No. 698,387 Patented Apr. 22, 1902.

H. B. ARNOLD.

DOUBLE ACTING CYLINDER PUMP.

(Application filed Aug. 6, 1901.)

(No Model.)

Fig. 1.

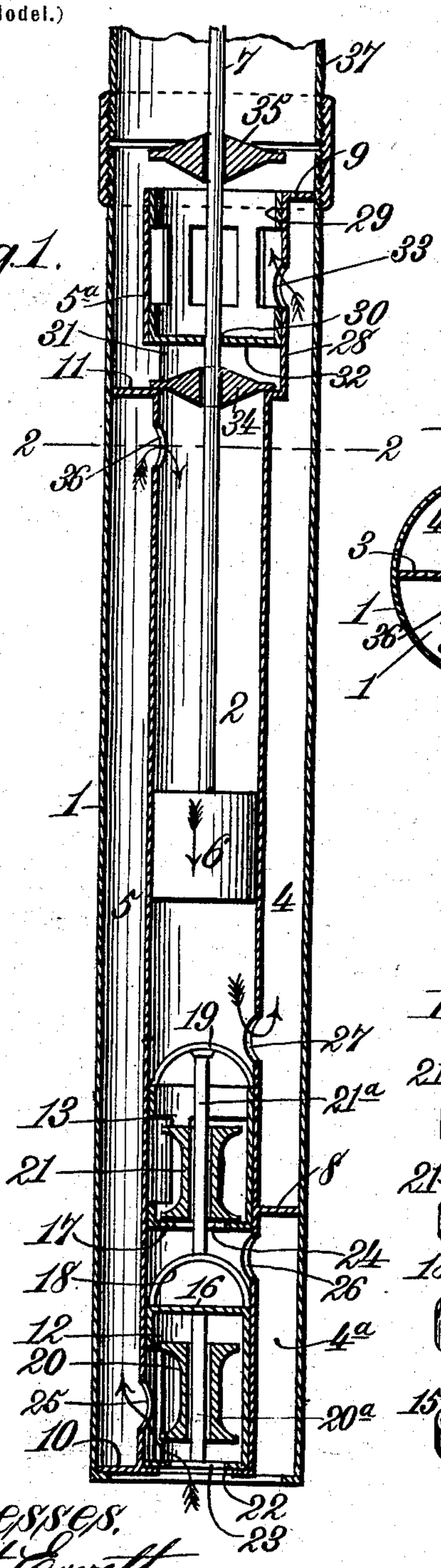


Fig. 2.

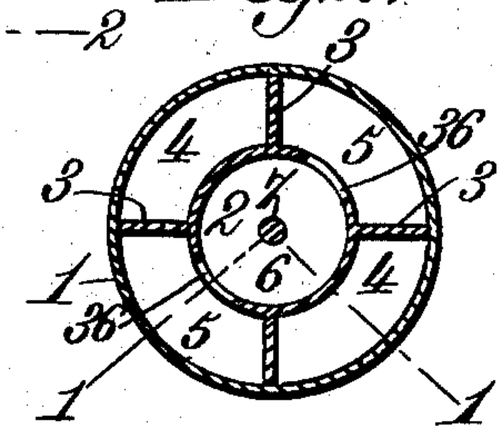


Fig. 3.

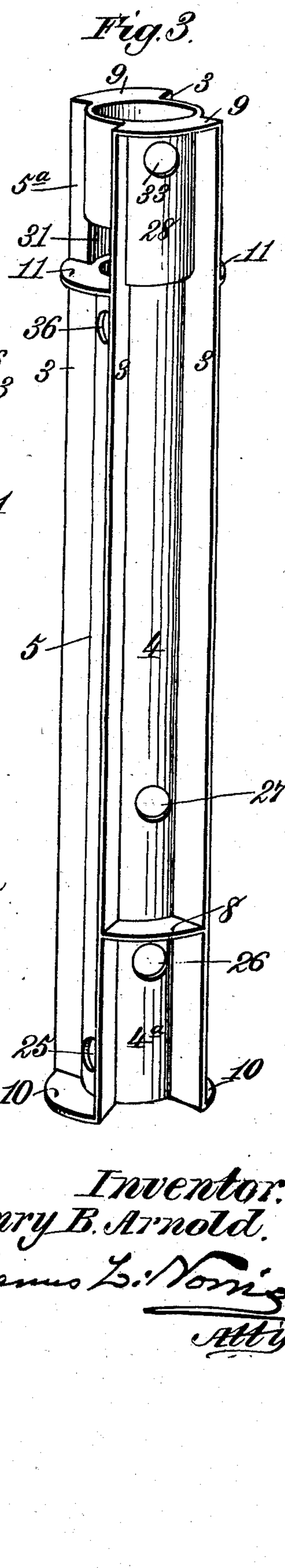
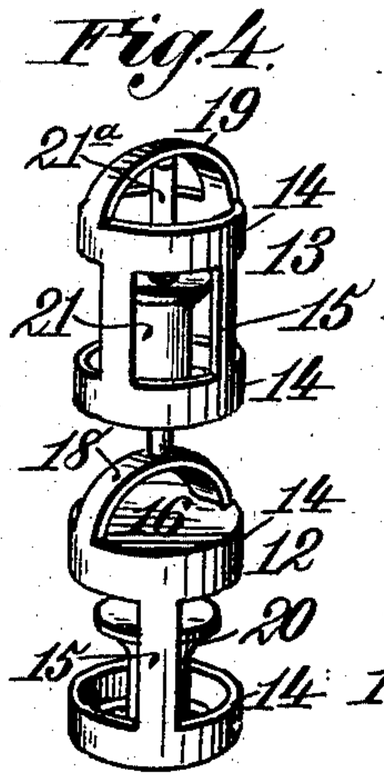


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY B. ARNOLD, OF MIDLAND, TEXAS, ASSIGNOR OF ONE-HALF TO MARTIN L. TAUL, OF MIDLAND, TEXAS.

DOUBLE-ACTING CYLINDER-PUMP.

SPECIFICATION forming part of Letters Patent No. 698,387, dated April 22, 1902.

Application filed August 6, 1901. Serial No. 71,059. (No model.)

To all whom it may concern:

Be it known that I, HENRY B. ARNOLD, a citizen of the United States, residing at Midland, in the county of Midland and State of Texas, have invented new and useful Improvements in Double-Acting Cylinder-Pumps, of which the following is a specification.

This invention relates to double-acting cylinder-pumps, and is in the nature of an improvement on the pump shown and described in a former application for patent filed by me on the 6th day of June, 1900, and serially numbered 19,275.

The present invention has for its object to improve and simplify the construction of the pump and render its operation more efficient and to provide cages for the check-valves so constructed that the cages and check-valves can be withdrawn from the piston-cylinder without removing or disturbing either the casing or piston-cylinder and can be replaced in the same manner.

To these ends my invention consists in the features and in the construction, combination, and arrangement of parts hereinafter described, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is a vertical sectional view of my improved pump, taken on the line 1 1 of Fig. 2. Fig. 2 is a transverse sectional view taken on the line 2 2 of Fig. 1. Fig. 3 is a detail perspective view of the piston-cylinder removed from the casing, and Fig. 4 is a similar view of the connected valve-cages removed from the piston-cylinder.

Referring to the drawings, the numeral 1 indicates the casing inclosing the pumping mechanism and consisting of a metallic tube which is adapted to be placed vertically in the bottom of the well or other liquid-reservoir from which the liquid is to be pumped.

The numeral 2 indicates the piston-cylinder, which consists of a hollow metallic cylinder of approximately the same length as the casing 1, but of much less diameter, the piston-cylinder being arranged concentrically within the casing and is held centrally therein by radial longitudinal partitions 3. The partitions 3 may be of any suitable or preferred number, four such partitions being shown in the present instance, which divide the space between the piston-cylinder and casing into four quadrantal induction and eduction chambers 4 4 and 5 5 of equal capacity. It will be noted that the two chambers 4 4 are arranged on opposite sides of the piston-cylinder, and the chambers 5 5 are arranged in like manner and between the chambers 4 4.

Arranged to reciprocate in the piston-cylinder is a solid piston 6, provided with an upwardly-projecting piston-rod 7, by means of which the piston is reciprocated with the aid of any suitable mechanism. (Not shown.) By the term "solid piston" I mean that the piston has no passages through it; otherwise the construction of the piston is immaterial.

Transverse partitions 8 are arranged in the lower portions of the chambers 4 4 at suitable points above the bottom of the casing and piston-cylinder and extend from one partition 3 to the other, said transverse partitions forming the bottoms of said chambers 4 4, and the latter are closed at their tops by similar transverse partitions 9. In like manner the bottoms of the chambers 5 are closed by transverse partitions 10, extending between the lower ends of their inclosing partitions 3, and are closed at suitable points below their upper ends by transverse partitions 11, arranged below the upper ends of the casing and piston-cylinder. The transverse partitions referred to form chambers 4^a beneath the chambers 4 and similar chambers 5^a above the chambers 5. The chambers 4^a and 5^a, respectively, constitute auxiliary induction and eduction chambers for feeding water to the piston-cylinder and conducting it therefrom.

Arranged in the lower end of the piston-cylinder are two check-valve cages 12 and 13, each consisting of two collars 14 14 of approximately the same diameter as the interior diameter of the piston-cylinder and arranged one above the other, said collars being connected together by vertical braces 15. The cages are arranged one above the other in the lower portion of the piston-cylinder, the lower cage 12 being closed at its upper end by a cover or diaphragm 16 and the lower collar 14 of the upper cage 13 is provided at its lower end with an inwardly-turned flange 17, forming a valve-seat, as will more fully hereinafter appear. The two cages are rig-

idly secured together by a yoke 18, secured to the cover 16 of the cage 12 and the lower end of the cage 13, and said cages are of such diameter that while they closely fit the interior of the piston-cylinder they may be freely inserted therein and withdrawn therefrom. To the upper collar 14 of the upper cage 13 is secured a bail 19, by means of which the cages may be inserted in and withdrawn from the piston-cylinder.

Arranged in the cages 12 and 13 are check-valves 20 and 21, one in each cage, said valves being loosely disposed in the cages and movable vertically therein. Each of said valves flares from its center toward its opposite ends, or, in other words, is spool-shaped, and the lower end of the lower collar 14 of the cage 12 is turned inward, as at 22, to form an inwardly-projecting flange or valve-seat in manner similar to the flange 17 on the cage 13. Each of the valve-seats 17 and 22 is centrally apertured, as at 23 and 24, said apertures forming ports which are controlled by the check-valves 20 and 21. Vertical guide-rods 20^a and 21^a are preferably fixed centrally in the respective cages 12 and 13 and pass loosely through the valves 20 and 21, said rods forming guides for the valves.

Formed in the opposite sides of the lower end of the piston-cylinder are ports 25, which place said piston-cylinder below the diaphragm 16 in communication with the induction-chambers 5, said ports being arranged opposite the lower cage 12, and similar ports 26 are formed in opposite sides of the piston-cylinder at points between the two cages 12 and 13 and place the piston-cylinder at that point in communication with the chambers 4^a. Ports 27 are also formed in opposite sides of the piston-cylinder opposite the upper end of the upper cage 13 and place the piston-cylinder above the valve-seat 17 in communication with the eduction-chambers 4. The upper ends of the chambers 5 are placed in communication with the piston-cylinder 2 by ports 36, formed in opposite sides of said piston-cylinder.

The upper end of the piston-cylinder 2 is provided with a slightly-enlarged extension or prolongation 28, and removably fitted in said extension is a cage 29, similar in construction to the cage 13, before described, excepting that the aperture 30 in its bottom is just of sufficient size to permit the passage therethrough of the piston-rod 7. The extension 28 of the piston-cylinder is provided on the opposite sides of its lower end with ports 31, that place said extension below the bottom 32 of the cage 29 in communication with the chambers 5^a, and is also provided on its opposite sides above the bottom 32 of the cage 29 with ports 33, that place the upper portion of the extension in communication with the upper portions of the eduction-chambers 4. Loosely arranged on the piston-rod 7 is a double conoidal-shaped valve 34, that is disposed between the bottom of the cage 29 and the top of the piston-cylinder 2 and is adapted to seat on the latter and close its upper end. A similarly-shaped valve 35 is loosely arranged on the piston-rod 7 above the cage 29 and is adapted to seat on the upper end of the latter and close the upper end of the extension 28 of the piston-cylinder.

The operation of my improved pump is as follows: The piston 6 is reciprocated in the piston-cylinder through the medium of the piston-rod 7 by any suitable pumping mechanism. Let it be assumed that the piston is on its downstroke. Then the valve 20 is lifted from its seat and the valve 21 is closed on its seat. The water then flows through the ports 25 into the induction-chambers 5 and through the ports 36 into the piston-cylinder above the piston. At the same time the water beneath the piston (the chambers being filled with water at all times) is forced into the eduction-chambers 4 through the ports 27 and out of the latter through the ports 33 and past the valve 35 into the upper end of the casing 1, from which it is conducted by a pipe 37. On the upstroke of the piston the valve 20 is forced to its seat and the valve 21 is lifted from its seat. The water is then drawn through chambers 4^a and ports 26 into the piston-cylinder, up through the opening 24 in the bottom of the cage 13, and into the piston-cylinder beneath the piston, the valve 35 seating itself on and closing the upper end of the extension 28 of the piston-cylinder. At the same time the valve 34 is lifted from its seat and the water in the piston-cylinder above the piston is forced up into the upper end of the casing through the ports 31 and from the casing by the pipe 37. A combined lifting and forcing action thus takes place on each stroke of the piston, the pump double acting in its operation.

The valves and their cages may be readily removed at any time for the purpose of cleaning or repairs, it merely being necessary to withdraw the piston-rod and piston to remove the valves 34 and 35 and the cage 29, and the two cages 12 and 13 and their inclosed valves 20 and 21 may be removed by inserting a rod or the like having a hooked end into the piston-cylinder and hooking the bail 19 and lifting the cages and their valves up through and out of the piston-cylinder. In the same manner the said parts may be replaced without disturbing the piston-cylinder or the casing.

I have shown two induction-chambers 5 and two eduction-chambers 4; but it will be manifest that the number of such chambers may be varied without departing from the spirit of my invention. For example, the piston-cylinder may only be provided with two partitions 3, thus dividing the space between said cylinder and the casing into two chambers 4 and 5.

Having described my invention, what I claim is—

1. In a double-acting cylinder-pump, the combination with the piston-cylinder and the

outer casing, said cylinder being provided with radial partitions dividing the casing into induction and eduction chambers, transverse partitions closing the opposite ends of said chambers and dividing the upper and lower ends of said chambers respectively into auxiliary eduction and induction chambers, an imperforate transverse partition in the lower portion of the piston-cylinder, an apertured partition arranged above the imperforate partition, a check-valve disposed in the lower end of the piston-cylinder and arranged to close its lower end, a check-valve arranged to seat on and close the apertured partition, a piston in the piston-cylinder, ports connecting the auxiliary induction-chambers with the piston-cylinder between said transverse partitions, ports connecting the lower end of the piston-cylinder with the induction-chambers, ports connecting the latter with the piston-cylinder above the piston, ports connecting the piston-cylinder below the piston with the lower ends of the eduction-chambers, and upwardly-opening check-valves controlling the discharge from the upper ends of the piston-cylinder and eduction-chambers, substantially as described.

2. In a double-acting cylinder-pump, the combination with the piston-cylinder and the outer casing, said cylinder being interiorly provided with longitudinal radial partitions dividing the casing into induction and eduction chambers, transverse partitions closing the opposite ends of said chambers and dividing the upper and lower ends of said chambers respectively into auxiliary eduction and induction chambers, two valve-cages connected together and removably fitted one above the other in the lower end of the piston-cylinder, the upper end of the lower cage being closed, and the lower end of the upper cage having a valve-opening, a bail secured to the upper end of the upper cage, reciprocating check-valves arranged in said cages, a piston in the piston-cylinder, ports connecting the auxiliary induction-chambers with the piston-cylinder above the closed end of the lower cage, ports connecting the piston-cylinder below said closed end of the cage with the induction-chambers, ports connecting the latter with the piston-cylinder above the piston, ports connecting the piston-cylinder above the valve-opening in the upper cage with the eduction-chambers, and upwardly-opening check-valves controlling the discharge from the upper ends of the piston-cylinder and eduction-chambers, substantially as described.

3. In a double-acting cylinder-pump, the combination with the piston-cylinder and the outer casing, said cylinder being exteriorly provided with longitudinal radial partitions dividing the casing into induction and eduction chambers, transverse partitions closing the opposite ends of said chambers and dividing the upper and lower ends of said chambers respectively into auxiliary eduction and induction chambers, two valve-cages connected together and removably fitted one above the other in the lower end of the piston-cylinder, the upper end of the lower cage being closed and the lower end of the upper cage having a valve-opening, a bail secured to the upper end of the upper cage, centrally-perforated spool-shaped check-valves arranged in said cages, guide-rods fixed in the cages and passing through said valves, a piston in the piston-cylinder, ports connecting the auxiliary induction-chambers with the piston-cylinder above the closed end of the lower cage, ports connecting the piston-cylinder below said closed end of the cage with the induction-chambers, ports connecting the latter with the piston-cylinder above the piston, ports connecting the piston-cylinder above the valve-opening in the upper cage with the eduction-chambers, and upwardly-opening check-valves controlling the discharge from the upper ends of the piston-cylinder and eduction-chambers, substantially as described.

4. In a double-acting cylinder-pump, the combination with the piston-cylinder and the outer casing, said cylinder being provided with longitudinal radial partitions dividing the casing into induction and eduction chambers, transverse partitions closing the opposite ends of said chambers and dividing the upper and lower ends of said chambers respectively into auxiliary eduction and induction chambers, an imperforate transverse partition in the lower portion of the piston-cylinder, an apertured partition above the imperforate partition, a check-valve arranged in the lower end of the piston-cylinder and arranged to close its lower end, a check-valve arranged to seat on and close the apertured partition, a piston in the piston-cylinder, ports connecting the auxiliary induction-chambers with the piston-cylinder between said transverse partitions, ports connecting the lower end of the piston-cylinder with the induction-chambers, ports connecting the upper ends of the latter with the piston-cylinder, ports connecting the piston-cylinder with the eduction-chambers below the piston, a cage removably inserted in the upper end of the piston-cylinder, ports connecting the latter with the eduction-chambers, ports connecting the upper end of the piston-cylinder beneath the cage therein with the auxiliary eduction-chambers and two valves loosely arranged on the piston-rod, one of said valves being arranged to control the flow of water through the port beneath the bottom of the cage in the upper end of the piston-cylinder and the other valve being arranged to seat on and close the upper end of said piston-cylinder, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

HENRY B. ARNOLD.

Witnesses:
ALLEN C. SOUTHERN,
SAM. W. HILT.