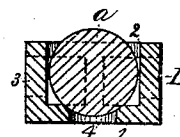
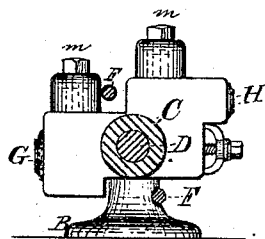
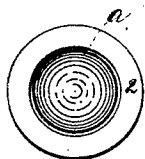
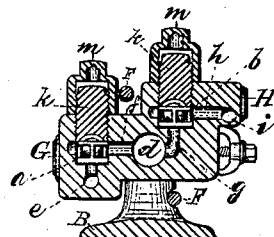
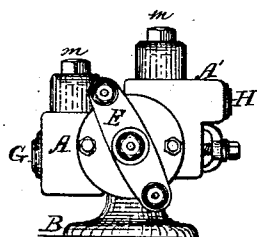
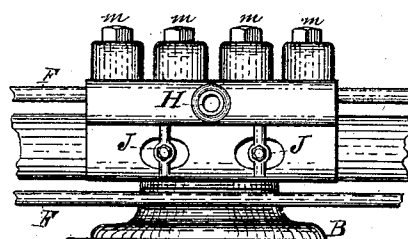
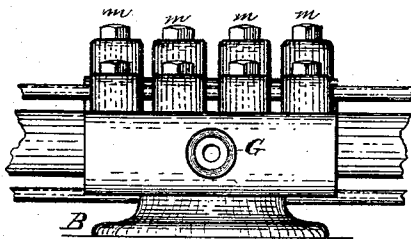
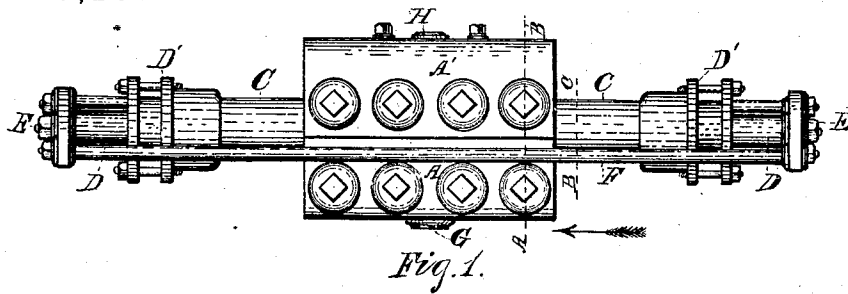


L. J. KNOWLES.

Force-Pump.

No. 160,207.

Patented Feb. 23, 1875.



Witnesses;
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UNITED STATES PATENT OFFICE.

LUCIUS J. KNOWLES, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN FORCE-PUMPS.

Specification forming part of Letters Patent No. **160,207**, dated February 23, 1875; application filed January 28, 1875.

To all whom it may concern:

Be it known that I, LUCIUS J. KNOWLES, of the city and county of Worcester, and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Force-Pumps for Pumping Oil, Water, and other Liquids; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings forming a part of this specification, and in which—

Figure 1 represents a top or plan view of my improved force-pump. Fig. 2 represents a rear side view of a portion of the pump shown in Fig. 1. Fig. 3 represents a front side view of the same parts shown in Fig. 2. Fig. 4 represents an end view of the pump shown in Fig. 1. Fig. 5 represents a cross-section on line A B, Fig. 1, looking in the direction of the arrow. Fig. 6 represents a cross-section on line B C, Fig. 1. Fig. 7 represents a top or plan view of the valve and valve-seat frame, and Fig. 8 represents a vertical central section through the valve and valve-seat frame. Figs. 7 and 8 are drawn to an enlarged scale to show the parts more clearly.

To enable those skilled in the art to which my invention belongs to make and use the same, I will proceed to describe it more in detail.

By the aid of force-pumps liquids are now thrown or forced to a distance and under a pressure which but a few years ago would have been regarded as an impossibility. One of my said improved pumps is now being used with success in forcing oil through line-pipes a distance of some fourteen miles.

To accomplish such results, however, the ingenuity of man has been taxed to a high degree in order to overcome the difficulties which attended the undertaking. In the first place it was necessary to combine great strength with simplicity of construction. It was also found necessary to provide some means to prevent the sudden concussion and great jar which would necessarily result from striking a liquid body with the pump piston or plunger, when such liquid required a pressure of five thousand pounds to the square inch in order to move it under the velocity and throughout the distance required. It was also found nec-

essary to have the liquid passage-ways through the pump so constructed and arranged in relation to the suction and exhaust ports that the air in the liquid would pass freely through the pump with the liquid, since if the passage-ways were of such construction as to allow the air to accumulate in them it would detract very much from the working capacity of the pump.

To secure the desired results, while at the same time obviating the foregoing and other objections, is the object of my present improvements.

In the drawings, the parts marked A A' constitute the central part of the pump, in which the valves are arranged. These parts A A' are cast in one piece. In the part A are arranged the first series of valves *a*, while in the part A' are arranged the second series of valves *b*, the latter series of valves being elevated above the first series, as fully indicated in the drawings. The parts A A' are supported by a suitable base, B. From the ends of the parts A A' project cylinders C C, in which the pistons D D work through stuffing-boxes D' D'. Said cylinders C may be cast with the parts A A', or they may be provided with suitable flanges and bolted to the ends of the parts A A'. The ends of the pistons D work into chambers in the parts A A', and which chambers extend nearly to the center of said parts, but are separated from each other by a central division, so that when power is applied to either of the cross-heads E E, which are connected by means of the rods F F to impart a back-and-forth motion thereto, one piston, D, is moved in while the other is drawn out, and the liquid is drawn in through the opening G to fill the space behind the outgoing piston, while the liquid in the other cylinder is being forced out through the opening H by the ingoing piston, and vice versa as the operation continues. The inlet-passage G communicates on the right and left with the first series of valves *a*, one-half of which admits the passage of liquid to one cylinder and the other half to the other cylinder, while the outlet-passage H communicates in like manner with all of the valves of the second series. Only two valves are shown on each side in each series for each cylinder, but they

are to be duplicated to any desired extent. The object of having a large number of valves is to prevent a too sudden shock and strain upon the pump and motive power by having the liquid passage-ways closed suddenly, which would be the case with a single valve arrangement on each side of each cylinder.

In Fig. 5 the interior *d* of one of the piston-chambers is shown. This chamber is partly in the cylinder *C* and partly in the parts *A* *A'*, and is the same on both ends of the pump. *e* represents one of the inlet passage-ways, through which the liquid passes to the valves *a*, and after passing said valves the liquid passes through passage-ways *f* to the piston-chamber *d*, and from thence, as the piston enters the chamber, it is forced through passage-ways *g* to and through valves *b*; thence through passage-ways *h* into the common passage-way *i*, which communicates with the outlet *H*. The passage-ways *f* and *h* extend around their respective valves and valve-frames, as fully indicated in Fig. 5.

The valve-frames *I* are fitted and held in position as follows: The valve-frames *I* are made with two rings, 1 and 2, united by vertical bars 3, four being used in each frame in this instance. The lower ring 1 has a central opening, 4, which is formed upon its inner upper side, so as to receive the ball-valve *a*, which closes said opening when in the position shown in Fig. 8, and it will, therefore, be seen that any pressure from below the valve will cause it to rise and allow the liquid to pass up and through openings in its frame *I*, while any pressure from above will cause the valve to fit closely upon its seat, thus preventing the return or escape back of the liquid that has once passed the valve.

The lower ring of the valve-frame *I*, in each series of valves *a* and *b*, is fitted close down upon a seat formed in the respective parts *A* *A'*, as indicated in Fig. 5, while a valve-frame-adjusting screw-plug, *k*, is screwed down so that its outer edge will bear down firmly against the upper ring 2 of the valve-frame; the lower end of the plug *k* being concaved out to allow the valves to rise up when the liquid is to pass the valves. As the liquid passes through these pumps under an immense pressure, it would be likely to find its way between the screw-threads on plug *k* and the threads in the parts *A* *A'*, into which said plugs are screwed, as indicated in Fig. 5. To guard against this difficulty, screw packing-caps *m* are employed, which are screwed upon the upper ends of screw-plugs *k* after the latter have been screwed down firmly upon their respective valve-frames *I*. The lower edges of caps *m* of the series of valves *a* are screwed firmly down upon seats

formed on the top of the part *A*, while the caps of the other series of valves *b* are screwed down upon seats formed on the top of the part *A'*, and if found necessary suitable packing may be interposed between the lower ends of screw-caps *m* and their respective seats.

With this arrangement, if one of the valve-frames *I* happens to become loosened by the constant heavy strain and the continual jarring of the working of the pump upon it, the attendant has only to remove its cap *m* and turn its plug *k* down a little, all of which can be accomplished in a very short time.

Each piston-chamber is provided with a cleaning or man hole, *J*, provided with a suitable clamping-stopper, by which access can be had to the chamber at any time for the purpose of examining them and the removal of any foreign substances therefrom, as occasion may require.

It will be understood that each valve *a* has a separate passage-way, *f*, which leads from the common ingress passage-way *e* to the piston-chamber *d*, and each valve *b* has separate passage-ways *g* and *h*, which lead from the piston-chamber *d* to the common egress passage-way *i*.

Having described my improved force-pump, what I claim therein as new and of my invention, and desire to secure by Letters Patent, is—

1. The combination with the central parts *A* *A'*, cast in one piece and relatively arranged, one part partially above the other, as shown and described, and having cylinders *C* *C* projecting from the ends thereof, of two series of valves, *a* *b*, relatively arranged in respect to each other substantially as and for the purposes set forth.

2. The combination, with valve frame or frames *I*, of the screw holding plug or plugs *k*, substantially as and for the purposes set forth.

3. The combination, with valve-frame *I* and the body of the pump that supports it, of screw-plug *k* and clamping and packing cap *m*, substantially as and for the purposes set forth.

4. A force-pump consisting of the central parts *A* *A'*, projecting cylinders *C* *C*, separate pistons *D*, working in separate chambers *d*, cross-heads *E*, connecting-bars *F*, with two series of valves, *a* and *b*, and their respective liquid passage-ways, arranged as described, for the admission and outlet of the liquid to and from the pump, substantially as and for the purposes set forth.

LUCIUS J. KNOWLES.

Witnesses:

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EDWIN E. MOORE.