No. 646,899. Patented Apr. 3, 1900.

J. W. EBERMAN.

STEAM VACUUM PUMP.

(Application filed Oct. 17, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

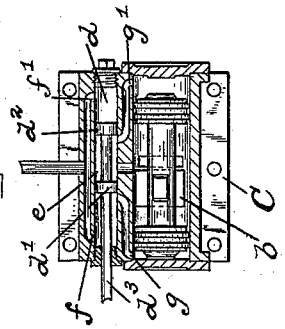

Fig. 3.

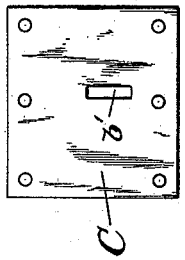

Fig. 1.

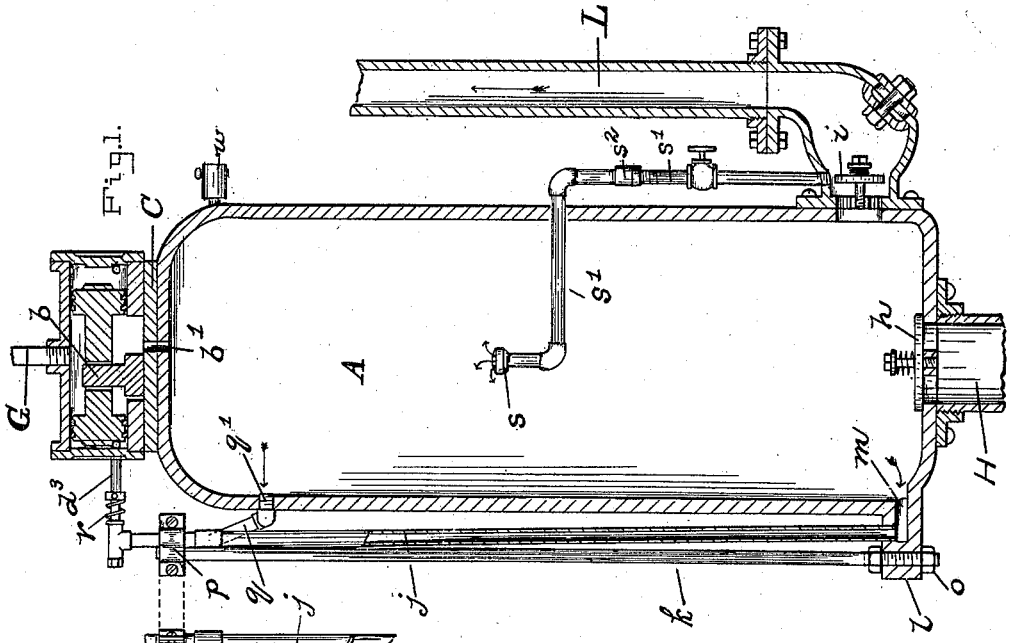

Fig. 4.

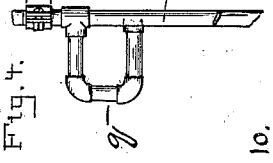

Fig. 10.

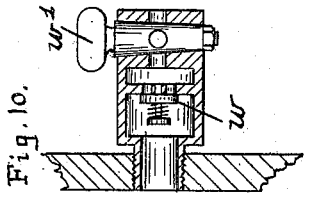

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Fig. 6.

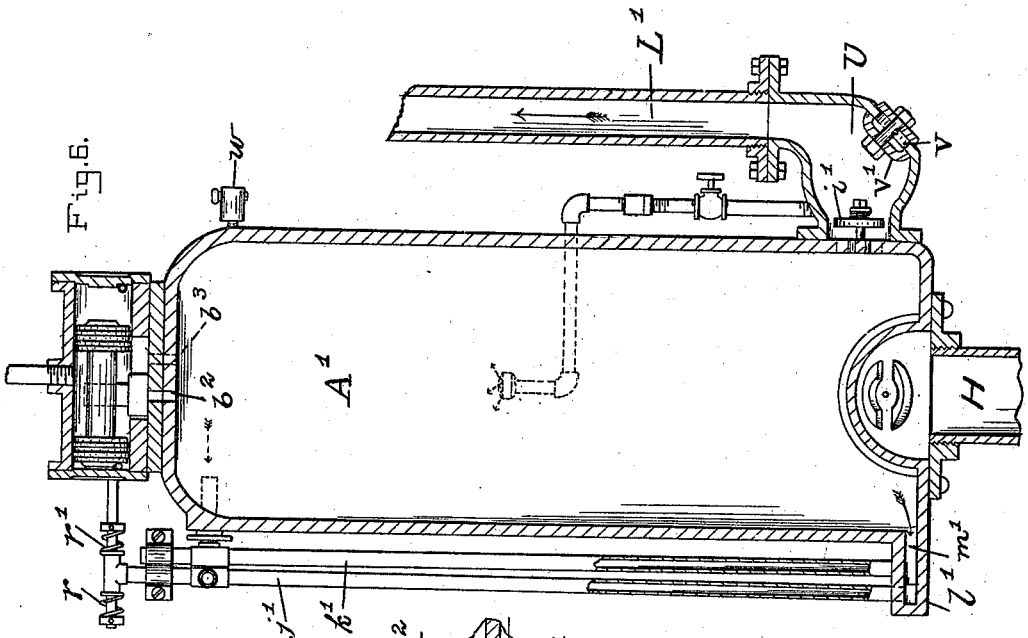


Fig. 7.

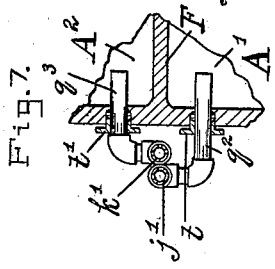


Fig. 8.

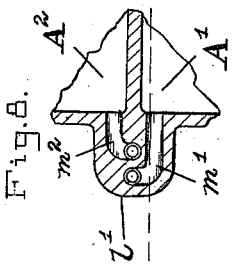


Fig. 9.

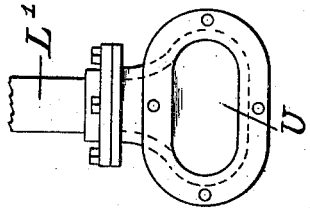
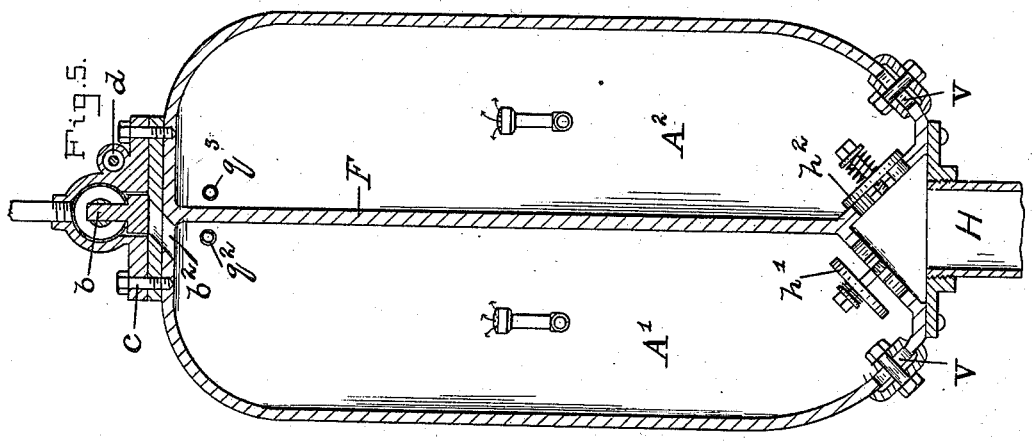


Fig. 5.



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UNITED STATES PATENT OFFICE.

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STEAM VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 646,899, dated April 3, 1900.

Application filed October 17, 1899. Serial No. 733,913. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. EBERMAN, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Steam Vacuum-Pumps, of which the following is a specification.

This invention relates to that class of pumping apparatus known as "steam vacuum-pumps" and in which the steam is admitted into the same chamber or chambers with the water and presses upon the surface thereof.

The object of the invention is to provide an improved device so constructed that the alternating changes of temperature will cause its expansion and contraction, which device shall constitute the motive force for operating the steam-valves.

Referring to the accompanying drawings, Figure 1 is a vertical section of one form of the pump, showing my improved valve-shifter. Fig. 2 is a horizontal section of the valves. Fig. 3 is a plan view of the slide-plate. Fig. 4 is a detail showing the flexible pipe connection at the free end of the shifter, as seen in a direction transverse from that seen in Fig. 1. Fig. 5 shows a vertical section of an apparatus with two chambers. Fig. 6 is also a vertical section of the two-chamber apparatus, the section being taken on a plane transverse to that seen in Fig. 5 and close to the partition separating the two chambers. Fig. 7 is a detail showing the form of flexible pipe connection employed in the two-chamber apparatus. Fig. 8 is a horizontal section showing the two passages opening into the lower end of the two chambers. Fig. 9 is a view of the discharge-pipe connecting with the two chambers, and Fig. 10 is a sectional view of the petcock.

The chamber A has on top a valve-chest containing a double-piston balance-valve *b*, alternately opening and closing a port *b'*, communicating with the said chamber A. This valve has its seat on a plate C, which, with the valve-chest, is secured to the top of chamber A by bolts *c*.

In the present instance supplemental valves are used which are in a chamber *d* on the side of the main-valve chamber. These two valves *d' d²* are on one stem *d³*. A passage *e* is always open between these two valves and the main-valve chamber, so that all the valves are balanced. Two induction and eduction ports *f f'* communicate with the supplemental chamber and are alternately opened and closed by the supplemental valve. The mechanical shifting of these valves by means presently to be described controls the action of the main valve *b*. Escape-ports *g g'* lead from each end of the supplemental chamber, and a pipe *g²* conveys the escaping steam from both ports to the atmosphere or to a condenser. A steam-supply pipe G is connected with the valve-chest. Such valves as are here shown are well known and have long been in use and their operation will be readily understood.

Opening into the lower end of the chamber A is a supply-pipe H for water or any other liquid, and a check-valve *h* is so arranged as to allow liquid to pass from said pipe into the chamber, but prevent its return to the pipe. A discharge-pipe L is attached to the lower part of the chamber and leads in any direction, and a check-valve *i* opens from the chamber to said pipe to allow liquid to pass out of the chamber, but prevent its return.

The improved valve-shifter comprises two members side by side and both rigidly attached at one end to the chamber, at least one of them being tubular, so as to communicate with the chamber, and both members having their free ends united together in such manner that one cannot elongate without affecting the other.

The valve-shifter shown in Fig. 1 comprises an upright tube *j*, whose lower end takes into a boss *l*, rigidly attached to the chamber, said boss having a passage *m* opening into said chamber. This tube serves as one member of the shifter. The other member consists of an upright tube or rod *k*, whose lower end is rigidly attached to the said boss *l* by screws and nuts *o* or other means. This second member extends up alongside of the tube *j*, and the upper ends of both members are united together at *p* by any suitable means that will prevent one from elongating without bending or swaying the other. The united upper ends of the two members, while tolerably stiff, are still free to have slight lateral

swaying movement to such an extent as the resiliency of the metal members will admit. For instance, if the member j elongates by expansion one-sixteenth of an inch and the other has no elongation the effect on a proper length would be to sway the upper ends laterally about three-fourths of an inch. The upper end of the tubular member j has a suitable flexible communication with the upper end of the chamber A, so that steam filling the chamber may also fill the tube, or, by way of the lower passage m, water filling the chamber may in like manner fill the tube. The flexible communication is shown in Figs. 1 and 4, and consists of a tube in the form of a double elbow q, one end of which is joined to the tubular member j and the other end to a short pipe q', which taps into the chamber A. The arrangement is such that the slight swaying movement of the shifter is permitted, while at same time communication is maintained between the tubular member and the interior of the chamber.

The upper end or movable end of the valve-shifter $j\,k$ is connected with the valve-stem d^3, which in the present instance has a spiral spring r around it that serves to cushion the throw of the valve-shifter. The spring may be omitted. When the parts are not operating, but are in their normal state of rest, the supplemental valves $d'\,d^2$ will have the position shown in Fig. 2—that is, will be at the limit of their inward traverse—and the upper end or movable end of the shifter $j\,k$ will be in its nearest position toward the chamber A. When the tubular member j of the shifter is heated, it will expand or slightly increase its length, and as the other member k has not been heated the effect will be to sway the two members laterally in a direction away from the chamber, thereby shifting the valves to the limit of their outward traverse.

Within the chamber A is a sprinkler s, and a pipe s' connects it with the discharge-pipe L. A check-valve of any well-known form is in the sprinkler at s^2, and cold water may pass from the discharge-pipe L to the interior of the chamber to cause the steam therein to condense quickly. The check-valve s^2 prevents the escape of either steam or water from the chamber back through the pipe s'. If desired, more than one sprinkler may be employed.

From what has been stated the operation will be readily understood. The main valve b in Fig. 1 has the open position, and steam from the supply-pipe G enters the valve-chest and can pass through the open port b' into the chamber A. The steam passes from the chamber through the short pipe q' into the tubular member k of the shifter and heats it, the heat causing its expansion and elongation and resulting in the upper end of the shifter swaying laterally and moving the supplemental valves $d'\,d^2$, which alters the course of the steam and shifts the main valve b to the closed position. A reduction of pressure in the chamber follows by the condensation of the steam, which is aided by the spray of water from the sprinkler s. A vacuum is thus produced in the chamber A, whereupon the check-valve h opens and liquid from the supply-pipe H instantly flows into the chamber A and fills the latter. This liquid also flows through the passage m into the tubular member of the shifter and cools it, and thereby contracts or slightly shortens it, resulting in the upper end of the shifter swaying in the opposite direction and again shifting the supplemental valve, and restores the course of the steam in the valve-chest and results in opening the main valve. Steam-pressure now enters the chamber A and acting on the surface of the liquid forces the latter out, the check-valve i opening and the liquid in the chamber rapidly discharging into the discharge-pipe L. These operations will be repeated again and again until the steam-supply at pipe G is shut off.

The construction shown in Figs. 5 to 9 illustrates a pump having two chambers, one of which fills while the other empties and only one of the improved valve-shifters being employed to operate the valve. The two chambers $A'\,A^2$ are separated by a partition F, and the valve may be the same, the only difference shown being that the valve-seat has two ports, one port b^2 inclining into the chamber A' and the other port b^3 inclining in the opposite direction into the other chamber A^2. In this case the boss l' at the lower end of the chamber has two passages, one, m', leading to one member of the shifter and the other, m^2, leading to the other member. The valve-shifter in this case has all the essential features of the one in Fig. 1. Here both members $j'\,k'$ must be tubular, and the upper end of each must have a flexible or movable communication with its coördinate chamber. The same or similar device to the double elbow shown in Fig. 4 may be used or a short tube q^2 may be attached to one member j' and fit and slide through a gland or stuffing-box t into chamber A', while another tube q^3, attached to the other member k', may slide in another gland l' into chamber A^2. It will be seen that this construction will allow the free end of the shifter to sway and will at the same time maintain communication between the shifter-tubes and the interior of both chambers. The upper end of the shifter where it connects with the valve-stem may have spiral springs r and r', one at each side, if desired. In the lower end of each chamber is a check-valve $h'\,h^2$, respectively, on an inclined seat, the two seats being reversely inclined, whereby both ports have equal access to the supply-pipe H. The discharge-pipe L' in this case has a union connection U broad enough to cover and include the two check-valves i' in the chambers. The lower portion of the discharge-pipe and also of each chamber may have a suitable hole v, closed by a clamped plate v', to serve for cleaning out these parts.

The operation of the two-chamber pump is like that of the one-chamber, only the filling and discharging are alternated first in one chamber and then in the next. The operation of the valve-shifter shown in Fig. 6 is substantially the same as that shown in Fig. 1, the difference being that as the two tubular members in Fig. 6 are both in communication with the chambers both of said members will be subjected to alternating changes of temperature and one will be elongating at the same time that the other is contracting.

It is to be understood that the valve-shifter herein disclosed constitutes an invention not limited to the particular use shown. It is obvious that this valve-shifter would shift whatever valve it may be connected with, either main valve or supplemental valves, and therefore the invention is not limited to the particular valves here shown.

At the upper part of the chamber A is a small air-inlet valve *w*, which is in the form of an ordinary check-valve opening inward to allow atmosphere to enter the chamber when the steam-pressure therein has been so reduced as to create a partial vacuum. The petcock *w'* attached governs the opening and may be changed as circumstances require.

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

1. The combination of a chamber having suitable inlets and outlets for steam and water and provided at one end with a boss; a valve which controls the steam that enters said chamber; a valve-shifter comprising two members side by side and both having one end immovably attached to the said boss—one of said members being tubular and one end thereof in communication with said chamber through the boss, and the other in communication with the opposite end of the chamber, both members having one end free to move independently of the chamber and said free ends united together so that neither member can elongate without causing both members to sway laterally, and a suitable connection between the swaying end of said shifter and the valve.

2. The combination of a chamber having suitable inlets and outlets for steam and water; a valve to open and close the steam-port to said chamber; a valve-shifter comprising two members side by side and having one end immovably attached to the said chamber—one of said members being tubular and in communication with the lower end of said chamber and both members having their other ends united together so that neither member can elongate without causing both members to sway laterally; a flexible communication between the free end of the tubular member and which is in communication with the interior of said chamber near the upper end thereof; and a suitable connection between the swaying end of the said shifter and the steam-valve.

3. The combination of a chamber having suitable inlets and outlets for steam and water; a steam-actuated valve which controls the passage of steam to said chamber; a supplemental valve to govern the application of steam to said valve; a valve-shifter comprising two members side by side and both having one end immovably attached to the said chamber—one of said members being tubular and in communication at both ends with said chamber, and both members having one end free to move independently of the chamber and these latter ends united together so that neither member can elongate without causing both members to sway laterally, and a connection between the swaying end of said shifter and the supplemental valve.

4. The combination of a two-chamber pump each having inlets and outlets for steam and water and provided with a boss having two passages; a valve device to control steam-passages opening into said chambers; a valve-shifter comprising two tubular members each having one end normally connected with each of the passages in said boss and thereby in communication with a different one of said chambers and the members non-communicating, but united at the free ends so that neither member can elongate without causing the free ends of both to sway laterally; a flexible communication at the top of each chamber, connecting the free ends of each tubular member with the interior of a different one of said chambers; and a connection between the swaying end of the two members and said valve device.

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

JOSEPH W. EBERMAN.

Witnesses:

CHARLES B. MANN, Jr.,

CHARLES VIETSCH.