provides close clearance, provides a design wherein the high pressure cavity in the piston block is very small compared to the piston displacement, and provides a relatively large cross-sectional valve area compared to the size of the high pressure cavity. All of these features combined provide a pump which is uniquely adaptable to pumping fluids which have compressibility, such as propane and butane.

This description is taken with reference to a single cylinder and piston. In practice the pump will normally be of the multiplex type having, as an example, three or five pistons arranged in spaced paralleled arrangement in a single laterally elongated piston block 10, with a valve seat block 12 for each piston, and a single laterally elongated cylinder head 14. Of course multiple cylinder heads 14 may be utilized with a multiplexed cylinder block 10.

Many arrangements of multiplexed pumps can be made utilizing the principles of this invention.

Although the invention has been described with a certain degree of particularity, it is manifest that many changes may be made in the details of construction and the arrangement of components without departing from the spirit and scope of this disclosure.

What is claimed is:

1. A pump comprising:

- (1) a fluid end block having,
 - (a) a cylindrical piston opening therein.
 - (b) the cylindrical piston opening terminating in a coaxial larger diameter cylindrical valve block cavity,
 - (c) the cylindrical piston opening having an intermediate coaxial cylindrical intake valve cavity,
 - (d) the internal diameter of the intake valve cavity being intermediate the internal diameter of the cylindrical piston opening and the valve block cavity;
- (2) a piston reciprocally positioned in the cylindrical piston opening;
- (3) a cylindrical flat disc intake valve having,
 - (a) a coaxial opening therein,
 - (b) the intake valve having an external diameter slightly less than the internal diameter of the intake valve cavity,
 - (c) the intake valve being reciprocally supported in the intake cavity,
 - (d) the internal diameter of the opening therein being slightly greater than the diameter of the piston;
- (4) a cylindrical valve seat block having,
 - (a) a forward and a rearward seating face,
 - (b) the valve seat block positioned in the fluid end valve block cavity,
 - (c) the forward end of the valve seat block being in sealing engagement with the forward end of the valve block cavity, the forward end of the valve seat block forming a boundary of the intake valve cavity and forming an intake valve seating surface,
 - (d) the valve seat block having an axial discharge valve opening in the rearward portion thereof,
 - (e) and a coaxial smaller diameter discharge valve inlet opening in the forward portion thereof,
 - (f) the intersection of the discharge valve inlet opening and the discharge valve outlet opening defining a discharge valve seating surface,
 - (g) the valve seat block having a deep annular groove formed in the cylindrical surface intermediate the ends thereof,
 - (h) a multiplicity of discharge passages,
 - (i) the discharge passages communicating the annular groove with the fluid end block intake valve cavity at the intake valve seating surface,
 - (j) the intake valve normally closing the discharge passages,
 - (k) the fluid end block having a fluid intake opening therein communicating with the annular groove in the valve seat block;
- (5) a spring means normally urging the intake valve in engagement with the valve seat block intake valve seating surface;
- (6) a discharge valve reciprocally supported in the discharge valve opening of the valve seat block;
- (7) a spring means normally urging the discharge valve in engagement with the discharge valve seating surface; and
- (8) a cylinder head removably affixed to the fluid end block,
 - (a) closing the valve block cavity,
 - (b) engaging the valve seat block rearward seating surface,

5

(c) the cylinder head having a discharge port opening therein communicating with the discharge valve opening in the valve seat block.

2. A pump according to claim 1 including compression gasket means in the valve seat block forward and rearward seating faces.

3. A pump according to claim 1 including a discharge valve guide member positioned in the valve seat block discharge valve opening, the valve guide member having at least three radially spaced paralleled relatively narrow guide fingers, the forward portion of the fingers reciprocally supporting the discharge valve.

6

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