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## FORCE-PUMP.

SPECIFICATION forming part of Letters Patent No. 389,419, dated September 11, 1888.

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*To all whom it may concern:*

Be it known that I, HIRAM C. STOUFFER, a citizen of the United States, residing at Cortland, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Force-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.

The object of my invention is to provide a continuous stream of water with an easy operation of the pump; and for this purpose my invention consists of an improved construction pump in which a hollow plunger-rod operates two pistons in cylinders of unequal diameters placed one above the other, the cylinder of least diameter being the upper one, and the space between the pistons having an air-vent through the hollow plunger-rod of the upper piston, whereby air is admitted into and allowed free escape from the cylinder-space between the pistons through the upper section of the plunger-rod. This construction gives the advantage of using closed cylinders with a hollow plunger-rod for the lower piston, through which water passes from the lower into the upper cylinder, and a hollow plunger-rod for the upper piston, through which air passes into and from the two cylinders in the up and down strokes of the pistons. This interior free air communication in a closed pump-cylinder having double pistons operating to keep the upper cylinder supplied with water whether the pistons be ascending or descending is the important matter of my invention.

In the accompanying drawings, which form a part of this specification, and in which the same reference-letters indicate corresponding parts, Figure 1 represents a vertical section of my improved pump, showing the pistons forced down; Fig. 2, a vertical section of the pump, showing the pistons ascending; Fig. 3, a side elevation of the pistons, their coupling-rod, and the lower end of the piston-rod; Fig. 4, a detail bottom view of the upper piston, showing the air-vents; and Fig. 5 is a section of the upper piston, showing the water-way and the air-vents.

In the drawings, the letter A indicates the lower larger cylinder, which is provided with

a seat, B, at its lower end, upon which an upwardly-opening valve, C, is seated and works. The upper cylinder, D, is of about the same length as said lower cylinder and of a smaller diameter than the same, and is secured with its lower end in the upper end of said lower cylinder, being either integral with the same or tightly secured to the same, and the discharge-pipe E, which is provided with the discharge-nozzle F, is secured in the upper end of said upper cylinder, and may be extended by a guide tube or chamber, G, which is formed with a stuffing-box, H, at its upper end, so as to guide the piston-rod and serve as an air-chamber and a reserve chamber for water which may be forced up in it.

The lower piston, I, as shown, is dome-shaped, and is provided with a downwardly-turned packing-flange, J, which is held in place by the valve-seat K, which is screwed into the lower end of said piston, clamping said packing-flange, and has the upwardly-opening valve L playing upon it.

The tubular connecting-rod M is secured in the upper end of said dome-shaped lower piston, and the upper piston, N, which operates in the upper cylinder, is secured to the upper end of said tubular rod or upper piston. This upper piston consists of an upper body portion, O, which is secured to the lower end of the tubular piston-rod P, which is open to the air and has a channel or passage, Q, which forms a continuation of the bore of said rod. The upper screw-threaded end of the tubular connecting or coupling rod M is screwed into a socket, R, in the lower end of said body portion O and opens into the bottom of a recess, S, in the side of said portion, which recess opens into the upper cylinder. The lower cylindrical portion, T, of the piston is screwed with its central screw-threaded bore R upon the upper threaded end of the tubular coupling-rod, clamping the upwardly-turned packing-flange V between it and said body portion, and is formed with an annular recess, W, in its upper face, and with air passages or holes X, which extend from said recess to its under side and open into the lower cylinder.

The upper end of the tubular piston-rod is suitably secured to its handle or other operat-



ing mechanism, and is provided with perforations Y, for connecting its interior with the outer air.

The operation of the pump is as follows:

5 When the piston-rod and pistons are raised, the water is drawn through the lower valve-seat into the lower cylinder, filling the same. When, now, the piston-rod and pistons are depressed, the water will flow through the lower  
10 piston and be forced up through the tubular connecting-rod into the upper cylinder above the upper piston and will fill said cylinder, and, on account of the lower cylinder being larger than the upper cylinder, a quantity of  
15 water will pass out at the nozzle, but leaving the cylinder full, or nearly so. When the piston-rod and pistons are again raised, the power-piston will again draw water into the lower  
20 cylinder, while the upper piston will lift the water left above it in the upper cylinder and force it out through the discharge-nozzle, so that a continuous stream will flow out at the nozzle at both strokes of the piston-rod and pistons.

25 On account of the lower cylinder being larger in diameter than the upper cylinder, the lower piston would be retarded in its up-stroke by the compression of the air above it and in its downstroke by the rarefying of the  
30 air above it; but this is prevented by the tubular piston-rod and the passages through the upper piston, which admit of the air above the lower piston escaping through said passages and piston-rod, when it is compressed by the  
35 lower piston being raised and of the air re-entering the space above the lower piston when the latter is forced down. In this manner it will be obvious that the pump may discharge a continuous stream at its nozzle, and that there  
40 will be no resistance of the air between the pistons during the operation of the pump.

On account of the air-vent for the space between the pistons being formed through the piston-rod, the pump may be used in drilled  
45 wells or in any desired places or positions without any danger of fouling the pump with sand, dirt, or other small objects, as is liable to happen when openings are provided in the sides of the cylinders for the escape and inlet  
50 of air; and this pump will occupy less space on account of its having a vent through the piston-rod than the pumps of this class which are provided with air-chambers and connecting channels or passages upon the sides of the  
55 cylinders. In this way my improved pump operates by its lower piston with a forcing action through a hollow plunger-rod and by its upper piston with a lifting action.

I may provide the upper portion of the lower  
60 cylinder with one or more side holes for the escape of water which may leak past the pistons.

Having thus fully disclosed the construction of my improved pump, its operation and advantages, what I claim as new is—

65 1. A piston for force-pumps, consisting of two plunger parts of unequal diameters, the

lower part being hollow and having a foot-valve, and the upper part having two vertical openings passing through it, a tubular piston-rod connecting the chamber of the lower  
70 plunger part with one of said openings of the upper plunger part and with a chamber above the latter, and a tubular operating-rod open at its upper end and connecting at its lower  
75 end with the other opening of said upper plunger part, the said tubular operating-rod forming an air-conduit opening between the plunger parts and the tubular piston-rod, forming a perpetual open water-conduit communicating with a chamber above the upper plun-  
80 ger part, substantially as described.

2. The pump-cylinder part having a smaller diameter provided with a top outlet, and a lower cylinder part of a larger diameter provided with an inlet foot-valve, each cylinder  
85 having a piston, the smaller one of which having two through-openings, one of which opens into the larger cylinder part above the lower piston, and the other opens into the smaller  
90 cylinder part above the upper piston, the larger piston being hollow and having an inlet-valve, a tubular piston-rod connecting the hollow piston with the smaller cylinder part, and a tubular coupling-rod connecting the  
95 larger cylinder part with the open air between said pistons, substantially as described.

3. In a pump, the combination, with an upper cylinder of a smaller diameter and a lower cylinder of a larger diameter, a lower piston  
100 in said lower cylinder, a tubular coupling-rod secured in said lower piston and formed with a screw-threaded upper end, a tubular piston-rod, an upper piston-body in said upper cylinder and secured to said piston-rod, and formed with a channel through it which  
105 forms a continuation of said rod, and with a recess at the side which has the tubular connecting-rod opening into it, a packing-flange at the lower end of said piston-body, and a lower piston portion screwed upon the upper  
110 end of said tubular coupling-rod to clamp said packing-flange against said piston-body, and formed with passages through it and with an annular recess in its upper face, substantially  
115 as described.

4. In a pump, the combination of the lower larger cylinder, A, formed with seat B and valve C, the upper smaller cylinder, D, the discharge-pipe E, formed with the nozzle F and guide-tube G, the lower piston, I, provided with the upwardly-opening valve L, the upper valve, O T, provided with the recess S and channel Q, the tubular coupling-rod M, and the tubular piston-rod P, formed with vent-openings at the upper end, substantially  
125 as and for the purpose described.

5. A pump-cylinder having an upper section of smaller diameter and a lower section of larger diameter, in combination with a piston for each cylinder coupled by a hollow piston-rod  
130 opening into the upper cylinder, and a hollow operating piston-rod open to the outer air and



communicating with the interior of both cylinders between the pistons, substantially as described.

5 6. In a pump, two pistons coupled by a hollow rod, the lower piston having a valve and the upper piston having a free passage for the hollow coupling-rod opening upward, and a hollow operating piston-rod open at its upper end to the outer air and having a free passage  
10 through said upper piston opening downward, in combination with the cylinders A and D, the upper one being of less diameter than the lower one, and within which the pistons cooperate in the way described.

15 7. In a pump, two cylinders of equal length, one above the other, the lower one being of greater diameter than the upper one and opening into each other at their junction, the lower cylinder having a foot-valve and the upper  
20 cylinder a discharge-nozzle, in combination with a valved piston for the lower cylinder, a

non-valved piston for the upper cylinder, a hollow coupling-rod for the pistons opening into the upper cylinder, and a hollow operating piston-rod opening into both cylinders and  
25 to the outer air, as described, for the purpose specified.

8. The top cylinder part having the discharge-opening and the bottom cylinder part, the wall-openings *a* at or near its junction  
30 with the top cylinder part, in combination with the pistons and the hollow piston-rod, the upper section of which opens into the lower cylinder part above the said wall-openings, as  
35 herein set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

HIRAM C. STOUFFER.

Witnesses:

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JOHN M. LAWTON.