No. 840,919. PATENTED JAN. 8, 1907.

P. H. DEIS.

PUMP.

APPLICATION FILED JAN. 9, 1906.

Fig. 1.

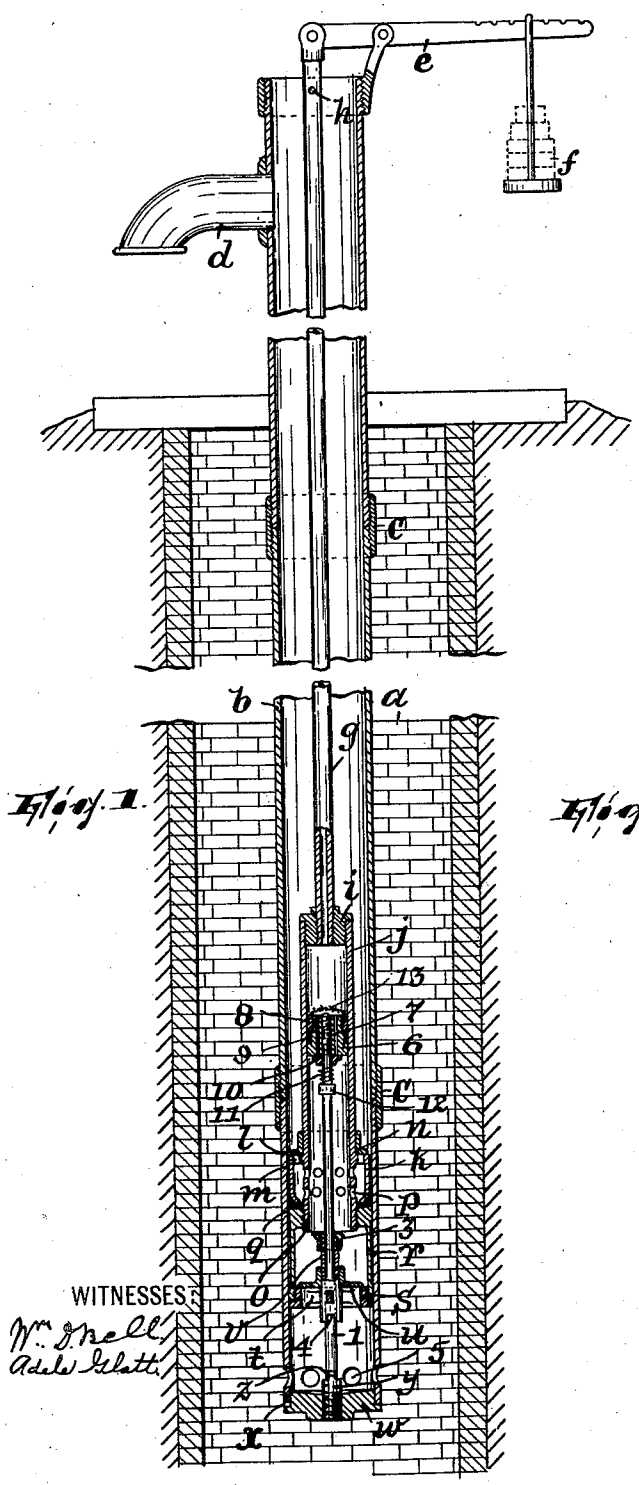
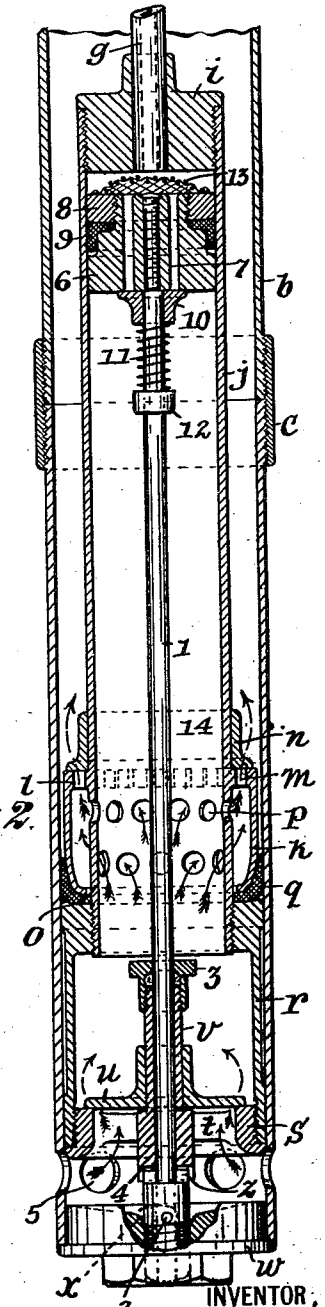


Fig. 2.



WITNESSES:

W. Noell,

Adele Gilatti.

INVENTOR,

Philip H. Deis,

BY

Arthur Stewart,

ATTORNEYS.

UNITED STATES PATENT OFFICE.

PHILIP H. DEIS, OF WASHINGTON, DISTRICT OF COLUMBIA.

PUMP.

No. 840,919. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed January 9, 1906. Serial No. 295,218.

To all whom it may concern:

Be it known that I, PHILIP H. DEIS, a citizen of the United States, residing in Washington, District of Columbia, have invented certain new Improvements in Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

My invention is an improvement in pumps of the reciprocating type; and it has for its essential object to so construct and arrange the operating parts of the lifting means that the latter may be approximately balanced at all times by suitable means for that purpose, with the result that the power necessary to maintain delivery is only that very small amount which is needed simply to raise substantially so much liquid as is to be discharged.

Means for "balancing," so called, the load on the lifting means of an ordinary lift-pump have been proposed, the same having usually taken the form of a weight or its equivalent connected with the lifting means in such manner as to counterbalance its load—*i. e.*, the resistance necessary to be overcome in raising the lifting means. Such means, however, when connected to lift-pumps of the common type having an upwardly-moving valve in the bottom of the well-pipe, as well as a similar valve in the plunger or sucker, can obviously never fully cover the object in view, because if there is any gain on the upstroke there must be a corresponding loss on the downstroke. The resistance overcome on the upstroke now manifests itself to the full extent on the downstroke in the form of the action of gravity on the weight. These considerations and extensive experiments, some of the results of which are illustrated in some of my previous patents, have led me to conclude that in order to permit the weight or its equivalent to be an effectual and true balancer at all times the column of liquid which stands in the well-pipe must not during the downstroke stand dormant or neutral, as is the case where it rests during the downstroke supported by the valve at the foot of the well-pipe, as in the ordinary lift-pump, but must continue on the downstroke, as well as on the upstroke, sustained by the lifting means. Then such column and the balancer thereof and of the lifting means itself together will remain truly in balance at all times, except, of course, for only substantially the amount of liquid which on each upstroke is to be delivered. This end I have accomplished in and by the present invention, one form of which for the sake of illustration I now proceed to describe in detail, with reference to the accompanying drawings, wherein—

Figure 1 shows my improved pump in vertical section substantially throughout; and Fig. 2 is a similar view, somewhat enlarged, of the essential parts of the invention.

a is the well; *b*, a well-pipe forming the conducting means and comprising, preferably, tubular sections connected together by screw-couplings *c*.

d is the nozzle of the well-pipe; *e*, a lever fulcrumed on the well-pipe or otherwise; *f*, a weight or weights suspended from one end of the lever, and *g* the sucker-rod pivotally connected to the other end of said lever. The sucker-rod is tubular, as shown, and has a port *h* near its upper end communicating with its bore. Onto the lower end of this sucker-rod is screwed a bushing *i*, which is in turn screwed into the upper end of the tubular portion *j* of a plunger whose main or body portion *k* nearly fits the inside of the well-pipe. An integral horizontal wall *l* connects the tubular portion *j* and body portion *k*, having orifices *m*, through which upward movement of liquid under pressure below said wall is permitted, but its downward movement therethrough prevented by an annular valve *n*, seating squarely against said wall *l* and being penetrated by and movable vertically freely on the tubular portion *j*. The lower end *o* of tubular portion *j* is open downwardly, and it is provided with orifices *p*, leading to the annular space between itself and the body portion *k*.

q is a leather cup which fits snugly in the well-pipe, being held between the lower end of body portion *k* of the plunger by a sleeve *r*, which is screwed onto the part *o* of the tubular portion *j* up against said cup. This cup completes the character of the plunger as such and makes it, ignoring details of construction, the substantial equivalent of the sucker or plunger of the ordinary lift-pump.

Into the lower end of the sleeve *r* is screwed

a spider *s* or other similar part having orifices *t*, and on this spider rests a valve *u*, which is penetrated by and movable vertically freely on the tubular stem *v* of said spider, the same being adapted to prevent downward, but permit free upward, movement of liquid through said orifices.

The bottom of the well-pipe is closed by a plug *w*, held therein by a bayonet-joint *x*, and into this is screwed a stud *y*, having a key *z* on the top thereof. This stud receives the lower end of a spindle 1, held permanently therein by a pin 2 and penetrating and snugly fitting the stem *v* of spider *s*, which stem may have a gland 3 to prevent liquid escape between the spindle and stem. Stem *v* has a cross-cut 4 to receive the key *z* of stud *y*. The stud whereby the spindle is anchored to the plug *w* is adapted to be screwed into the latter by introducing down into the well-pipe the assembled plunger, sleeve, spider, and stem with the key and cross-cut engaged and then turning the stud (thus interlocked with these parts against relative rotation) in the plug *w*. Above the plug *w* the well-pipe has orifices 5, affording access from the well to the well-pipe.

The upper end of spindle 1, which is reduced, carries a piston comprising the body portion 6, having ports 7 therethrough, a nut 8, and a leather cup 9, snugly fitting the tubular portion *j* of the plunger and clamped between parts 6 and 8. The extremity of the spindle is upset to keep the piston thereon. A valve 10 is pressed upwardly against the part 6 by a spiral spring 11, surrounding the spindle and compressed between the valve and a collar 12 on the spindle, acting to normally close ports 7. A wire-gauze 13, carried by the part 6, prevents grit and other foreign matter from entering through the tubular sucker-rod and ports 7 of the piston and preventing the snug seating of valve 10.

Operation: Fig. 1 shows the parts of the half-stroke position of the plunger. Fig. 2 shows the parts when the plunger is at its lowest limit. I use the expressions "prime column" and "prime load" herein to define, on the one hand, the liquid column extending from the lifting means to substantially the point of discharge (the nozzle) when the lifting means is at its highest limit, and, on the other hand, the combined weight of such column and the lifting means in the same position of the lifting means. In the use of such expressions as "upwardly" and "downwardly" it will be understood that I speak relatively and without referring only to vertical direction. On an upstroke of the plunger the chamber 14, which is formed by the cylindrical wall of the plunger, the piston, and the valved lower end of sleeve *r*, is caused to, in effect, contract, because the piston stands fixed while the plunger rises, forcing the liquid which we will assume is already contained therein through the pressure-escape thereof (orifices *p* and *m*) past the valve *n*. Substantially the quantity of liquid by which the prime column is thus augmented represents what is now caused to be discharged from the nozzle as the plunger ascends. On the downstroke of the plunger the chamber 14 in effect expands, the result of which is twofold: first, the tendency toward a reduction of pressure therein permits liquid from the supply (the well) to elevate valve *u* and thus recharge such chamber, and, second, the pressure above the valve *n* being greater than that beneath it on account of the weight of the liquid above said valve *n* remains closed, so that the plunger carries the full prime load back with it on the downstroke. If now the weight or weights be applied to lever *e* sufficient to balance the prime load, a state of equilibrium will exist in any position of the parts, whether during the upstroke or downstroke, ignoring, of course, the load represented by so much liquid as has augmented the prime column. The work on the power source is therefore only such as is necessary on each upstroke to raise substantially the quantity to be delivered. These conditions, moreover, may exist without regard to the capacity of the pump or the working depth.

It is essential in the construction shown to provide against the promotion of a vacuum or an accumulation of such liquid as might pass the piston and clog its action in the interior of the plunger above the piston, hence the use of a tubular sucker-rod having the port *h* open to the atmosphere and of the spring-actuated valve 10, the former of which maintains an equilibrium of pressures at all times above and below the piston and the latter of which allows liquid caught above the piston to have adequate escape.

I desire to emphasize the fact that in my pump the parts are so constructed that when the balancing means is attached the prime load is at all times held in a state of suspense (or balanced) by the balancing means, so that when the pump is set in motion all the power required is only that necessary to lift the amount of liquid which the pump discharges.

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

1. In a pump, the combination, with a conducting means, of a lifting means having an upwardly-opening valve constantly subject to the closing pressure of the rising column, and means for maintaining a pressure tending to open said valve which shall be greater during the upstroke and less during the downstroke than that due to said column, whereby to maintain the prime load substantially constant during a full stroke in both directions.

2. In a pump, the combination, with a conducting means, of a lifting means having an upwardly-opening valve constantly subject to the closing pressure of the rising column, and means for maintaining a pressure tending to open said valve which shall be greater during the upstroke and not more during the downstroke than that due to said column, whereby to maintain the prime load substantially constant during a full stroke in both directions.

3. In a pump, the combination, with a conducting means, of a lifting means having an upwardly-opening valve constantly subject to the closing pressure of the rising column, and means for maintaining a pressure tending to open said valve which shall be greater during the upstroke than that due to said column and substantially the same during the downstroke as it is when the lifting means is at rest, whereby to maintain the prime load substantially constant during a full stroke in both directions.

4. In a pump, the combination, with a conducting means, of a lifting means having an upwardly-opening valve constantly subject to the closing pressure of the rising column, a balancer for the prime load connected with the lifting means, and means for maintaining a pressure tending to open said valve which shall be greater during the upstroke and not more during the downstroke than that due to said column, whereby to maintain the prime load substantially constant during a full stroke in both directions.

5. The combination, with the conducting means, of a plunger having a vertical space therein, upwardly-opening relatively superposed valves movable with and relatively to said plunger, and a piston in said space with relation to which said plunger is movable, the lower valve being relatively below said space and the pressure escape by the upper valve being relatively between said lower valve and the piston, substantially as described.

6. The combination, with the conducting means, of a tubular plunger, a fixed piston arranged in the space of said plunger, and upwardly-opening relatively superposed valves movable with and relatively to said plunger, the lower valve being relatively below said space and the pressure escape by the upper valve being relatively between said lower valve and piston, substantially as described.

7. The combination, with the conducting means, of a tubular plunger, a tubular sucker-rod connected to the plunger and affording atmospheric communication to the space thereof, a fixed piston arranged in said plunger, upwardly-opening relatively superposed valves movable with and relatively to said plunger, the lower valve being relatively below said space and the pressure escape by the upper valve being relatively below the valve and the piston, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 8th day of January, 1906.

PHILIP H. DEIS.

Witnesses:
JOHN W. STEWARD,
WM. D. BELL.