

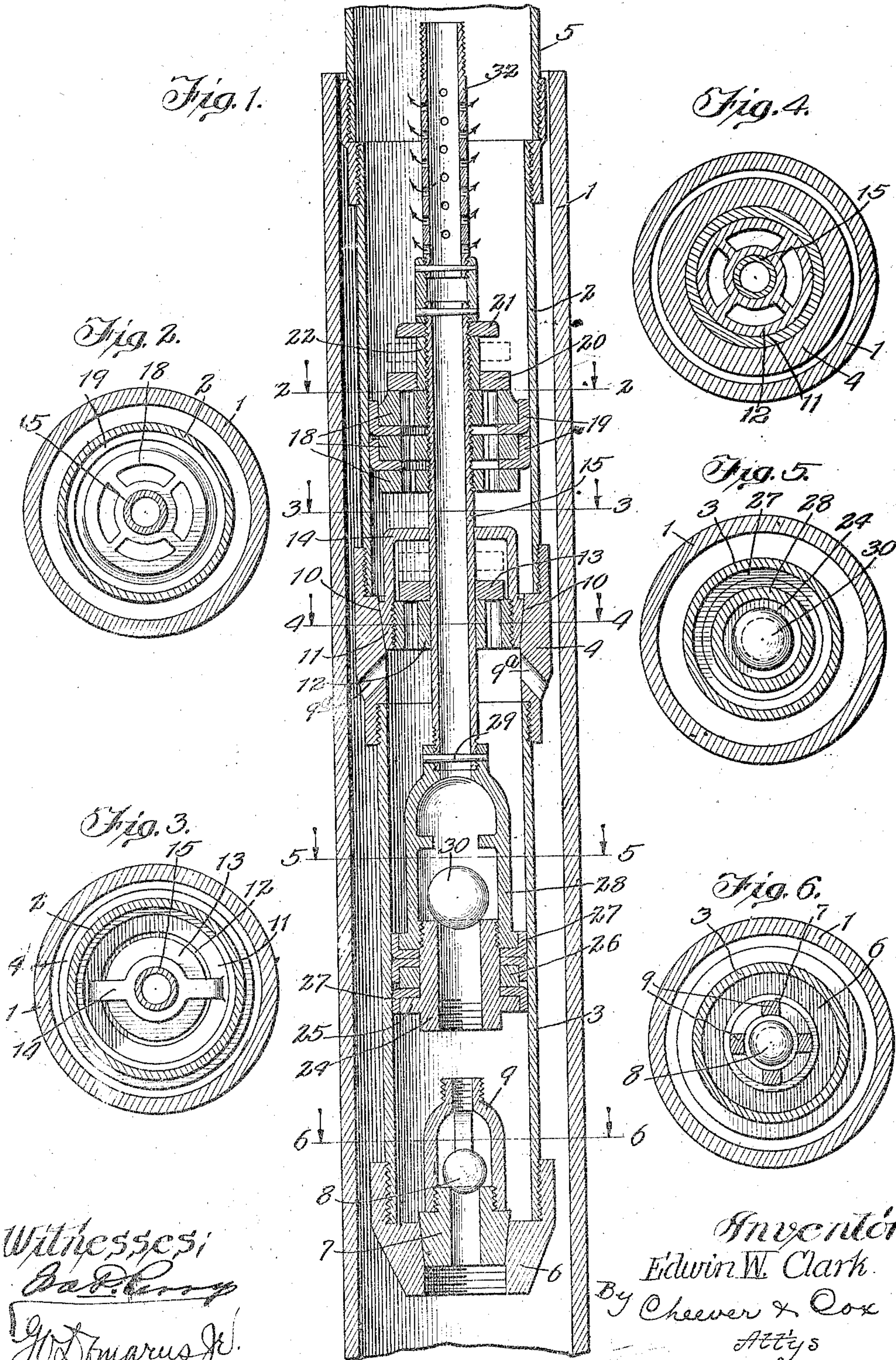
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PUMP.

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UNITED STATES PATENT OFFICE.

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PUMP.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, EDWIN W. CLARK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Pumps, of which the following is a specification.

My invention relates to pumps and is especially adapted for deep wells, particularly those where a well casing is employed. In its most advantageous form, my pump is double acting, and I have selected this form to illustrate the invention.

The general object of the invention is to obtain a pump which shall be durable, simple in construction and efficient in action.

Some of the specific objects of the invention are: first, to provide a pump of this general character in which the flow will be continuous; second, to provide a pump in which the operation shall be positive, the parts operating to actually force the liquid instead of depending upon atmospheric pressure as in the case of a pump acting upon the vacuum principle; third, to provide a construction such that the acting parts may be withdrawn by merely raising the pump rod without removing the cylinder from the well casing; fourth, to provide a construction in which the stationary parts within the cylinder may be seated by merely lowering them after the cylinder is in position in the well; and fifth, to provide certain details of construction hereinafter more fully specified.

I obtain my objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a central vertical section of a pump embodying my invention and shown in position in a well casing. Figs. 2, 3, 4, 5 and 6 are transverse sectional views taken respectively on the lines 2—2, 3—3, 4—4, 5—5 and 6—6 of Fig. 1.

Similar numerals refer to similar parts throughout the several views.

The parts of the pump proper are contained within the well casing 1 which is usually circular in cross section and extends from top to bottom of the well. Within the well casing are the upper and lower cylinders 2 and 3 which are connected together by the intermediate coupling 4. The upper cylinder is attached to and communicates with the pipe 5 through which the liquid is pumped to the top of the well. The lower cylinder 3 terminates at the bot-

tom in the bottom coupling 6 which is apertured to permit liquid to pass up through it. Said bottom coupling is provided with a check valve, for preventing the downward passage of liquid through it, and in the preferred construction said check consists of a vertically apertured seat 7 adapted to cooperate with the check valve 8. Said check valve is preferably a ball and is held captive by means of a cage 9 or other suitable device. In order that the valve seat 7 may come to a bearing automatically and thereafter be firmly held in position, it and the bottom coupling 6 are correspondingly tapered to fit each other as shown. The cage 9 is screw threaded near the top in order that it and the valve seat and valve may be withdrawn from the well when desired by means of the correspondingly threaded part 24 hereinafter mentioned.

The intermediate coupling 4 above mentioned is provided with lateral apertures 9a through which the liquid may pass from the outside of the cylinders 2 and 3 to the inside thereof. At a point above said apertures said coupling has an annular tapered surface 10 which converges downwardly and forms a seat for the correspondingly tapered valve seat which in the present instance is formed of two parts 11 and 12, the part 11 having the taper and the part 12 being vertically apertured and threaded for screwing into the part 11 to form a support for the check valve 13. In the design shown, the part 11 is provided with an arch 14 for preventing valve 13 from rising too great a distance from its seat.

The parts 12, 13 and 14 are centrally apertured in a vertical direction to receive the center pipe 15 which is vertically movable and carries the upper and lower plungers. Although the construction of these plungers may be altered without departing from the spirit of the invention, the form illustrated is advantageous, the upper plunger consisting of a plurality of metallic disks 18, 18 screwing onto the upper portion of the center pipe 15 and carrying between them washers or cup leathers 19. The parts 18 and 19 are vertically apertured at points outside of the pipe 15 to permit upward flow of liquid. A valve 20 is adapted to seat upon the top of the upper plunger to prevent liquid from passing downward through it. Said valve is capable of rising a limited distance off its seat when the liquid presses upward upon it

from beneath, as indicated in dotted lines, Fig. 1. The upward movement of the check valve 20 is limited by means of the stop or collar 21 which screws upon the center pipe 5 15 although any other suitable means may be employed. By preference a sleeve 22 is screwed onto pipe 15 between the collar 21 and upper section 18 of the upper plunger and thus constitutes a distance piece for 10 holding the parts 18 and 21 in relative position and serves as a guide for the check valve 20.

The lower plunger in its preferred form consists of a vertically apertured valve seat 15 24 having an inner flange 25 near the bottom adapted to support the disk 26 and washers or cup leathers 27. Said disk and washers are held down by means of a part 28 which screws onto the upper part of the valve seat 20 24 and serves to reciprocate the latter up and down within the cylinder 3. Said part 28 connects at the top with the bottom of the center pipe 15 and is secured thereto preferably by screw threads and a pin 29. 25 Part 28 is imperforate at the sides so that liquid cannot escape except through the pipe 15. It is so formed as to hold the ball 30 captive so that the latter will seat upon the valve seat 24 and prevent downward 30 passage of liquid. It will be noted that in this preferred form the parts numbered 24 to 30 inclusively constitute a combined lower plunger and check valve operating in the cylinder beneath the stationary check 35 valves, 11, 12 and 13. Part 24 is threaded at its lower end to engage the threaded upper portion of the part 9, so that all of the loose or removable parts may be withdrawn from the cylinder through the agency of the 40 piston rod 15.

Pipe 15 is attached to and communicates with the lower end of a pipe 32 which is laterally apertured to permit the escape of liquid from the inside of said pipe out into 45 the discharge pipe 5 at a point above the upper plunger. Pipe 32 is adapted to be secured to and to be vertically reciprocated by the pump rod (not shown) which extends upward to the top of the well and 50 connects to the source of power.

In operation, when the parts are in their lowermost position the valves 8, 13, 20 and 30 will be down upon their respective seats. As soon as the pipe 32 and parts connected 55 thereto commence to rise, the weight of the liquid outside in the well casing, assisted by the suction of the lower plunger causes the valve 8 to rise and admit liquid into the lower cylinder beneath the lower plunger; 60 at the same time the weight of liquid and suction of the upper plunger cause the valve 13 to rise and admit liquid into the upper cylinder 2 beneath the upper plunger, the liquid entering through the apertures 9a 65 and the vertically apertured part 12. Thus

the upper and lower cylinders are both filled with liquid beneath the respective plungers. During the upward movement of the parts the valves 20 and 30 remain seated and hence the liquid is caused to be lifted or 70 "pumped" upwardly in the discharge pipe 5.

As soon as the parts have reached their highest position and commenced to descend, the valves 8 and 13 will become seated and 75 prevent the downward escape of liquid from the upper and lower cylinders. The liquid confined above the bottom check valve 8 and center check valve 13 causes the valves 30 and 20 respectively to rise from their seats 80 and permit the upward passage of liquid through the lower and upper plungers respectively. The downward movement of the upper plunger produces no effect upon the level of the water in the discharge pipe 5, 85 but the downward movement of the lower plunger causes the liquid confined beneath it to be forced upward through the valve seat 24, center pipe 15 and outward through the lateral apertures in the pipe 32. This quan- 90 tity of liquid emerging from the pipe 32, being added to the amount of liquid already contained within the discharge pipe 5, and prevented from escaping downward there- 95 from by the check valve 13, causes an upward flow of water in the discharge pipe 5. Hence there is a pumping action upon both the upward and downward stroke and the pump is double acting.

It will be understood that under the 100 ordinary practical conditions in pumping water or oil from a well, the washers and other frictional parts are subjected to great wear and it becomes desirable to frequently 105 renew them. In a pump of my construction the removal of the reciprocating parts is accomplished in a very simple manner, for all that is necessary is to pull up the pump rod and pipe 32 and raise the parts 110 to the top of the well, the lower plunger striking the seat of the center check valve 13 and lifting it from its tapered or conical support 4. The mere lifting of the pump rod 115 therefore is all that is necessary to withdraw both plungers and all of the valves and valve seats except the bottom one, which may be 120 afterward removed by means of a suitable tool as herein previously suggested. Conversely, the parts may be adjusted while the cylinders remain at the bottom of the 125 well by merely lowering them into place, the weight of the parts causing the proper seating of the tapered members. Although renewals are thus easily made in a pump of my construction such renewals need not be made 130 with such frequency as is required in a pump where the vacuum principle is employed, in part or in whole, and where leaky valves would destroy the necessary vacuum. In my pump the action is positive and the liquid 135

is at all times positively forced in the proper direction.

Although the upper and lower cylinder 2 and 3 and intermediate coupling 4 are here shown and described as separable pieces, they may if desired be made in a single piece. Furthermore the upper and lower plungers may be constructed with a greater or less number of disks and washers than are illustrated.

It will be noted that in my pump there is an opening at the lower end of the cylinder through the bottom check valve. As a result sand and gravel cannot collect here. It will be noted that in my pump in case either one of the plungers should become out of order the other will be permitted to operate in the regular manner. Hence the pump will operate to a limited extent even if one or the other of the plungers fails to operate.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In a pump, the combination of a cylinder, two different plungers therein arranged one above the other, the upper plunger being of larger diameter than the lower and the upper portion of the cylinder where the upper plunger is located being of greater diameter than the lower portion where the lower plunger is located, and suitable check valves associated with said plungers, one of said valves being located between said plungers and having a taper seat whereby it may be lifted from its seat by the lower plunger.

2. In a pump, a cylinder which is of larger diameter at its upper portion than at its lower portion, a taper valve seat at the junction of the smaller and larger portions of said cylinder, a piston rod, two plungers secured to said rod, one being located in the smaller and the other in the larger portion of said cylinder, and suitable check valves, one of which is adapted to seat upon said taper valve seat whereby it and said plungers may be withdrawn from the cylinder by withdrawing said piston rod.

3. In a pump, a cylinder which is of larger diameter at its upper portion than at its lower portion, a taper valve seat at the junction of the smaller and larger portions of said cylinder, a pump rod, two plungers secured to said rod, one being located in the smaller and the other in the larger portion of said cylinder, a check valve

upon each of said plungers, another check valve beneath the lowest plunger and a fourth check valve seated upon the aforesaid taper seat.

4. In a pump cylinder which is of larger diameter at its upper portion than at its lower portion, a taper valve seat at the junction of the smaller and larger portions of said cylinder, a pump rod, two plungers secured to said rod, one being located in the smaller and the other in the larger portion of each cylinder, a check valve upon each of said plungers, another check valve beneath the lowest plunger and a fourth check valve seated upon the aforesaid taper seat, there being a lateral opening in the side of the cylinder beneath said taper valve seat for the purpose described.

5. In a pump, in combination, a cylinder which is of larger diameter at its upper portion than at its lower portion, a taper valve seat at the junction of the larger and smaller portions of the cylinder, a hollow piston rod, two plungers secured to said rod, one in the larger and one in the smaller portion of said cylinder, a check valve carried by each of said plungers, another check valve seated in said taper seat, a taper seat in the smaller portion of the cylinder beneath the lower plunger, and a bottom check valve in the last mentioned seat, said lower plunger being adapted to screw onto said bottom check valve for withdrawing it.

6. In a pump, in combination, a cylinder which is of larger diameter at its upper portion than at its lower portion, a taper valve seat at the junction of the larger and smaller portions of the cylinder, said cylinder having openings in its side at said junction, a hollow piston rod, two plungers secured to said rod, one in the larger and one in the smaller portion of said cylinder, a check valve carried by each of said plungers, another check valve seated in said taper seat, a taper seat in the smaller portion of the cylinder beneath the lower plunger, and a bottom check valve in the last mentioned seat, said lower plunger being adapted to screw onto said bottom check valve for withdrawing it.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

EDWIN W. CLARK.

Witnesses:

HOWARD M. COX,
C. J. CHRISTOFFEL.