(No Model.)

J. B. ERWIN.

STEAM PUMP.

No. 546,313. Patented Sept. 17, 1895.

Fig. 1.

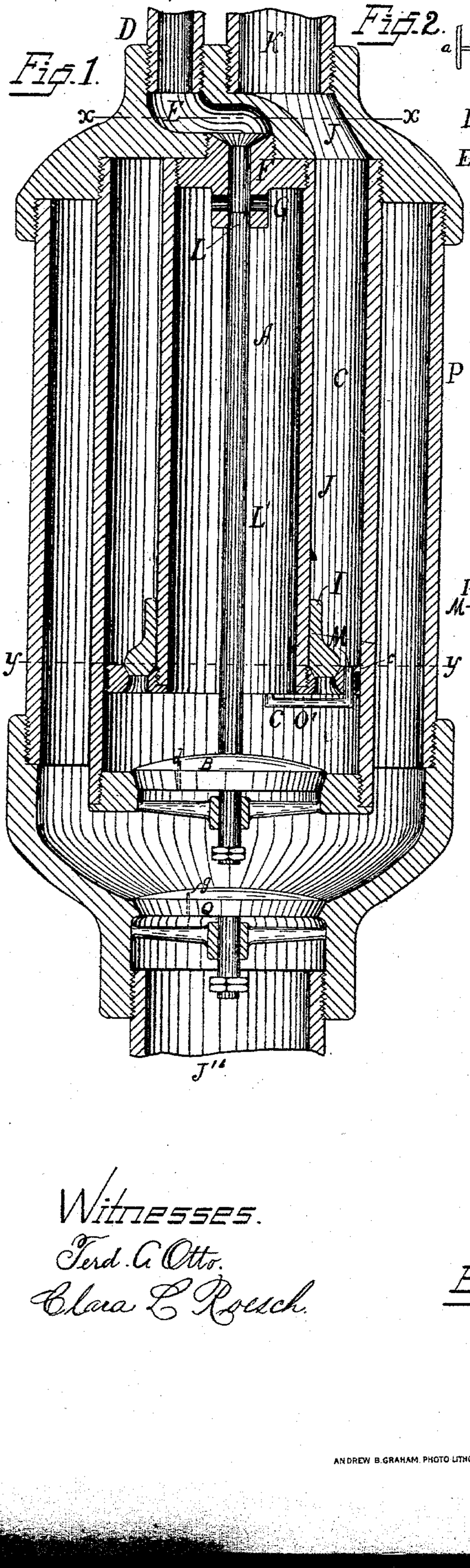


Fig. 2.

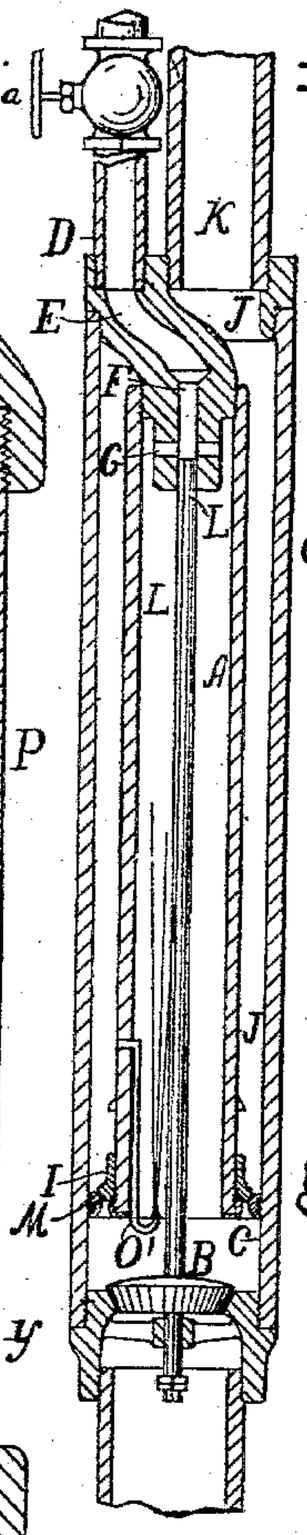


Fig. 3.

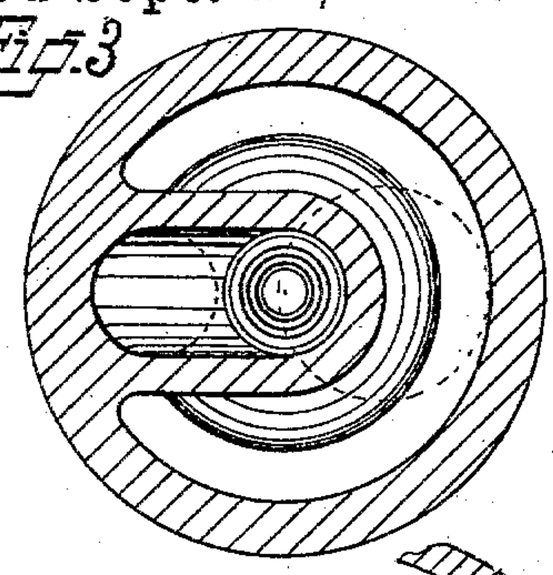


Fig. 4.

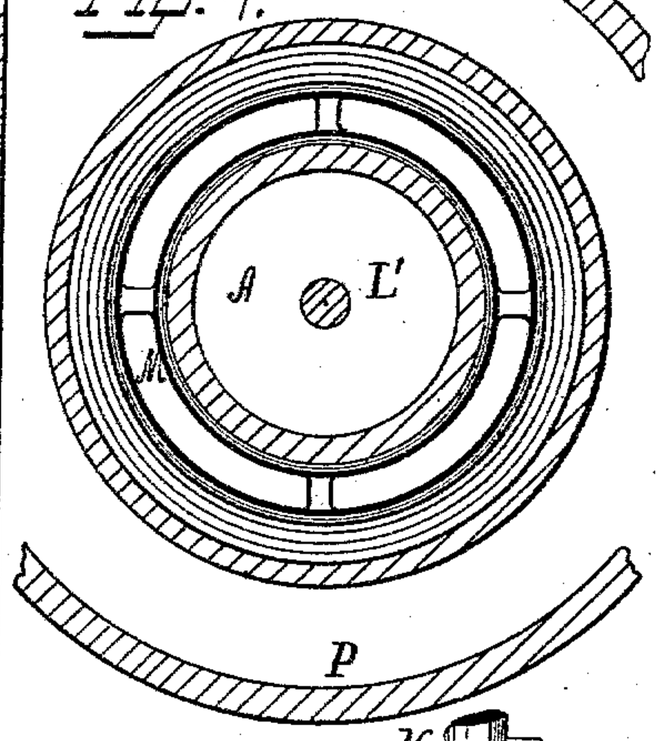
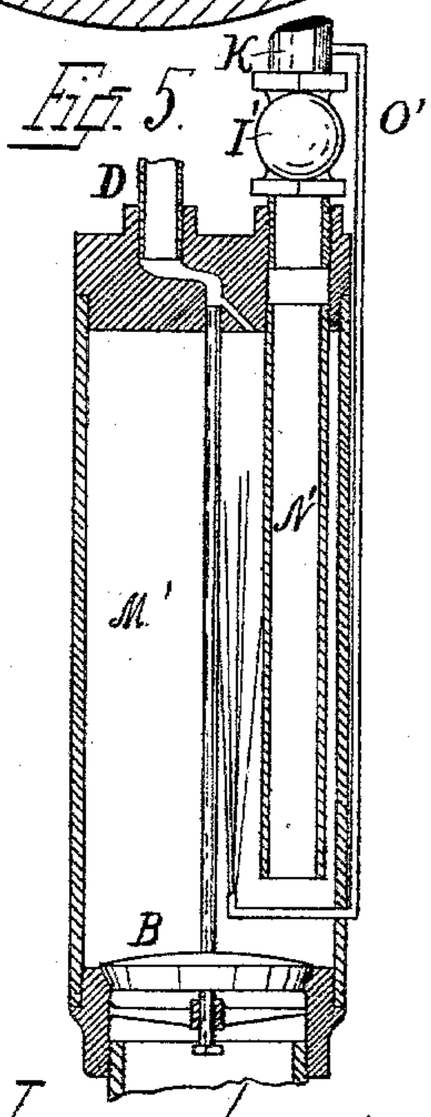


Fig. 5.



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UNITED STATES PATENT OFFICE.

JAMES B. ERWIN, OF MILWAUKEE, WISCONSIN.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 546,313, dated September 17, 1895.

Application filed December 20, 1894. Serial No. 532,407. (No model.)

To all whom it may concern:

Be it known that I, JAMES B. ERWIN, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Steam-Pumps, of which the following is a specification.

My invention relates to improvements in the class of steam-pumps with which the water is raised by the direct action of the steam upon its surface and is caused to enter the pump when it is elevated above the surface of the water by a partial vacuum therein produced by the condensation of steam and when submerged by the combined action of the vacuum and the gravity of the surrounding water.

The object of my invention is to provide a water-elevating device which is simple in construction, durable, and inexpensive, and which, owing to the fact that all the parts are inclosed in a cylindrical tube of small dimensions, is adapted to be used in the smallest tubular wells, if desired, not exceeding two inches in diameter.

The construction of the device is further explained by reference to the accompanying drawings, in which—

Figure 1 represents a longitudinal vertical section of that form of pump which is adapted to be used above the surface of the water to be elevated. Fig. 2 represents a longitudinal section of a modified form more especially adapted to be submerged beneath the surface of the water to be elevated. Fig. 3 represents a horizontal section of the pump, drawn on line X X′ of Fig. 1. Fig. 4 represents a horizontal section drawn on line Y Y of Fig. 1. Fig. 5 represents a modified form of the pump in which the function of the interior and exterior chambers are reversed and the steam is admitted direct into the larger or exterior chamber, while the water is discharged through the smaller inclosed chamber.

Like parts are represented by the same reference-letters throughout the several views.

In the drawings, A represents the steam-chamber, into which when the pump is submerged the water flows of its own gravity, entering through the check-valve B in the lower end of the chamber C. Steam is admitted to the chamber A from the boiler through the steam-pipe D, steam-duct E, vertical steam-port F, and radial steam-ports G, whereby the water therein is forced down and out through the chamber C, upward past the annular check-valve I, and thence through the outlet-passage J and discharge-pipe K to the place of discharge.

The admission of steam through the steam-ports F and G is controlled by the vertical reciprocating valve L, formed at the upper end of the valve-rod L′, which rod is supported from and actuated by the inlet check-valve B. The outlet check-valve I is provided with an annular seat M, which is preferably secured permanently to the exterior surface of the steam-chamber A, while its periphery has a packed or closely-fitting bearing against the inner surface of the chamber C.

The parts of the invention thus far described are common to both forms of construction shown in Figs. 1 and 2. When, however, the pump is located above the surface of the water, I preferably use an additional chamber P, which surrounds and incloses the other two chambers and forms a water-reservoir from which the chamber A is more quickly and readily filled with water than it could be when drawing it direct from the supply at a lower level.

Q is a check-valve, which is closed by the water as it passes from the reservoir or chamber P to the steam-chamber A. The valve Q may be substituted by an ordinary check-valve located at or near the lower end of the inlet water-pipe; but for convenience of construction the form and location of the check-valve shown are preferred.

In starting the pump when located above the surface of the water steam is first admitted a moment to expel the air, when the cock *a* in the steam-pipe is closed a few seconds to permit the admitted steam to condense, whereby a partial vacuum is produced, which causes the water from the cistern or other supply to flow up into the pump, when it fills the steam-chamber A. As soon as this chamber is filled and the water ceases entering, the check-valve B will drop of its own gravity, thereby carrying with it the steam-controlling valve L, whereby (the steam-cock *a* being open) steam is admitted to the sur-

face of the water in the chamber A, when the water therein is expelled therefrom and forced up past the check-valve I, and thence through the duct J and pipe K to the place of discharge. When all the water has been forced out from the mouth of the steam-chamber A, the steam therein is instantly released and is free to rush up through the water in the chamber J, whereby the steam is condensed so much faster than it can enter through its comparatively-small inlet-duct that a partial vacuum is produced, that causes the water to be drawn from the reservoir P up into said steam-chamber, when in so doing it raises the check-valve B. With this upward movement of the check-valve B, the steam-controlling valve L is closed, thus excluding the further admission of steam, while by the continuous admission of cold water the steam is more completely condensed, a more perfect vacuum is produced, and the steam-chamber is again filled with water. This done, the valve B closes again, as before, when steam is again admitted, whereby the operation described is again and continuously repeated so long as the supply of steam is maintained. While the steam is forcing the water a second time from the steam-chamber the water from the supply below is simultaneously entering the water-reservoir P preparatory to being drawn therefrom into the steam-chamber. Thus as the chamber A is being emptied the reservoir P is being filled, and as the chamber A is filled the reservoir P is being emptied. By this arrangement the action of the water in filling the steam-chamber is more prompt than it could be were it drawn direct from the cistern at a lower level. When, however, the pump is submerged beneath the surface of the water to be elevated, as it is the more common way to use the form of pump shown in Figs. 2 and 5, the chamber P and check-valve Q may be dispensed with, as the pressure of the surrounding water at a higher level will cause it to flow of its own gravity up into the chamber A. If desired, the annular check-valve I may be substituted by an ordinary check-valve I′, as shown in Fig. 5, located above the pump in the pipe K. To provide for the escape of water when the pumps are exposed to frost, minute openings *c*, *d*, and *g* are provided, communicating from the chamber C above the check-valve I and the inlet-pipe J″ below the check-valve Q. These openings also perform an important function when the water is to be elevated to a great height, as it has been found by experience that the pump will start much more promptly with a light than a heavy lift. It follows that when the water is permitted to flow back past the check-valves the pump will always start promptly as soon as the steam-valve is opened.

In the modified form shown in Fig. 5 the large chamber M′ is the steam-chamber, from which the water is forced by the steam out and up through the small chamber N′ and the check-valve I′ through the discharge-pipe K. In all other respects the construction is substantially the same as shown in Figs. 1 and 2.

To accelerate the condensation of steam in the steam-chamber when the water has been expelled therefrom, a duct or passage O′ is provided, which communicates from the chamber C above the check-valve to or near the mouth or lower discharge end of the steam-chamber A, whereby as soon as the water has been discharged from the chamber A and the pressure is reduced by the escape and condensation of steam below the pressure of the column of water in the pipe K and chamber C a jet of cold water is at once discharged up into the steam-chamber, thereby increasing the rapidity of the condensation, thus causing the check-valve B to be more quickly raised and the steam-valve closed, as heretofore described. It is obvious that by thus locating the discharge end of the spray tube or duct O′ at the extreme lower end of the steam-chamber it will remain submerged by water and that steam cannot escape through it until all the water is driven from the steam-chamber, in view of which fact such tube is made in a single open piece unobstructed by a check-valve, which otherwise, if located higher, would be required to prevent the steam escaping through it from the steam-chamber before it had done its work.

In Fig. 1 the water passage or duct O′ is made through the valve-seat M; but for convenience of construction it may be formed through the wall of the chamber A, as shown in Fig. 2, or through the exterior inclosing wall, as shown in Fig. 5.

I am aware of the state of the art in steam and vacuum pumps as shown in the prior application of William Kirkwood, Serial No. 508,620, filed April 23, 1894, and I make no claim herein to the invention therein shown.

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

1. In a single acting steam pump the combination within a single inclosure of a steam chamber provided at its upper end with a steam controlling valve; a water chamber communicating at its upper end with a water discharge pipe, and at its lower end with the lower end of said steam chamber; a check valve located between said steam and water chambers, and the inlet water supply duct; a valve rod communicating between said check valve and said steam valve, and a water discharge check valve located between said steam chamber and said water discharge pipe and adapted to permit the escape of water to, and to prevent its return from said water discharge pipe, substantially as and for the purpose set forth.

2. In a single acting steam pump, the combination of a steam chamber provided at its upper end with a steam controlling valve; an

exterior inclosing water chamber communicating at its upper end with the water discharge pipe and provided at its lower end with an inlet water controlling check valve; a valve-rod communicating between said check valve and said steam valve; and a check valve located between said steam chambers and said water chamber and adapted to permit the escape of water and to prevent its return from said water discharge pipe, substantially as and for the purpose specified.

3. In a single acting steam pump of the class described, the combination of a steam chamber provided at its upper end with a steam controlling valve; an exterior inclosing chamber communicating at its upper end with the water discharge pipe and provided at its lower end with an inlet water controlling check valve; a valve-rod communicating between said check valve and said steam valve; an annular valve seat surrounding the lower end of said steam chamber inclosing the space between said steam chamber and the inclosing water chamber; and an annular valve located between said steam chamber and said water discharge pipe and inclosing said steam chamber against which it has guide bearings adapted to close said annular valve seat against the return of the water elevated, substantially as and for the purpose specified.

4. In a single acting steam pump, the combination of a steam chamber provided with a steam controlling valve; an exterior water chamber communicating at its upper end with the water discharge pipe and provided at its lower end with an inlet water controlling check valve; means for communicating motion from said check valve to said steam valve; a check valve adapted to close the outlet water passage against the return of the elevated water; and an exterior inclosing water reservoir surrounding both of said chambers, closed at its upper end and communicating at its lower end with the inlet water pipe, and with the lower ends of said inclosed steam and water chambers, substantially as and for the purpose specified.

5. In a single acting steam pump, the combination within a single inclosure of a steam chamber open at its lower end for the reception of water and provided at its upper end with a steam controlling valve; a separate water chamber communicating between the inlet water duct and the lower end of said steam chamber; a water controlling check valve located between said inlet water duct and said water chamber; a valve-rod communicating between said inlet water controlling valve and said steam valve; an outlet water duct communicating from said steam chamber with the water discharge pipe; an outlet check valve located in said outlet water duct or pipe; a water return spray duct communicating from said outlet water duct above said outlet check valve with the interior of said steam chamber, all substantially as and for the purpose specified.

6. In a single acting vacuum pump, the combination of a steam chamber provided at its upper end with a steam controlling valve, an inlet water duct or chamber, a water controlling valve located in said inlet duct or chamber, a connection communicating between said water and said steam controlling valves, a discharge duct or chamber communicating from said steam chamber to the place of discharge, provided with a check valve to prevent the return of water, and an open unchecked spray tube communicating from above the check valve in said outlet discharge duct or chamber to the lower end of said steam chamber, substantially as and for the purpose specified.

In testimony whereof I affix my signature in the presence of two witnesses.

JAMES B. ERWIN.

Witnesses:
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FERD. C. OTTO.