(No Model.)

J. W. POWERS.

Pump.

No. 230,149. Patented July 20, 1880.

Fig. 1.

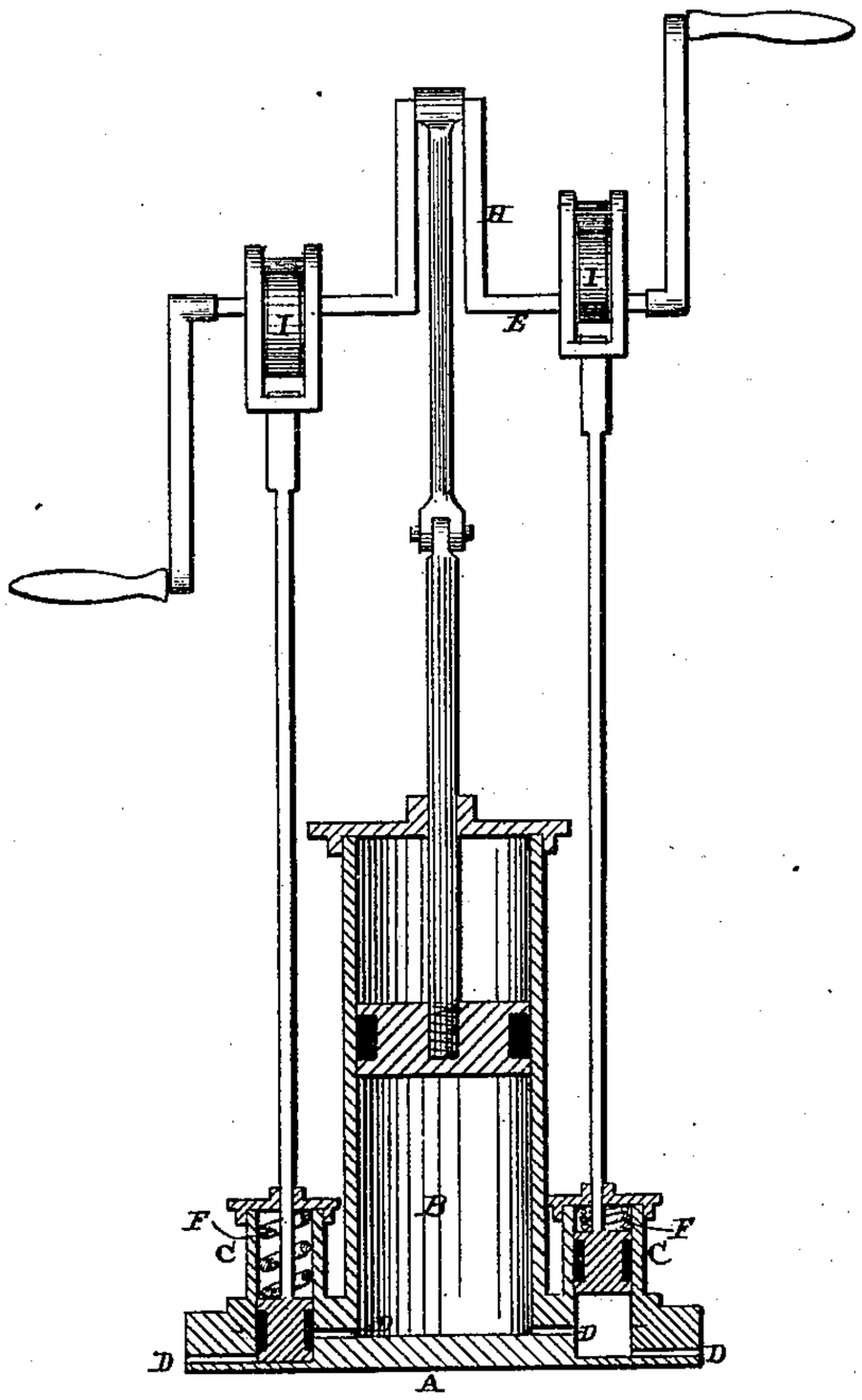


Fig. 2.

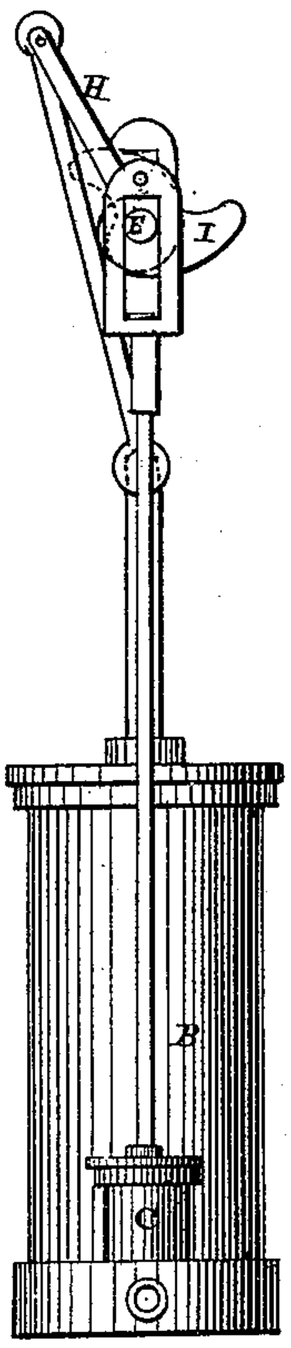
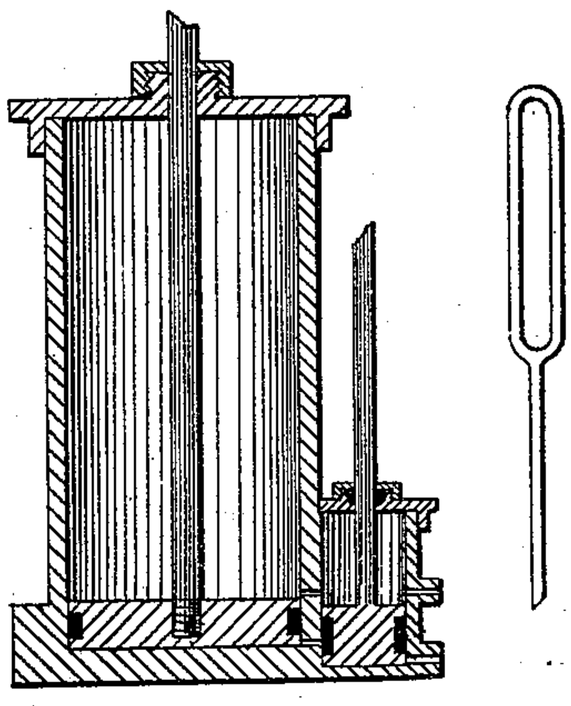


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAY W. POWERS, OF PORTAGE, WISCONSIN.

PUMP.

SPECIFICATION forming part of Letters Patent No. 230,149, dated July 20, 1880.

Application filed May 6, 1880. (No model.)

To all whom it may concern:

Be it known that I, JAY W. POWERS, of Portage, in the county of Columbia and State of Wisconsin, have invented certain new and useful 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in pumps for forcing or drawing either air or water; and it consists in the combination of three cylinders and three pistons which are operated by the same shaft, whereby two of the pistons compress or suck the air or force the water while the third one closes the air or water passage leading through all three of the cylinders, the bottoms of the two outer cylinders being extended beyond the end or bottom of the central one.

It still further consists in placing a spring in the smaller cylinders on top of the pistons, so that after these pistons have been alternately raised to the full length of their stroke they are suddenly depressed, so as not only to force the air or water from their cylinders, but to close the water-passages.

While this pump will force air or water alike, it is intended more especially for an air-pump for exhausting air both from solid and fluid bodies of all kinds, and for forming more perfect vacuums in vessels of all kinds than has heretofore been possible.

Another object of my invention has been to make the pistons take the place of the ordinary valves, so that the extent of the vacuum being formed will not depend upon the operation of the air, as has heretofore been the case in all of the air-pumps now in use.

Figure 1 is a vertical section of my invention. Fig. 2 is an end view of the same. Fig. 3 is a vertical section of a modification of my invention.

A represents a suitable base, upon which the large cylinder B, and the two small ones C, are rigidly secured. These three cylinders may bear any desired relation to each other in size, and may either be placed in a line, as here shown, or may be arranged in any other form that may be preferred. The bottom of each of these smaller cylinders C is placed on a lower plane than that of the bottom of the large cylinder B, and the air and water passages D, which extend through all three of the cylinders, pass through the two smaller cylinders below the level of the bottom of the cylinder B. In each of these cylinders is placed a closely-fitting air-tight piston, of any desired construction, and each one of these pistons is connected to the same operating-shaft E by means of suitable piston-rods.

In each one of the smaller cylinders C, and upon the top of the piston, are placed suitable springs F, which are compressed as the pistons are raised upward, and then, after the pistons have been raised upward to the full length of their stroke and then released, these springs suddenly force the pistons downward to the bottoms of the cylinders, so as not only to force out any air or water which may be in them, but to close the air-passages air and water tight.

The operating-shaft E has a crank, H, formed in its center for operating the piston in the large cylinder B, and a cam, I, upon each of its ends for operating the two pistons in the two small cylinders C, which cams are turned in opposite directions, so as to operate the two pistons alternately. The upper ends of the two piston-rods, connected to the pistons in the two smaller cylinders C, have their upper ends slotted for any suitable length, so as not only to allow the cams to revolve in the openings, but to allow the shaft E to be turned any distance desired in raising the piston in the large cylinder B without affecting either one of the pistons in the small cylinders C. The distance which this shaft shall move without affecting the pistons in the smaller cylinders will, of course, be proportioned to the relative sizes of the three cylinders.

Instead of the operating-crank or other motive power being applied directly to the shaft E itself, the shaft may be provided with suitable gear-wheels, which may form the crank for the piston and the cylinder B, and these wheels receive their motive power from a driving-shaft which is provided with suitable driving-

pinions for meshing with the wheels, which driving-shaft may be journaled in the same frame-work which supports the shaft E, or in a separate and independent frame of its own.

I lay no special claim to the mechanism here shown for operating the three cylinders, for this may be varied at will and any suitable device applied for this purpose. Either the mechanism here shown may be used, or any other one that may be preferred for accomplishing the same purpose.

The crank and the two cams are placed in such relation to each other that as the piston in the central cylinder, B, is being raised, one of the pistons in one of the smaller cylinders is being raised at the same time, while the piston in the other cylinder C remains in the bottom of its cylinder. As this piston in the cylinder B and the one in the cylinder C are being raised upward they form a vacuum in their cylinders for the purpose of drawing the air or water from any vessel, cask, or body to which they may be connected, and then, just as the piston in the cylinder B has, or has about, reached the full length of its upward stroke, the small piston, which was raised upward with it at the same time, is suddenly released from its cam, and the spring F in the cylinder C causes it to descend very quickly and with considerable force, so as not only to force all of the air or water in the cylinder into the cylinder B, but at the same time to close the air or water passage which leads through the cylinder C and connects it with the large one, B. While this piston remains down no further supply is being drawn from the cask or vessel to which the pump is connected; but as the piston in the cylinder B starts on its downward stroke the piston in the second cylinder C, and which has heretofore been stopping the air or water passage connecting it with the large cylinder B, begins to open, and just as the piston in the cylinder B reaches the bottom of the cylinder the piston which has just been raised in the cylinder C is suddenly released, and forces out any water or air which may be in this cylinder, and closes the air or water passage which connects it to the cylinder B. As the piston in the cylinder B again begins to rise the two pistons again draw air or water from the cask or body to which the pump is connected.

Heretofore air-pumps have been provided with valves which operate very readily until the air has become very much rarefied; but after the rarefication has reached a certain point the air will no longer operate the valves, and hence it is impossible to form a perfect vacuum. This difficulty I entirely overcome by doing away with valves of all kinds and substituting operating pistons in their place, which pistons not only take the place of the valves, but also assist in drawing and forcing the air or water, the same as the pistons in other pumps.

As the operation of these smaller pistons is not in any way dependent upon the action of the atmosphere, it is evident that they will continue to operate as long as there is a motive power to drive the operating shaft, and each time that the two pistons are moved together, as already described, they draw or force a further quantity of the air from the vessel with which the pump is connected, so that a practically perfect vacuum can be formed.

So perfect and absolute is the vacuum formed by the constant operation of the three cylinders and their pistons here described, that air can be exhausted not only from fluids, but from solid bodies of all kinds. Where solid bodies, such as coins, metals, precious stones, and other such objects are placed in a vessel containing water, and this pump is connected to the vessel and set in motion for the purpose of forming a vacuum over the top of the water, the air will be drawn from these solid bodies placed in the bottom of the vessel, and this air will manifest itself by forming small air-bubbles upon the face of the object, and of such size that the bubbles will push one another from off the surface of the article, and rise to the top of the water.

This vacuum is obtained, as stated above, by doing away with the use of all valves which are dependent upon the pressure of the atmosphere for their action, and substituting therefor pistons having a direct and positive motion, which not only act as pistons but as valves at the same time.

One of the small cylinders, C, may be dispensed with, if so desired, in which case the small cylinder will be closed at its top by its stuffing-box, and the piston in this small cylinder will serve to close both of the air-passages which connect it with the large one. The vessel to be exhausted is attached to this cylinder just above the top of the piston, and there is a corresponding hole made through the opposite side of the cylinder, through which the air from the vessel being exhausted and the small cylinder is drawn by the large piston.

Leading from the bottom of the large cylinder is an air-outlet, O, through which all of the air drawn from the small cylinder and the vessel being exhausted is forced. The rod connected to the piston in the small cylinder has a loop or slot formed in its upper end, and through this loop or slot passes either an operating lever or a cam on the operating-shaft. As the piston in the large cylinder is raised upward from the very bottom of the cylinder a vacuum is formed in the large cylinder, and into which the air is drawn from the small cylinder and the vessel being exhausted. As the piston in the large cylinder reaches the full length of its upward stroke the piston-rod connected with the piston in the small cylinder is raised upward high enough to close the two exhaust-openings through the sides of the small cylinder, and thus the small piston remains in this position while the piston in the large cylinder is making a downward stroke and forcing the air out of the large cylinder

through the exit-opening O, which was opened just after the two exhaust-openings through the sides of the small cylinder were closed. This small piston remains in its elevated position, closing the two exhaust-openings and opening the outlet O, until the large piston has nearly completed its stroke, when the lever or the cam on the shaft strikes against the lower end of the loop or slot (already referred to) and forces the small piston downward, so as to close the outlet-opening and open the two exhaust-openings. This slotted piston-rod does not move so quickly as when the piston is moved by a spring; but the two movements are substantially the same, and may be used one for the other.

In order to make the small piston first close the exhaust-openings before it opens the outlet, the bottom of the smaller cylinder is placed on a lower plane than that of the large cylinder, as shown, so as to cause the piston to move some distance before the outlet-opening is exposed at all.

The same principle is embodied in this invention that is shown in the pump represented in Figs. 1 and 2, there being no valves which are dependent upon the action of the atmosphere.

Having thus described my invention I claim—

1. In a pump, the combination of two or more cylinders connected together, two or more pistons working therein, and an operating-shaft for working all of the pistons, one of the pistons being made to always take the place of a valve or valves, and the end or bottom of one of the cylinders being extended beyond the end or bottom of the other, substantially as shown.

2. The combination of three cylinders which are connected together, three pistons working therein, and an operating-shaft, the two pistons in the outer cylinders being operated alternately and made to not only draw and force air or water, but act as valves, the outer cylinders having their ends extended beyond the end or bottom of the central one, substantially as shown.

3. The combination of the cylinders B C, provided with pistons, a suitable mechanism for operating the pistons in the order described, and means, substantially as shown, for depressing the pistons in the cylinders C and holding them rigidly against the bottoms of the cylinders after the pistons have reached the end of their stroke, substantially as specified.

In testimony that I claim the foregoing I have hereunto set my hand this 6th day of May, 1880.

JAY W. POWERS.

Witnesses:
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