C. H. HALL.

Improvement in Steam Vacuum-Pumps.

No. 131,519. Patented Sep. 24, 1872.

Fig. 1,

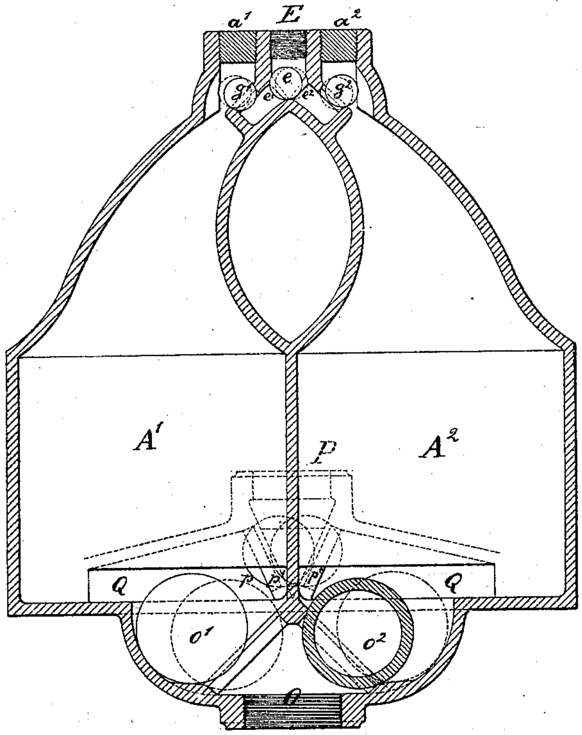
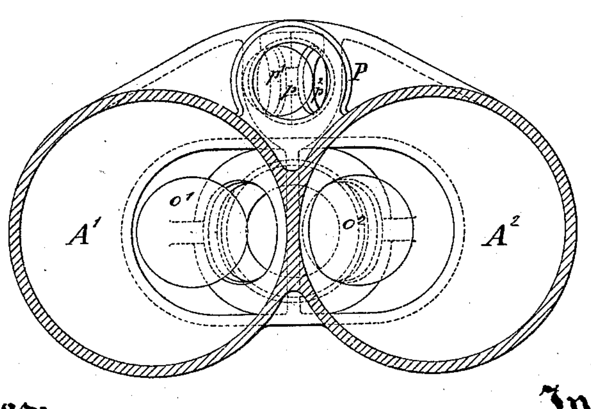


Fig. 2,



Witnesses:

Arnold Hörmann.

W. C. Dey

Inventor;

C. H. Hall

by his attorney

T. D. Stetson

AM. PHOTO-LITHOGRAPHIC CO. N.Y. (OSBORNE'S PROCESS.)

UNITED STATES PATENT OFFICE.

CHARLES H. HALL, OF NEW YORK, N. Y.

IMPROVEMENT IN STEAM VACUUM-PUMPS.

Specification forming part of Letters Patent No. **131,519**, dated September 24, 1872.

CASE E.

To all whom it may concern:

Be it known that I, CHARLES H. HALL, of New York city, in the State of New York, have invented a certain Improvement in Steam Pumping Apparatus, of which the following is a specification:

To distinguish this from other inventions of my own which are somewhat analogous, I will designate this particular invention by the letter E.

The apparatus belongs to a class of steam-pumps in which the solid working parts are small, relatively, to the capacity of the apparatus; and the steam is caused to act by direct pressure upon the water. There is a marked gain by the reduction of rubbing-surfaces, and the great efficiency and small cost of the apparatus.

The following is a description of what I consider the best means of carrying out the invention. The accompanying drawing forms a part of this specification.

Figure 1 is a vertical section, and Fig. 2 is a horizontal section.

Similar letters of reference indicate like parts in all the figures.

A^1 A^2 are vessels of equal size, formed of cast-iron in one piece, and adapted to resist a strong internal pressure, as also to resist the external pressure of the atmosphere when a vacuum is formed therein. E is a steam-pipe, which communicates with a boiler, not represented. The steam-pipe E is of small internal diameter, or there must be, at some point in the steam-connection, a narrow passage through which the steam cannot flow readily, except in a very contracted current. O is a pipe, of sufficient size, communicating with the tank or well from which the water is to be taken; and P is a delivery-pipe, adapted to convey away the water under pressure, and discharge it at a higher point or wherever it is desired to force the water. The chambers A^1 and A^2 are filled alternately with steam and water. The action is self-controlling. When the steam is excluded from a chamber, the water is received from the pipe O, and fills it. Meantime the opposite chamber is being emptied of its water by the steam entering at its top and pressing down on the surface with such force as to discharge the water outward through the discharge-pipe. When the water is thus expelled, the reception of steam is cut off, and the chamber is soon again filled with water. The provisions for receiving and discharging the water are as follows: A spherical valve, o^1, controls the communication between the suction-pipe O and the chamber A^1. A similar valve, o^2, performs a similar service for the chamber A^2. The valves are self-acting, and open and close by rolling a little distance. There may be cages over them to prevent a too great displacement of the valves under any circumstances, but my experiments indicate that such are not necessary. The discharge of the water from the chambers A^1 and A^2 into the delivery-pipe P may be similarly arranged. That is, there may be two rolling valves, one for each orifice, but I have simplified the construction by placing the seats close together, and causing a single ball to serve as the valve for each. It is marked p. When the water is delivered from the chamber A^1 it forces the valve p away from its seat, p^1, and allows it to rest in the opposite seat p^2; and when the action of the apparatus changes and the water is delivered from the chamber A^2, the valve p is driven out of its seat p^2, and rests again in its seat p^1. The automatic controlling of the admission and exclusion of the steam at the top of each chamber is more difficult of explanation. I have arrived at the devices employed by a long series of laborious and expensive experiments. A single ball-valve, e, is placed in the mouth of the pipe E, and, by a slight movement, rolls alternately into and out of a seat on each side. When in its seat e^1 it excludes the steam from the chamber A^1. When in its seat e^2 it excludes the steam from the chamber A^2.

The apparatus can be operated with some success without the additional balls represented on each side, and I will first proceed to describe it as so working.

Supposing the valve e to be in the position represented in Fig. 1, it closes the communication with the chamber A^1, and allows the steam to enter and exert its full pressure on the surface of the water in the chamber A^2. Under these conditions the valves at the bottom assume the proper positions, and the water is rapidly forced out of the chamber A^2. When the water is all expelled, the water-line getting below the point of discharge, the steam itself rapidly enters, and passes up the discharge-passage. The steam passes through the valve-seat p^2, and, moving up into the delivery-pipe P, meets a large surface of cold water, previously untouched by steam, and is very rapidly condensed. The sudden diminution of pressure due to this condensation induces an acceleration in the current of steam entering at the top, and this causes the ball-valve e to instantly roll and close the orifice leading into the chamber A^2. The condensation continuing, induces immediately such a vacuum in the chamber A^2 that the water commences to be supplied through the pipe O to fill it. The movement of the valve e into its seat e^2 necessarily opens the passage for the steam past the seat e^1, and allows the steam to enter the chamber A^1. The steam continues to flow moderately into the chamber A^1, and expels the water therein. The same round of operations is repeated for the chamber A^1 as has been before described for the chamber A^2. In each case the steam, on being admitted to a chamber and striking on the surface of the cold water, heats the upper surface of the water, and thereby forms a stratum of hot water which protects the steam from the condensing effect of the great mass of the cold water below. There is but a slight condensation, after the first access of the steam, until the moment when the steam passes into the discharge-pipe. The success of the apparatus depends on the suddenness with which the rate of condensation is then increased. The apparatus pulsates by the sudden augmentation of the current of steam at that moment, and the change in the position of all the valves occurs thereon, as herein described.

Now for the uses of the additional ball-valves g^1 g^2: These rest in seats, as represented, on each side, and serve as check-valves to prevent a back flow from the chambers A^1 A^2, respectively, toward the steam-pipe E and the steam-valve e. Their use is to guard against a liability of disturbance of the valve e when a chamber, A^1 or A^2, is entirely filled with water. The operation of filling with water under a strong suction is liable to terminate with a sudden and violent pressure, analogous to that experienced in the hydraulic ram. The percussive force of the body of water, flowing up in this manner, if allowed to strike directly against the valve e, is liable to throw it out of its seat and cause it to change its position from the seat on one side to the seat on the other side, thus cutting off the flow of steam in the opposite chamber before it has time to become fully emptied of its water. The check-valves g^1 g^2, arranged as represented, offer no appreciable resistance to the influx of the steam at the proper time; but they effectually resist any back action of the water. The valves g^1 g^2 are inserted through holes produced in the metal immediately above, which, after their insertion, are closed by the screw-plugs a^1 a^2.

Although I have described the steam as flowing up past the delivery-valve p into the delivery-pipe P and being there condensed, I believe that, in practice, in pumping water at ordinary temperatures, it is all condensed before it reaches the delivery-valve. I esteem it very important to induce as rapid a condensation of the steam at this juncture as is possible. I find that by widening the passage through which the water, and thus, at this juncture, the steam, is discharged, the rapidity of the condensation is increased; I have, accordingly, spread the discharge-aperture so that it occupies about one-sixth of the entire circumference of the base of each chamber. This passage is indicated by Q. The construction is such that while the orifice controlled by the delivery-valve p is of slight width, the orifice below it, and which forms really the discharge-passage from the chambers A^1 A^2, respectively, is much wider. I believe that, upon the sinking of the water-line to a little below the level of the top of the wide orifice Q, on either side, the surface of the water is very greatly agitated. It is important that the upper edge of each orifice Q shall be exactly level, so that the discharge of steam through the upper portion of it, to flow toward the discharge-valve p, shall be simultaneous along the whole of the broad line. The effect is to instantly disturb a large portion of the surface, and this agitation brings to the surface fresh cold particles from below, and the steam in the entire chamber is rapidly condensed thereon.

I claim as my invention—

1. The single valve e, operating relatively to the two chambers A^1 A^2 and the two seats e^1 e^2, so as to admit the steam alternately into each, and to operate by the acceleration of the current into either when the water is discharged to the proper line, as herein specified.

2. The check-valves g^1 g^2, arranged and operating relatively to the steam induction-valve e and the chambers A^1 A^2 and their connections, as specified.

3. The water induction-valves o^1 o^2, arranged and operating relatively to the chambers A^1 A^2, and suitable means for introducing and discharging steam, and for the discharge of the water, as herein specified.

4. The single valve p, controlling the discharge from both the chambers A^1 A^2, in combination with means for introducing steam alternately into each chamber, and allowing the ingress of water into each, as herein specified.

5. The broad discharge-passage Q having a level upper edge, arranged as shown, and adapted to serve relatively to a steam and water chamber, and to a delicately self-operating steam induction-valve, e, so as to quicken the condensing action at the right moment, as herein specified.

In testimony whereof I have hereunto set my hand this 18th day of May, 1872, in the presence of two subscribing witnesses.

C. H. HALL.

Witnesses:

ARNOLD HÖRMANN,

W. C. DEY.