June 10, 1930. C. G. HOLT 1,762,625

PUMP

Filed Oct. 2, 1926

FIG. I

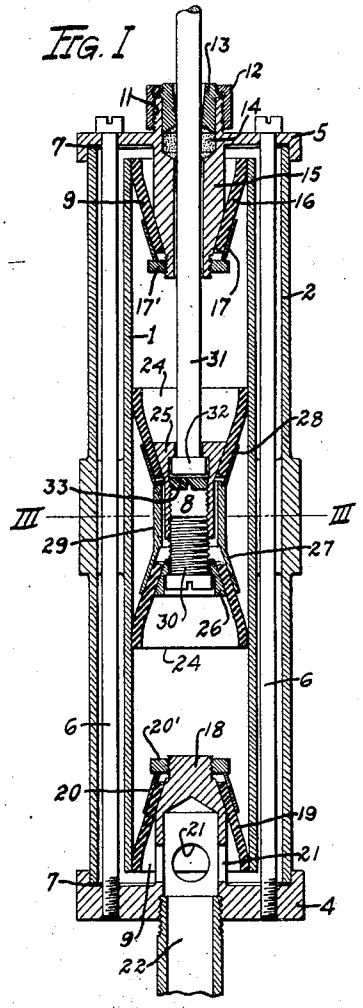


FIG. II

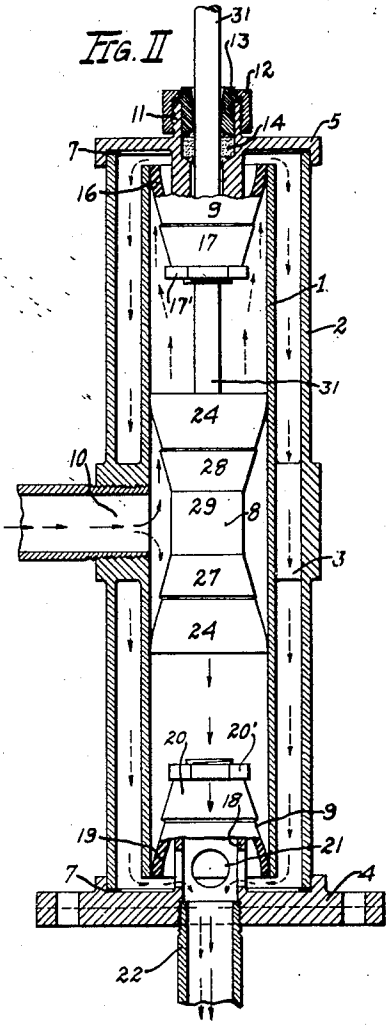
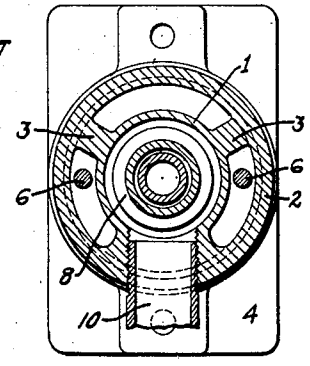


FIG. III



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UNITED STATES PATENT OFFICE

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PUMP

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This invention relates to improvements in pumps and the novel features are especially adapted for use in double-acting reciprocating pumps. In the ordinary double-acting pump, each end of the cylinder is provided with an inlet valve and a discharge valve, and there are no valves in the piston. During each stroke of the ordinary pump, the fluid entering the cylinder flows toward the piston, and the incoming fluid moves at substantially the same speed and in the same direction as the piston. At the beginning of each stroke there is a sudden reversal in the direction of the flow of this fluid. The incoming fluid tending to move onward in response to momentum must be stopped and then moved in the opposite direction. This reversal in the ordinary double-acting pump not only requires a sudden increase in power, but it also causes shocks in the pumping mechanism and results in very irregular pulsations usually requiring an air chamber as a cushion which only partly compensates for the various undesirable effects of the sudden reversals of the fluid in the pump.

One of the objects of the present invention is to produce a double-acting pump wherein these reversals are eliminated by the coaction of elements which cause a substantially continuous progressive flow at each side of the piston. In other words, the fluid passes through the pump without reversing the direction of flow at either side of the piston. The momentum of the incoming fluid tends to move it lengthwise of the cylinder and toward the exhaust port, and when the piston motion is reversed the fluid is pushed in the same direction, so the pump does not require an added impulse to overcome the momentum or to reverse the flow of the incoming liquid.

As a consequence, I have eliminated various disadvantages that ordinarily result from sudden reversals of the fluid in the cylinder of a double-acting pump. Less power is required to operate the pump; there are no severe destructive shocks at the beginning of each stroke; the ordinary air chamber may be dispensed with, and the fluid is delivered in a substantially uniform stream. Actual experience has shown that the liquid discharged in response to each stroke of the piston is greater than the displacement of the piston.

A further object is to produce a pump having a double piston with the piston elements separated from each other to form a passageway through which the fluid flows from an inlet to an exhaust port. The incoming fluid preferably passes one of these piston elements while the other piston element is used to discharge fluid from the cylinder, and the parts are preferably so arranged that the incoming liquid moves in a direction opposite to the piston movement, so as to avoid a reversal of the liquid to be discharged when the piston is reversed.

With the foregoing and other objects in view, the invention comprises the novel construction, combination and arrangement of parts hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown the preferred embodiment of the invention. However, it is to be understood that the invention comprehends changes, variations and modifications which come within the scope of the claim hereunto appended.

Fig. I is a longitudinal section of the device constructed in accordance with my invention.

Fig. II is a section taken approximately through the center of Fig. I, with some of the elements shown in elevation.

Fig. III is a section taken on line III—III, Fig. I.

1 designates an inner cylinder held within the outer cylinder 2 by means of webs 3, said outer cylinder 2 being provided with heads 4 and 5 both apertured to receive screw bolts 6 which connect the heads and force them onto gaskets 7 at the ends of the cylinders. Operating in said cylinder 1 is the double piston 8, said inner cylinder 1 being also provided with check valves 9 and an inlet port 10.

Integrally cast with the head 5 is an externally threaded collar 11 extending outward therefrom, on which is a screwed ring

12 which engages a flange on a gland 13 to force the same against packing 14.

Integrally cast with the head 5 is the inwardly projecting tube 15, drilled, tapered and threaded as shown in Fig. I. The upper check valve 9 includes a conical collar 16, preferably of rubber, having its small end rigidly clamped about the tapered portion of the tube 15 by means of a tapered sleeve 17 engaged by a nut 17′ on the threaded end of the tube 15. The large end of the flexible rubber collar 16 yieldingly engages the inner face of cylinder 1, the whole acting as a check valve.

Integrally cast with the head 4 and extending inwardly therefrom is the tubular member 18 tapered and threaded as shown in Fig. I. The lower check valve 9 includes a conical collar 19, also preferably of rubber, rigidly clamped about the tapered portion of said tubular member 18 by means of a tapered sleeve 20 engaged by a nut 20′. The large end of said rubber collar 19 yieldingly engages the inner face of the cylinder 1, the whole also acting as a check valve.

The lower portion of the tubular member 18 is provided with apertures 21. The head 4 is provided with a discharge pipe 22 through which fluid passes from the apertures 21.

The double piston 8 comprises a pair of oppositely disposed conical collars 24 made of rubber or other suitable flexible material, the large ends of said collars being in contact with the inner face of the cylinder 1, and adapted to overlap the relatively small ends of the collars 16 and 19, respectively. The means for securing these flexible collars includes a pair of inner tapering members 25 and 26 engaging inner faces of said collars at the small ends thereof, and a pair of outer tapering members 27 and 28 contacting with the outer faces of said collars. The member 27 is provided with a tubular extension 29 engaging the small end of the tapering member 28. The inner tapering members are connected by means of a screw 30 having a head engaging a shoulder on the member 26 and a threaded portion screwed into the member 25. The screw 30 can be adjusted to force the inner tapering members 25 and 26 toward each other, thereby clamping the small end portions of the flexible collars between said inner tapering members and the outer tapering members 27 and 28.

The large ends of the conical rubber collars yieldingly engage the inner face of the cylinder 1 to serve as piston members and also to act as check valves.

31 designates a piston rod extending through the stuffing box in the cylinder head 5 and having an enlarged end 32 loosely mounted in the tapered member 25 and secured by means of a short screw 33. The piston rod is also loosely secured in the stuffing box, and the gland 13 has a tapered opening to permit lateral displacement of the piston rod.

In Fig. II the arrows shown by full lines indicate the directions in which the fluid flows when the piston moves downwardly, and the arrows shown by dotted lines indicate the directions when the piston moves upwardly.

In operation fluid enters the inlet port 10. The piston traveling downward drives the fluid before it past the lower check valve 9, thence through the apertures 21 and out the discharge pipe 22. While this is occurring the vacuum created in the chamber at the other end of the cylinder caused by the downward stroke of the piston draws the fluid past the upper check valve member 24 of the piston into said chamber. On the upward stroke the functions are reversed, the fluid being forced past the upper check valve 9, down through the annular space between the two cylinders and out through the apertures 21.

At the end of the downward stroke, the piston momentarily stops before starting upward again. However, the momentum of the fluid, entering the pump, tends to cause the fluid to flow past the upper check valve 24 on the piston and also past check valve 9 in the upper part of the cylinder, even before the piston starts on its return stroke, this being possible because both of these valves open in the same direction. That the pump, in actual test, delivered more fluid than the actual displacement volume of the piston substantiates the above.

It will now be apparent that the incoming liquid moves in a direction opposite to the piston movement, and that this avoids a reversal of the liquid to be discharged when the piston is reversed.

In the pump I have shown to illustrate one form of the invention the port 10 between the valve elements 24 of the piston serves as an inlet port, and the check valves 9 lie in the exhaust ports, but it is to be understood that the invention is not limited to this arrangement. By merely reversing the check valve elements 9 and 24, the port 10 will become the exhaust port and the ports at the ends of cylinder 1 will be the inlet ports.

I claim:

In a double-acting pump, a cylinder having an inlet port, a double piston in said cylinder, said cylinder being provided with oppositely disposed flexible conical check valves located at its ends and contacting with the inner face of the cylinder, said piston being provided with oppositely disposed flexible conical check valves contacting with the inner face of said cylinder at opposite sides of said inlet port and cooperating

with the first mentioned conical check valves to permit a continuous flow of fluid through the cylinder, the conical valves at the ends of the cylinder having their relatively small ends extended toward the piston valves, and the relatively large end of each piston valve being extended toward and adapted to overlap the relatively small end of one of the first mentioned valves.

In testimony that I claim the foregoing I hereunto affix my signature.

CLAUDE G. HOLT.