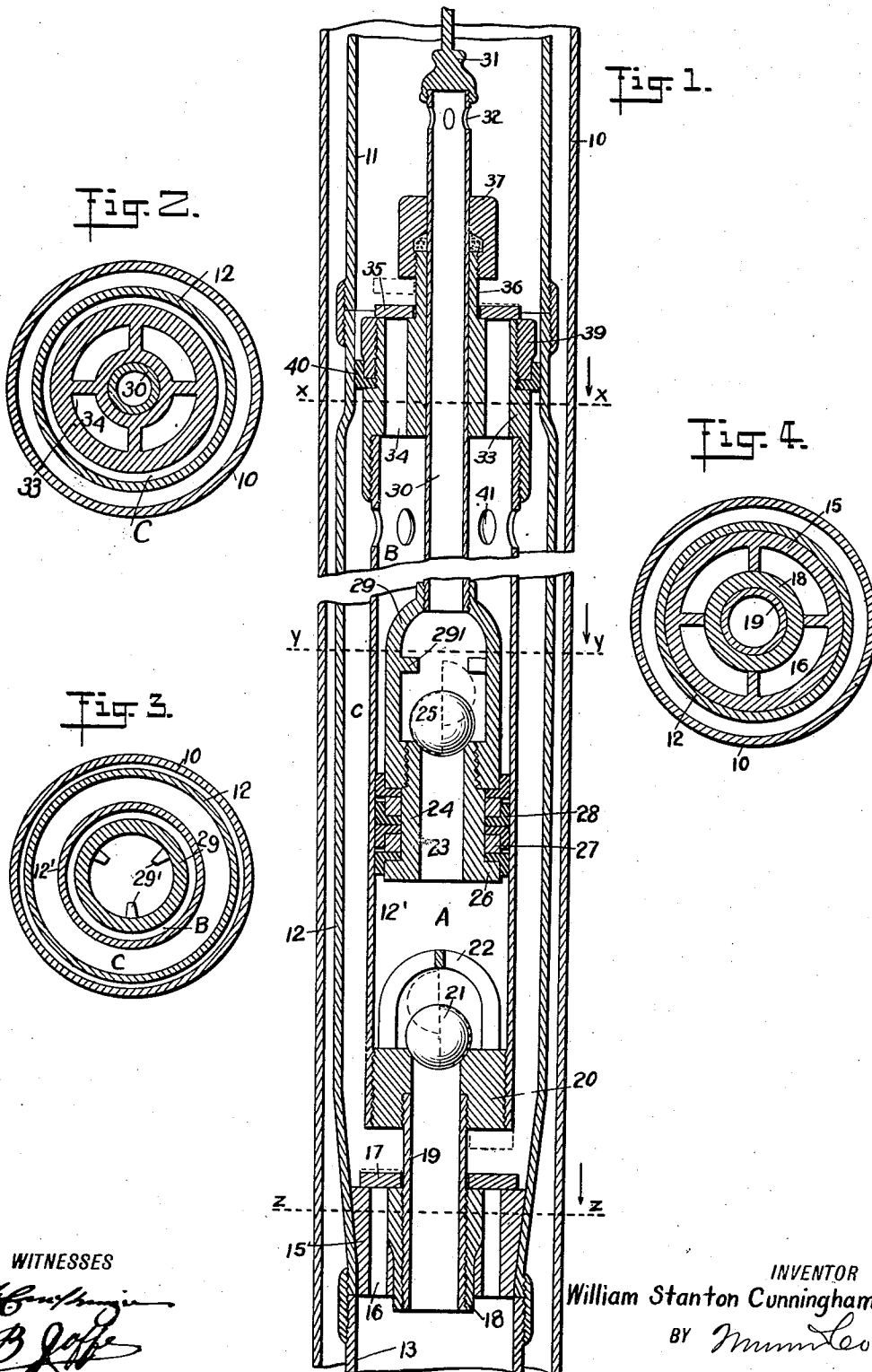


W. S. CUNNINGHAM.
DEEP WELL PUMP.
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Patented June 17, 1913.



WITNESSES

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DEEP-WELL PUMP.

1,065,225.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM STANTON CUNNINGHAM, a citizen of the United States, and a resident of Springfield, in the county of Greene and State of Missouri, have invented certain new and useful Improvements in Deep-Well Pumps, of which the following is a full, clear, and exact description.

This invention relates to improvements in deep well force pumps, and has for its object an inexpensive, simple and reliable pump of reciprocating, double-acting type, which will give a continuous flow of liquid and require minimum attention, having few moving parts, and all the parts of the pump being so positioned as to form an easily extractable unit readily accessible for inspection and repairs.

The above-outlined object is carried out by a pump comprising two concentric cylinders forming the predetermined voluminal clearance, a hollow reciprocating piston in the inner of said cylinders, and automatically operated inlets and outlets associated with said cylinders and piston.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a vertical section through a well, and an embodiment of my invention positioned in same; Fig. 2 is a horizontal section on the line X—X of Fig. 1; Fig. 3 is a similar section on the line Y—Y of Fig. 1; and Fig. 4 is also a similar section on the line Z—Z of Fig. 1.

Before proceeding to a more detailed description of my invention, it must be clearly understood that the voluminal clearance between the two concentric cylinders or barrels closed at the extremities, will depend on the diameter of the well, the diameter of the inner barrel or cylinder, and the length of the barrel. In practice, however, the diameter of the well is a fixed factor. The other two parts, consequently, may be so varied as to obtain a maximum delivery of liquid for the given diameter of the well. Certain parts of the pump may be altered so as to meet special conditions or individual preference without departing from the underlying spirit of my invention.

Referring to the drawings, 10 indicates a well casing usual to all wells, extending

from top to bottom. Within the well casing a pump delivery pipe or drop 11 runs from the top of the well in close relation to the casing 10 to the desired depth, where a working barrel is coupled to same and consists of cylinders 12, 12'. The cylinder 12 is preferably of larger diameter than the pipe 11, but has sufficient clearance within the casing, and its extremities are properly contracted for coupling at its upper end with the pump pipe 11 and with the strainer 13 at the lower end. The lower contracted end of the cylinder 12 receives interiorly a foot valve seat 15, which may be drawn out through the upper contracted end of the cylinder 12. A cone shape is preferably given to the contraction and valve seat so that any pressure applied to the valve seat will seat same tightly in the contracted end. The valve seat 15 is provided with vertical inlet openings 16 concentrically disposed about a central opening contracted in its lower portion and adapted to receive a bushing 18 having the same profile in vertical section as the central opening of the foot valve seat 15 (see Fig. 1). The upper horizontal surface of the bushing 18 is made flush with the upper similar surface of the valve seat 15 so that a ring valve 17 positioned on top of the valve seat 15, can seat tightly against the upper surface of the said valve seat and bushing over the concentric inlets 16.

In the bushing 18 is concentrically threaded a nipple 19 projecting above the bushing and through the ring valve 17, and constituting a guide for said ring valve. The upper end of the nipple is threaded into a valve seat 20 positioned in the bottom of the cylinder 12' concentric with the cylinder 12, and forming a chamber C between the cylinders. The foot valve seat 20 is preferably threaded into the foot of the cylinder 12' and centrally provided with an orifice forming the extension of the nipple into the said cylinder, and in connection with the nipple forming a foot rest or support for the inner cylinder 12'. A ball valve 21, having its seat on the upper surface of the valve seat 20 over the orifice, is prevented from excessive displacement during the flow of water by a cage 22, attached in any suitable way to the valve seat 20. A plunger or piston 23 adapted to reciprocate in the inner cylinder 12' is formed of a centrally bored member 24 having a valve seat

on its upper surface on which a ball valve 25 seats. A shoulder 26 is provided on the lower end of the lateral surface of the member 24, and the upper lateral end of the said member is slightly contracted and threaded to receive a dome 29 covering the ball valve and having internal projections 29' preventing an excessive displacement of said valve in said dome. Between the shoulder 26 and the lower horizontal surface of the dome 29 is an alternate series of leather cups 28 bearing against the lateral surface of the cylinder 12', the rings 27 being held tightly against the shoulder 26 by the dome 29 and the lateral surface of the member 24, the leather cups being so positioned as to prevent any leaking along their lateral surface of bearing. It can be easily seen from the drawings that the inner cylinder 12' is divided by the plunger or piston 23 into two separate chambers, the lower one marked A and the upper one marked B.

The upper portion of the dome 29 is centrally contracted and engages the lower threaded end of a hollow pump or piston rod 30 projecting through the central orifice formed in the top fitting valve seat 33 which is screwed onto the exterior end of the top of the inner cylinder 12'. The projecting upper end of the piston rod 30 is coupled to the rod 31 extending up to the reciprocating mechanism, and a plurality of radiating discharge orifices 32 are provided near the coupled end of the piston rod 30 above the working barrel. The top valve seat 33 is provided with vertical concentric apertures 34 and a central portion 36 projecting above the upper surface of the valve seat and through a ring valve 35 seated on the same surface over the above stated apertures 34. The projecting portion 36 guides the movement of the ring valve 35, and at its extremity is threaded and provided with a stuffing box 37 preventing the leakage of fluid during the motion of the rod 30 through the valve seat 33. The upper lateral end of the valve seat 33 is contracted and threaded so as to form an exterior shoulder onto which a lateral cup 40 fits, and is engaged by the lower end of the threaded cap or ring 39 screwed onto the contraction above stated, thereby forcing said lateral cup against the contraction formed in the upper portion of the cylinder or barrel 12. The inner diameter of this contraction of the valve 12 is of slightly smaller diameter than the inner diameter of the pump pipes 11 so that the leather cup 40 normally fits tightly in said contraction, passing freely into the pipes 11. The inner cylinder 12' is provided with radiating orifices 41 positioned on the upper portion of same near the foot of the valve seat 33, and through these orifices the liquid is admitted and expelled from the upper portion of the inner

cylinder 12' when the piston is reciprocated in same.

To further illustrate the action of my apparatus, in Fig. 1 I have shown the valves halved, dotted, those halves on the left side representing the position of the whole valves on the "up" stroke of the plunger, and those halves on the right side representing the position of the whole valves on the "down" stroke of the plunger.

The operation of the pump is as follows: On the up stroke of the piston 23, a vacuum is formed in the chamber A, consequently the ball valve 21 is raised by the water in flowing through the nipple orifice from the strainer into the chamber A, and the water positioned in the chamber B is forced out of same through the concentric apertures 34 provided in the valve seat 33, thereby raising the ring valve 35 from the seat and allowing the water to enter the pipe 11. The water in the chamber B will also have a chance to flow out of the radiating orifices 41 into the chamber C, and consequently will seat the ring valve 17 against the foot valve 15, preventing the water in the chamber C from escaping, and the water in the pipe 11 will also seat the valve 25 against its seat in the piston 23, preventing the water from the pipe 11 communicating by means of the orifices 32 with the hollow piston 23. In the downward motion of the plunger, the water in the chamber A will force the ball valve against its seat, and similarly the water of the chamber A will raise the ball valve 25 and escape through the pump and hollow plunger 30 and orifices 32 provided on the upper portion of this rod, into the pipe 11, while in the chamber B a vacuum will be formed. Thus the pressure in the pipe 11 will seat the valve 35 against the valve seat 33, and the vacuum formed in the chamber B will allow the water from the strainer to pass through the concentric apertures 34 into the chamber C and into the chamber B through the radiating orifices 41, thus completing the cycle of operation. As will be easily seen, there will be a continuous flow of water, as there is a delivery for the upward and downward motion of the plunger.

When repairs make it necessary to remove the working parts, the pump rod 31 is pulled upward, the hollow piston bringing the top of the dome 29 into contact with the lower surface of the top fitting valve seat 33; when the entire inner cylinder 12' will be raised upward taking with it the top fitting valve seat 33, inner cylinder supply pipe 19, the ring valve 17 and the bushing 18, from its seat in the foot valve 15. Upon the return of the parts to the valve, bushing 18 will seat in foot valve 15, press same against the cone contraction and make a perfect seal preventing leakage. The ring

valve 17 will be seated in place and leather cup 40 in top fitting valve seat 33, will come again in contact with the upper contracted end of the outer cylinder 12 and tightly close the formed clearance between the two cylinders and the pumping may be resumed again.

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

1. A fluid pumping apparatus comprising a pump delivery pipe, a cylinder having contracted ends suspended from said delivery pipe, a valve seat positioned in the lower contraction of said cylinder, a removable cylindrical unit positioned in said cylinder, means on said cylindrical unit co-acting with the upper contracted end of said cylinder and said valve seat in the lower contracted end of same and thereby keeping said cylindrical unit concentric within said cylinder, a predetermined voluminal clearance defined by said cylinder and cylindrical unit, and closed at the extremities by the above-mentioned means on said removable unit, a reciprocating plunger within said removable unit, and inlet and outlet valves associated with said removable unit and plunger and co-acting with said valve seat in the lower contracted end of said cylinder.

2. A fluid pumping apparatus comprising a pump delivery pipe, a cylinder suspended from said delivery pipe having a foot valve seat positioned in its lower end, a removable cylindrical unit positioned in said cylinder, means on said cylindrical unit, co-acting with the upper end of said cylinder and with the said foot valve in same, thereby defining a voluminal clearance closed at its extremities by said means on said removable unit, a reciprocating plunger within said removable unit, and inlet and outlet valves associated with said removable unit and plunger and co-acting with said foot valve in said cylinder.

3. A pump comprising a pump delivery pipe, a cylinder suspended from said delivery pipe and a foot valve fitting at its lower end, a removable unit having at its lower end a removable seat on the said foot valve fitting and having a head at its upper end fitting liquid tight in the upper end of the mentioned cylinder, said removable unit

having a body constituting a cylinder, forming with the first-mentioned cylinder a working barrel, there being a clearance space between the two cylinders having an inlet thereto through the mentioned foot valve fitting, a hollow plunger in the cylinder of the removable unit dividing said cylinder into upper and lower chambers, a hollow pump rod carrying said plunger and having an outlet to the delivery pipe above the working barrel, the above mentioned member of the unit forming a delivery pipe leading through the foot valve fitting of the outer cylinder to the lower chamber of the inner cylinder, a valve in the hollow plunger commanding the passage from the lower chamber through the hollow plunger and pump rod, the upper chamber of the inner cylinder communicating with the said mentioned clearance space and having a valve outlet passage through the said head of the removable unit into the delivery pipe independently of the hollow plunger rod.

4. A pumping apparatus comprising a pump delivery pipe, a cylinder suspended at the foot of said pipe, a removable unit positioned in said cylinder and comprising a cylinder concentrically positioned in said first cylinder and defining a clearance space between said cylinders, the upper end of said clearance space being closed, a plunger in the inner cylinder, dividing same into upper and lower chambers, means establishing communication between the upper chamber and the said clearance space, said cylinders constituting the working barrel, there being a liquid passage that leads from below of said working barrel into the lower chamber of the inner cylinder, through the plunger up into the said delivery pipe, and another independent liquid passage also leading from below the working barrel into the clearance space through the means in the upper chamber of the inner cylinder and up into the delivery pipe, and valves automatically controlling these passages.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM STANTON CUNNINGHAM.

Witnesses:

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FRED A. SMITH.