

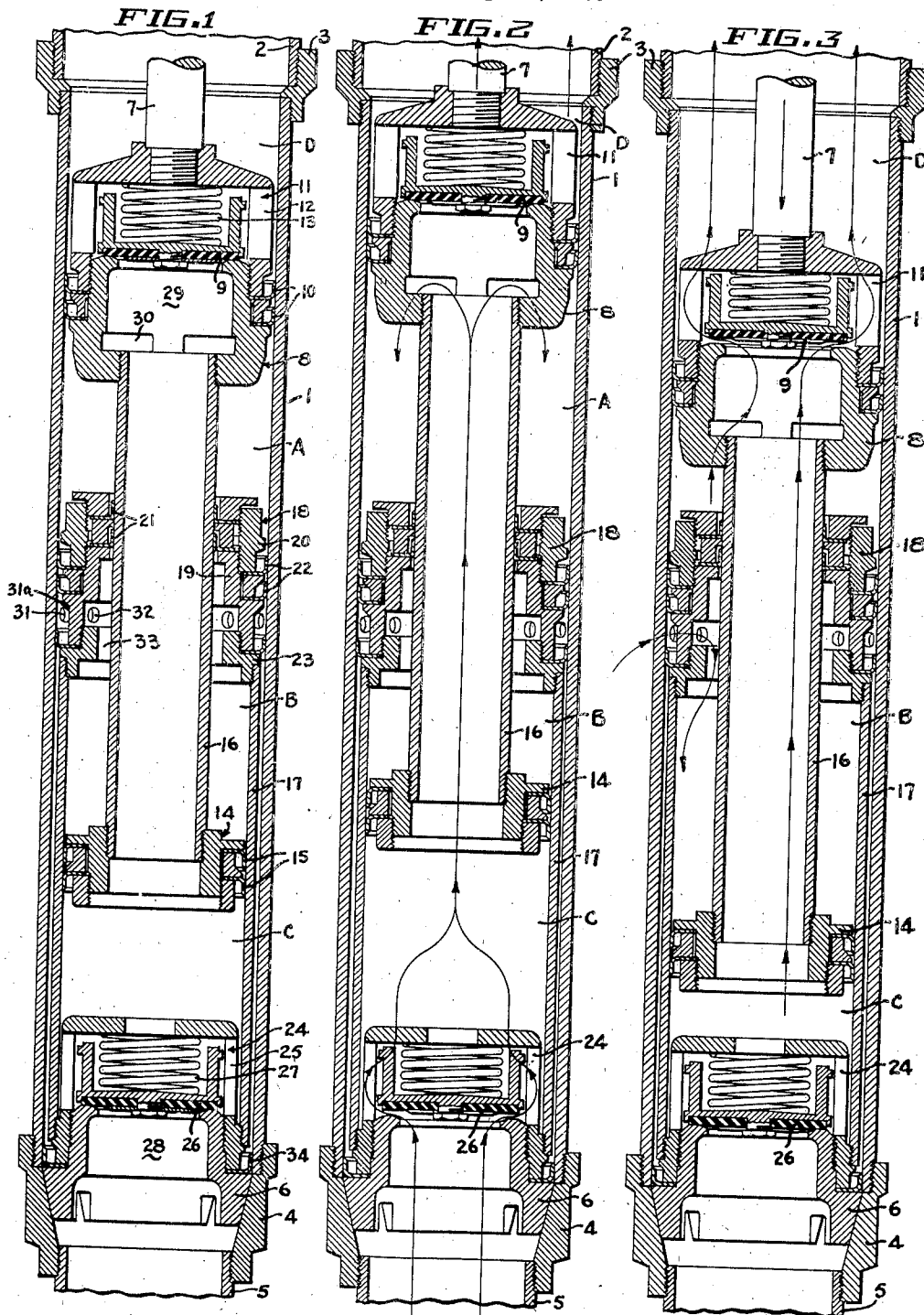
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DOUBLE ACTING PUMP

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DOUBLE ACTING PUMP

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This invention relates to a double acting pump. The pump of the present invention is especially adapted to be used in deep wells, any wells 300' in depth, or more.

It is my object to provide a double acting pump wherein fluid is delivered by two plungers which are interconnected so as to operate in conjunction with one another.

It is another object to provide a pump of the foregoing type wherein the two plungers are connected by a reciprocable hollow member which functions to deliver fluid to a chamber associated with the upper plunger and to deliver fluid from a chamber associated with the lower plunger to the delivery outlet.

Another object is to provide a pump of the foregoing type wherein the working parts may all be removed from the pump by merely pulling the sucker rod upwardly out of the well pipe; this single operation withdraws the entire working assembly from its operative position so that it can be adjusted or repaired without going to the inconvenience of pulling the well pipe.

Another object is to provide a double acting pump which is so constructed that all sealed vacuum space is eliminated whereby the plunger is relieved of any undue load and the necessity for provision of check valves or other moving parts between the upper and lower plungers is eliminated.

Still other objects will be apparent from the following description of a preferred embodiment of the present invention.

Referring to the accompanying drawing:

Figure 1 is a vertical sectional view of a pump constructed in accordance with the present invention and showing the parts as they are disposed when the pump is not operating.

Figure 2 is a similar view showing the position of the working parts during the upstroke of the sucker rod.

Figure 3 is a view similar to Figure 2 but showing the position of the parts on the down stroke of the sucker rod and its associated parts.

Referring to the drawing in detail, reference numeral 1 designates the pump casing which is connected at its upper end by coupling 3 to a well pipe 2, and at its lower end by a coupling member 4 to a pipe 5 which extends downwardly in the well. Coupling 4 is internally tapered and receives a correspondingly tapered collar 6 which is provided at the lower end of the working assembly. Tapered collar 6 is thus adapted to be wedged tightly into coupling 4 and thereby

to support the working apparatus in tight engagement in the outer casing during operation of the pump.

The sucker rod 7 is screw-threadedly engaged with an upper plunger designated generally as 8 which is provided with a valve 9 adapted to allow passage of water from below plunger 8 into space D above plunger 8 but to prevent the reverse flow of water. Upper plunger 8 is provided with sealing washers 10 and carries a cage 11 provided with spaced arms 12, the upper portion of cage 11 limiting upward movement of valve 9. A spring 13 normally presses valve 9 into closed position.

A lower plunger designated generally as 14 is provided having sealing washers 15. Plungers 14 and 8 are interconnected by hollow tube 16 so that they reciprocate together. Tube 16 passes partially through plunger 14 and communicates with the space therebelow. Lower plunger 14 reciprocates within an inner casing within which plunger 14 is sealed by washers 15. Inner casing 17 is normally stationary and is slightly smaller in outside diameter than the inside of outside casing 1 so that it is freely slidable therewithin when it is desired to remove the assembly upwardly by pulling on the sucker rod 7.

Disposed between upper plunger 8 and lower plunger 14, there is provided a sealing assembly designated generally as 18 which divides the space between plungers 14 and 8 into a space A adjacent plunger 8 and into a space B adjacent plunger 14. On pulling sucker rod 7 up beyond its normal position of reciprocation, plunger 14 strikes adapter 23 of sealing assembly 18 and then causes the whole working assembly to lift. Sealing assembly 18 comprises a main member 19 and a member 20 screw-threadedly attached thereto. This assembly is provided with sealing means 21, sealing it with respect to hollow tube 16 and preventing passage of liquid upwardly or downwardly along the exterior of hollow tube 16. Sealing assembly 18 is further provided with sealing means 22 which seals it with respect to outer casing 1. Thus spaces A and B are sealed relative to each other. Sealing assembly 18 is fixedly attached to the upper end of inner casing 17 by means of adapter 23 which is screw-threadedly engaged with member 19 and also with the inside of inner casing 17. In this way, sealing assembly 18 is stationary during the operation of the pump.

At its lower end, inner casing 17 is provided with a cage 24 which screw-threadedly engages on its exterior the bottom of inner casing 17 and

on its interior the upper portion of lower collar 6. Between cage 24 and collar 6, there is provided a sealing washer 34 which seals the assembly with respect to outer casing 1. Cage 24 is provided with upstanding arms 25 which enclose a check valve 26 normally held in closed position by spring 27 which presses against the upper portion of cage 24. Tapered collar 6 is provided with a passageway 23 which allows liquid to freely pass upwardly through check valve 26 when that valve is open. Check valve 26 prevents liquid from passing downwardly as will be obvious.

A space C is formed within inner casing 17 between plunger 14 and check valve 26. This space C is interconnected with space A by means of tube 16, passageway 29 and ports 30 formed in the lower part of plunger 8. Passageway 29 is in direct communication with check valve 9 in plunger 8.

In order to allow free movement of tube 16 and associated lower plunger 14 within the space B, means is provided connecting this space B at all times with the exterior of outer casing 1, so that the fluid surrounding outer casing 1 may pass into and be expelled from space B during operation of the pump. This venting means comprises holes 31 provided in the casing 1 and in free communication with holes 32 provided in sealing assembly member 19 and with an elongated annular space designated generally as 33 which surrounds tube 16 and extends through adapter 23 into communication with space B. An annular passageway 31a is provided in member 19 so that ports 31 are always in communication with ports 32 regardless of the angular disposition of the working assembly relative to outer casing 1. Thus, as plunger 12 moves up and down, air or the liquid being pumped, such as water, flows into and out of space B.

In operation, upward movement of sucker rod 7 draws water through foot or check valve 26 into space C by means of plunger 14 while plunger 8, because of its valve 9 being closed, lifts water into the well pipe 2. At the same time, plunger 8 draws water through tube 16 into space A, and plunger 14 forces water or air out of space B through ports 31.

On the down stroke, check valve 26 is closed and plunger 14 forces liquid from space C through tube 16 and upwardly through valve 9 in upper plunger 8 into space D, and at the same time plunger 8 forces liquid from space A through ports 30 up through open valve 9 into space D. In addition, on the down stroke, a fluid, such as water or air, from outside of casing 1 is sucked through ports 31, 32 and passageway 33 into space B by the downward movement of plunger 14.

Thus water is discharged upwardly out of well pipe 2 on both the upstroke and the down stroke. Water is discharged on the upstroke by the lifting action of the plunger 8 and on the down stroke by reason of the fact that the water contained in spaces C and A is greater in volume than the downward displacement of plunger 8, that is, than the increase of volume of space D attendant upon the downward movement of plunger 8.

The pump as thus constructed is adapted to deliver about 1.7 times the capacity of a single plunger such as plunger 8 by itself. The capacity of the pump is not double that of two single plungers having the diameter of the inside of

casing 1 because the effective area of plunger 14 is lower because of the area of pipe 16 and the reduced inner diameter of inner casing 17 compared with outer casing 1. By the present invention, numerous advantages are attained other than the advantage of increased capacity and of pumping on both upstroke and down stroke. Among these is that the assembly is completely removable up through well pipe 2 as above described, and the provision of venting means for space B eliminates the vacuum in space B and any necessity for a relief valve in connection with the same.

It will be understood that I desire to include within my invention such modifications as may be necessary to adapt the same to varying conditions and uses.

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

1. A double acting pump comprising an outer casing containing an assembly comprising an upper plunger closely slidably engaging said casing, stationary sealing means below said upper plunger, an inner casing positioned within said outer casing and supporting said stationary means, a lower plunger within said inner casing upwardly opening, check valve means below said lower plunger supported by said inner casing, a hollow tube passing through said stationary means connecting said plungers and providing a fluid passageway from the space below the lower plunger to ports arranged in communication with the space below the upper plunger, sealing means between said stationary means and said tube, valve means in said upper plunger for allowing fluid to pass from said chambers to a point above said upper plunger, internally downwardly converging means at the lower end of said outer casing, and seated therein a correspondingly shaped collar mounted on the lower end of said inside casing, all of said assembly being removable as a unit up through said outer casing upon pulling upwardly on said upper plunger.

2. A pump comprising an outer casing, an interiorly downwardly converging coupling mounted on the lower end thereof, and a working assembly in said casing comprising an upper plunger closely slidably engaging and reciprocating in the upper portion of said casing, a lower casing mounted in the lower portion of said casing, a lower plunger closely slidably engaging and reciprocating in said lower casing, means rigidly connecting said plungers, means providing fluid communication between the spaces below said plungers, an upwardly opening check valve in said upper plunger, stationary sealing means mounted on the upper end of said lower casing for sealing the space between said outer casing and said lower casing, an exteriorly downwardly converging collar rigidly carried on the lower end of said lower casing and adapted to be normally wedgedly received in said coupling, and an upwardly opening check valve carried by said collar, said assembly being removable upwardly as a unit by pulling upwardly on said upper plunger.

3. A pump comprising an outer casing, an interiorly downwardly converging coupling mounted on the lower end thereof, and a working assembly in said casing comprising an upper plunger closely slidably engaging and reciprocating in the upper portion of said casing, a lower casing mounted in the lower portion of said casing, a lower plunger closely slidably engaging and re-

reciprocating in said lower casing, means rigidly connecting said plungers, means providing fluid communication between the spaces below said plungers, an upwardly opening check valve in said upper plunger, stationary sealing means mounted on the upper end of said lower casing for sealing the space between said outer casing and said lower casing, vents in said outer casing opposite the normal position of said stationary means, and ports in said stationary means in communication with said vents and with the space above said lower plunger, an exteriorly downwardly converging collar rigidly carried on the lower end of said lower casing and adapted to be normally wedgedly received in said coupling, and an upwardly opening check valve carried by said collar, said assembly being removable upwardly as a unit by pulling upwardly on said upper plunger.

4. A pump comprising an outer casing, an interiorly downwardly converging coupling mounted on the lower end thereof, and a working assembly in said casing comprising an upper plunger closely slidably engaging and reciprocating in the upper portion of said casing, a lower casing mounted in the lower portion of said casing, said lower casing being just slightly smaller in outside diameter than the inside diameter of said outer casing, a lower plunger closely slidably engaging and reciprocating in said lower casing, means rigidly connecting said plungers, means providing fluid communication between the spaces below said plungers, an upwardly opening check valve in said upper plunger, stationary sealing means mounted on the upper end of said lower casing for sealing the space between said outer casing and said lower casing, vents in said outer casing opposite the normal position of said stationary means, and ports in said stationary means in communication with said vents and with the space above said lower plunger, an exteriorly downwardly converging collar rigidly carried on the lower end of said lower casing and adapted to be normally wedgedly received in said coupling, and an upwardly opening check valve carried by said collar, said assembly being removable upwardly as a unit by pulling upwardly on said upper plungers.

5. A double acting pump comprising an outer casing, a reciprocating upper plunger in sliding engagement with the inner wall of said outer casing, stationary sealing means below said upper plunger and having resilient portions engaging said outer casing, an inner casing positioned within the outer casing and containing a lower plunger, upwardly opening check valve means leading into the space between said lower plunger, a hollow tube passing through said stationary seal and connecting said plungers and providing a fluid passageway from the space below the lower plunger to ports arranged in communication with the space below the upper plunger, vents in said outer casing, venting means carried by said stationary seal between said resilient portions connecting the space above said lower plunger with said outer casing vents, and valve means in said upper plunger for allowing fluid to pass from said chambers to a point above said upper plunger.

6. A double acting pump comprising an outer casing, a reciprocating upper plunger in sliding engagement with the inner wall of said outer casing, an inner casing positioned within said outer casing and containing a reciprocating lower plunger, stationary sealing means supported

by said inner casing and having portions constructed and arranged for sliding frictional engagement with the outer casing and separating said plungers into separate operating chambers, check valve means located below said lower plunger and opening upwardly into the space below said lower plunger, common means passing through said stationary means providing fluid communication by means of a port opening between said chambers and connecting said plungers so that they move together, valve means in said upper plunger for allowing fluid to pass therethrough from said chambers to a point above said upper plunger, vent means in said outer casing, and means carried by said stationary means between said portions for venting the space formed between said lower plunger and said stationary means, said stationary sealing means aligning the venting means carried thereby with the venting means in the outer casing.

7. A pump comprising an outer pump casing, an inner pump casing positioned within said outer casing, plunger means in sliding engagement with the inner wall of the outer pump casing, plunger means in sliding engagement with the inner wall of the inner pump casing, means for rigidly interconnecting the plungers, sealing means transversely traversing the pumping chamber between the plungers for separating the working area of the outer casing from the working area of the inner casing, said sealing means having resilient sealing members, means providing fluid communication between the working areas of the plungers, a foot-valve supported by said inner pump casing and a head valve carried by the upper-most plunger.

8. A pump comprising an outer pump casing, an inner pump casing positioned within said outer casing, plunger means in sliding engagement with the inner wall of the outer pump casing, plunger means in sliding engagement with the inner wall of the inner pump casing, means for rigidly interconnecting the plungers, sealing means supported by said inner casing and resiliently engaging said outer casing interposed between the plungers for separating the working area of the outer casing from the working area of the inner casing, means providing fluid communication between the working areas of the plungers, a foot-valve supported by said inner pump casing and a head valve carried by the upper-most plunger.

9. A pump comprising an outer pump casing, an inner pump casing positioned within said outer casing, plunger means in sliding engagement with the inner wall of the outer pump casing, plunger means in sliding engagement with the inner wall of the inner pump casing, means for rigidly interconnecting the plungers, sealing means supported by said inner casing interposed between the plungers constructed and arranged for sliding engagement with said outer casing and for separating the working area of the outer casing from the working area of the inner casing, means providing fluid communication between the working areas of the plungers, a foot-valve supported by said inner pump casing and a head valve carried by the upper-most plunger, said inner pump casing being supported within the outer pump casing by means of the foot-valve body.

10. A pump comprising an outer casing including a separate support member carried upon the lower end of said casing, and a working assembly in said casing comprising an inner casing po-

sitioned within said outer casing, a plunger in sliding engagement with said inner casing, a plunger in sliding engagement with said outer casing, means for rigidly interconnecting said plungers, sealing means interposed between said plungers carried by said inner casing and in resilient engagement with said outer casing, a foot-valve supported by said inner casing, a head valve in the upper-most plunger, means for providing fluid intercommunication between the working areas of said plungers, and means for supporting said inner casing upon said support means, said working assembly being removable upwardly as a unit, said sealing means and said upper plunger means being removable from said outer casing by sliding the same upwardly out of engagement with said outer casing.

11. A double acting pump comprising an outer casing containing a reciprocating upper plunger,

stationary sealing means below said upper plunger, an inner casing positioned within said outer casing and containing a lower plunger, upwardly opening check valve means below said lower plunger leading into the space below said lower plunger, a hollow tube passing through said stationary seal connecting said plungers and providing a fluid passageway from the space below the lower plunger to ports arranged in communication with the space below the upper plunger, vents in said outer casing, venting means carried by said stationary seal connecting the space above said lower plunger with said outer casing vents, means to prevent fluid vented through said seal from entering the space between said casings, and valve means in said upper plunger for allowing fluid to pass from said chambers to a point above said upper plunger.

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