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PUMP CYLINDER AND VALVES THEREFOR

Filed July 28, 1922

2 Sheets-Sheet 1

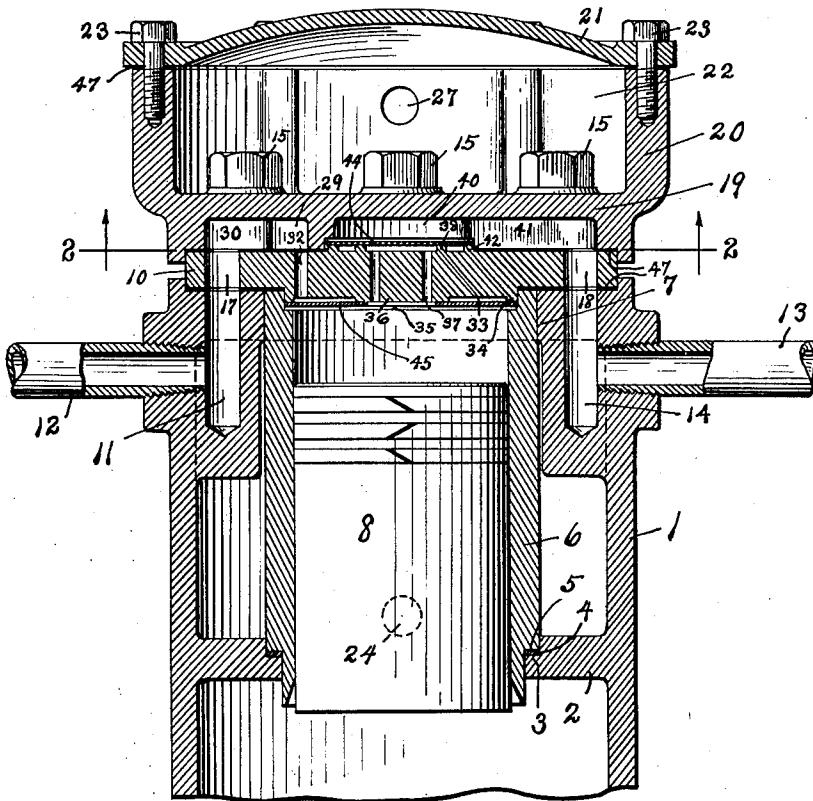


Fig. 1.



Fig. 4.



Fig. 5.

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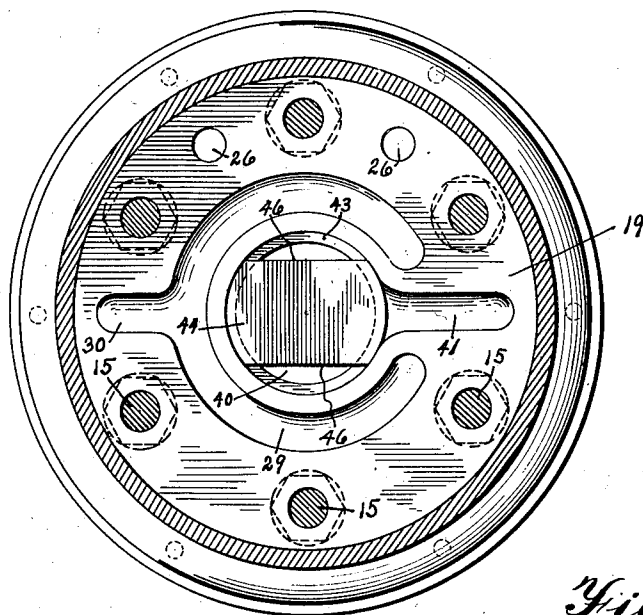


Fig. 2.

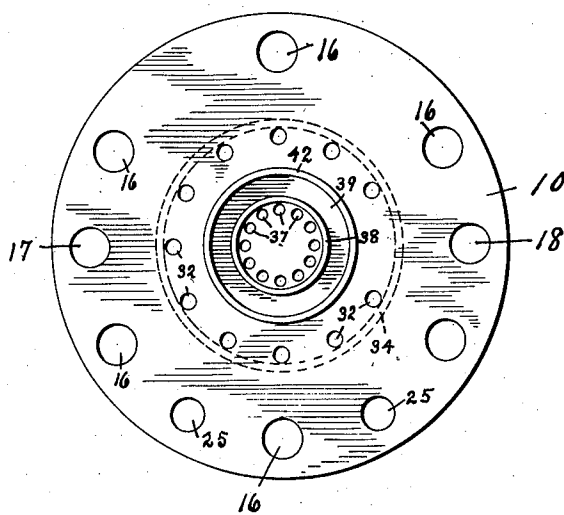


Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY J. BERRY, OF DETROIT, MICHIGAN, ASSIGNOR OF ONE-HALF TO ELLSWORTH S. BRYANT, OF DETROIT, MICHIGAN.

PUMP CYLINDER AND VALVES THEREFOR.

Application filed July 28, 1922. Serial No. 578,101.

To all whom it may concern:

Be it known that I, HENRY J. BERRY, a citizen of the United States, and residing at Detroit, in the county of Wayne and State of Michigan, have invented new and Improved Pump Cylinders and Valves Therefor, of which the following is a specification.

This invention consists in a cylinder for air and gas compressors, air pumps and similar machines for changing the pressure of gases, and its object is to provide a construction of this character which will operate efficiently for a maximum of time and which can be constructed at minimum cost.

This invention consists in a cylinder and a head therefor, a valve plate between the cylinder and its head, said valve plate being provided with novel valve seats for the inlet and discharge valves and with inlet and discharge passages, and valves of thin resilient sheet metal adapted to bend to open and close said passages. It further consists in inlet and discharge passages for the cooling liquid in the cylinder walls and in the cylinder head and in passages in said valve plate communicating with the passages in the cylinder and head. It also consists in the details of construction illustrated in the accompanying drawings and particularly pointed out in the claims.

In the accompanying drawings Fig. 1 is a central longitudinal section of a compression cylinder construction embodying my present invention. Fig. 2 is a section on the line 2—2 of Fig. 1. Fig. 3 is a plan of the valve plate. Figs. 4 and 5 are perspective views of the inlet and discharge valves.

Similar reference characters refer to like parts throughout the several views.

The cylinder 1 is formed with an internal flange 2 intermediate its ends provided with a circumferential shoulder 3 to support the packing ring 4 which prevents leakage of the cooling liquid between this shoulder and the circumferential shoulder 5 on the lining 6. The outer end of this lining fits tightly within the circumferential shoulder 7 at the outer end of the cylinder. A piston 8 of any desired construction is slidable within this lining. The cylinder is formed with an intake passage 11 to which the intake pipe 12 connects while the discharge pipe 13 connects to the discharge passage 14.

Secured to the outer end of the cylinder

by means of the screws 15 is a valve plate 10 having holes 16 to receive these screws and which is formed with passages 17 and 18 which communicate with the passages 11 and 14 in the cylinder respectively.

Secured to this valve plate and to the cylinder is a cylinder head 19 having a flange 20 and closure 21 to constitute a chamber 22 for the cooling liquid. Screws 23 secure this closure 21 in position. Packing gaskets 47 may be employed if desired. The cylinder may be formed with an inlet 24 for the cooling liquid and two passages, not shown, in the upper shoulder 7 which register with the passages 25 (Fig. 3) in the valve plate and the passages 26 (Fig. 2) in the cylinder head, and the head is provided with an outlet opening 27 for the cooling liquid. It will be understood that the number of these passages 25—26 may be increased or decreased as desired.

The cylinder head is formed with a circular groove 29 having an extension 30 which communicates with the passage 17 in the valve plate and the valve plate has a series of smaller holes 32 which communicate with this groove 29. The plate also has a shallow groove 33 just within the circular rib 34 which extends into a recess 35 in the outer end of the lining 6. This plate also has a central boss 36 in the plane of the rib 34 and a second series of small holes 37 which are all within the circular rib 38 on the outer side of this plate. This rib is surrounded by a shallow groove 39 and by a second circular rib 42 whose outer edge is just within the outer edge of the circular recess 40 in the head. This recess has an extension 41 which connects to the discharge passages 18 and 14 in the valve plate and cylinder respectively.

The head is formed with a shallow groove 43 around the recess 40 therein to receive the circular rib 42 and the discharge valve 44 of thin resilient metal preferably spring steel while the inlet valve 45 is placed in the recess 35 in the upper end of the lining 6, a small clearance being allowed so the edge of the valve will not be pinched. The groove 33 is but a few one-thousandths of an inch deep so that when the piston 8 moves outward, the pressure within the cylinder which bends the valve 45 would press it against the bottom of this groove 33 before breaking the valve. But this valve is seat-

ed at that time on the rib 34 and the boss 36 and as these are accurately ground no leakage occurs.

A series of operating tests extending over many weeks demonstrated that this shallow groove 33 and the flat surfaces surrounding it together with the thin metal valve 45 constituted an ideal valve construction for compressors and other pumps for ammonia and other fluids. The upper valve 44 likewise has a free movement to permit bending. The space within the circular rib 38 is depressed a few thousandths of an inch, sufficiently to permit the valve 44 to fit against this rib 38 but not sufficiently deep to permit the valve to bend beyond its elastic limit. This valve like the valve 45, is bent away from its seat by the gas passing through the holes 37 and the gas passes the straight edges 46 of this valve into the recess 40. Neither of these valves requires a spring to cause it to seat as they are of resilient metal and bend under the pressure of the gas to permit it to pass but as soon as the pressure is reversed, they seat themselves by their own resiliency. The distance the valves are permitted to bend toward the valve plate is determined by the depths of the grooves in the valve plate while the distance they bend while "open" can be accurately determined by the rate of intake and discharge of the cylinder.

The details of construction and proportions of parts may all be changed by those skilled in the art without departing from the spirit of my invention as set forth in the following claims.

I claim—

1. In combination, a cylinder, a valve plate closing the outer end thereof, a cylinder head attached to the cylinder and valve plate, the cylinder, valve plate and head having intake and discharge passages for gases, the valve plate having holes extending from the intake and discharge passages in the head to the cylinder and having shallow grooves in which the discharge ends of these holes open; and thin sheet metal valves adapted to engage the head around said grooves to prevent return of the gases.

2. In combination, a valve plate having a circular rib surrounding a depression and a series of holes extending through the plate into said depression, a thin sheet metal valve mounted on the rib and adapted to bend away from the rib to permit gases to pass through said holes, and means to resist the outward movement of the outer edge of the valve.

3. In combination, a valve plate having a circular rib surrounding a shallow depression and a series of holes extending through the plate into said depression, a thin sheet metal valve whose width equals the external diameter of the rib and of

greater length than width positioned to engage the rib to prevent passage of gases through the holes and adapted to bend centrally away from the rib to permit such passage, and means to engage the ends of the valve to limit the movement thereof away from the rib.

4. In combination, a valve plate having a circular rib and a shallow depression concentric therewith and a series of holes extending through the plate into said depression, a valve of thin resilient sheet metal positioned to engage the rib to prevent passage of gases through the holes and adapted to bend centrally away from the rib to permit such passage, and means to engage the valve farthest from the center of the rib to limit the movement of the valve away from the rib.

5. In combination, a cylinder, a valve plate at the outer end thereof, a cylinder head at the outer side of the valve plate, means to secure the head and plate to the cylinder, said cylinder head having separate intake and discharge grooves in the surface next to the valve plate, said cylinder having intake and discharge openings in its wall and said cylinder, valve plate and head having passages connecting the intake and discharge openings in the cylinder wall to the intake and discharge grooves in the cylinder head, said valve plate having two groups of holes whereby the intake and discharge grooves in the cylinder head may connect to the cylinder independently of said passages and a sheet metal valve on each side of the valve plate to permit and prevent passage of fluids through said holes.

6. In combination, a cylinder, a valve plate at the outer end thereof, a cylinder head at the outer side of the valve plate, means to secure the head and plate to the cylinder, said cylinder head having separate intake and discharge grooves in the surface next to the valve plate, said cylinder having intake and discharge openings in its wall, and said cylinder, valve plate and head having passages connecting the intake and discharge openings in the cylinder wall to the intake and discharge grooves in the cylinder head, said valve plate having two groups of holes whereby the intake and discharge grooves in the cylinder head may connect to the cylinder independently of said passages and a sheet metal valve on each side of the valve plate to permit and prevent passage of fluids through said holes, the holes of each group being arranged in a circle and the valve plate having a circular rib on each side concentric with one of the groups of holes to constitute a valve seat.

7. In combination, a cylinder, a valve plate at the outer end thereof, a cylinder head at the outer side of the valve plate, means to secure the head and plate to the

cylinder, said cylinder head having separate intake and discharge grooves in the surface next to the valve plate, said cylinder having intake and discharge openings in its wall and said cylinder, valve plate and head having passages connecting the intake and discharge openings in the cylinder wall to the intake and discharge grooves in the cylinder head, said valve plate having two concentric circular groups of holes whereby the intake and discharge grooves in the cylinder head may connect to the cylinder independently of said passages and a sheet metal valve on each side of the valve plate to permit and prevent passage of fluids 15 through said holes, the valve plate having two circular ribs on each of its sides concentric with the groups of holes to constitute a valve seat, the outer ribs cooperating with circular portions of the head and cylinder 20 respectively to limit the movements of the outer edges of the valves.

HENRY J. BERRY.