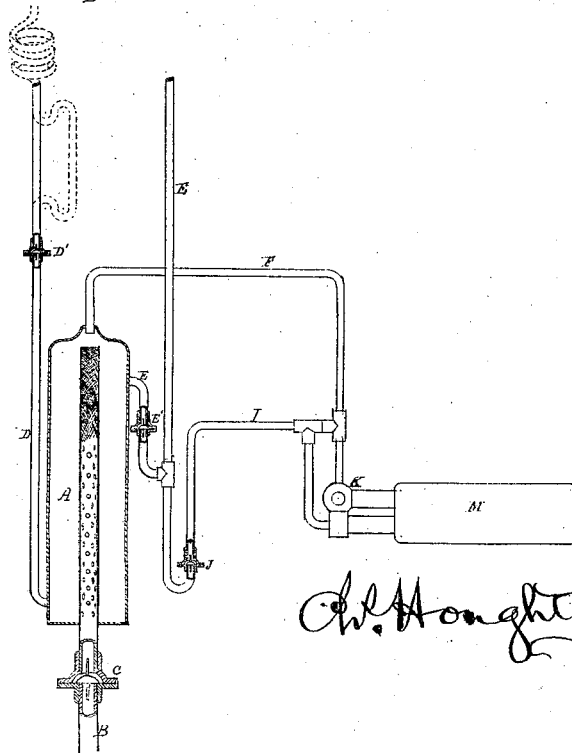
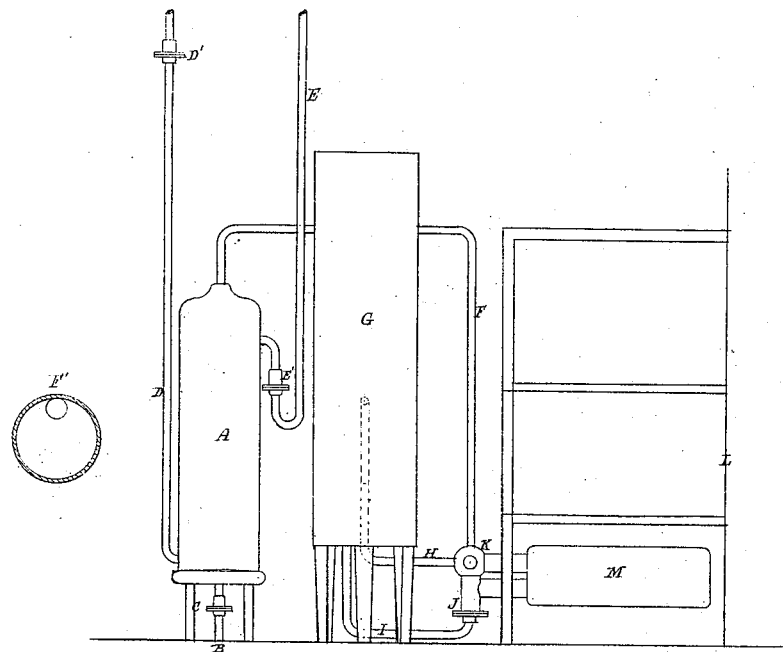


C. Houghton,
Steam Water Elevator.
No. 111,542. Patented Feb. 7, 1871.



C. Houghton

Witnessed { *C. Warren Brown.*
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UNITED STATES PATENT OFFICE.

CHARLES HOUGHTON, OF ROXBURY, BOSTON, MASSACHUSETTS.

IMPROVEMENT IN AUTOMATIC STEAM WATER-ELEVATORS.

Specification forming part of Letters Patent No. **111,542**, dated February 7, 1871.

To all whom it may concern:

Be it known that I, CHARLES HOUGHTON, of Roxbury, in Boston, in the county of Suffolk and Commonwealth of Massachusetts, have invented certain Improvements in the Construction of Automatic Steam-Pumps for raising water in dwelling-houses, and other places, by the use of the ordinary fire in a cooking-range, stove, or furnace, without additional fuel, from the well or cistern to the tank above, from which it is to be drawn for use; and the following, in connection with the drawing referred to, is a description of the same, sufficient to enable those skilled in mechanism to make and use the same.

A in the drawing is a hollow metallic cylinder, with both ends closed, except by the ingress of the pipes described, and is alternately a receptacle for the water to be raised and the steam which raises it. It is preferably made of sheet-copper, and of a size and length adapted to the quantity of steam which can be generated in the generator or hot-water back used for that purpose, the proportion of its length to its diameter being as about six or seven to one. B in the drawing is the inlet-pipe, and should extend from near the bottom of the well or cistern from which the water is to be drawn, where its open end should be so covered by a strainer as to prevent solid matter of any kind from entering it, up to and into the lower end of the cylinder A; thence, as hereinafter described, within the cylinder A, to near its top. Below the cylinder A this pipe should be made of iron or other metal of considerable strength, with the inlet-valve C placed in it at a convenient point. The extension of this inlet-pipe within the cylinder A I make of very thin metal, perforated with fine holes, or of very fine wire-cloth, the object being to conduct the inflow of cold water from the cistern to the top of the cylinder, to complete the condensation of steam in it by flowing through the perforations or interstices in the pipe as well as over the top of it; and when the water is expelled by the steam from the cylinder A the pressure will also expel it from this pipe, so that the water-level in the pipe and in the cylinder around it will be the same. This is desirable, as, if the column of water in this pipe did not flow out, so as to keep on a level with that in the cylinder, it

would have a tendency to take up caloric from the steam and retard the expulsion of the water from the cylinder A. This inlet-pipe ought to be of a size large enough to allow a flow of water through it sufficient to fill the cylinder A in a very short time. The inlet-valve C is placed in the inlet-pipe B at any convenient point below the bottom of the cylinder A, opening upward when the water flows from the well or cistern into the cylinder A, and closing by its own gravity when the water ceases to flow; and is held in its place, preventing a return-flow of water to the well, by the weight of water upon it. D in the drawing is the outlet-pipe from the cylinder A, conducting the water, as it is forced out of the cylinder A by steam, to and into the tank at the top of the house. This pipe should be made of iron or metal of considerable strength, with an inside diameter according to the amount of water which it is to conduct to the tank, but not so large but that the pressure of steam which will expel the water from the cylinder A will also drive the water before it up and out of this pipe. At a convenient point in this pipe, and preferably four to six feet above the top of the cylinder A, the outlet-valve D' is inserted; and if the tank to be filled is at a considerable distance farther up than another outlet-valve should be placed in this pipe at about eight or ten feet above the valve D'; or, instead of another valve, a short bend or coil in the pipe D will accomplish the desired purpose, viz: to prevent injury to the pipe D, or noise by the falling of water down the pipe when condensation of steam takes place in the cylinder A and the outlet-pipe D. The valve D' opens upward while the water is being expelled by steam from the cylinder A, and, when water ceases to flow through it, will close by its own gravity, unless steam should follow the water above it, which it is likely to do whenever there is a considerable pressure of steam, in which case it will close when condensation of steam takes place in the cylinder A, being then forced down and held in its place by returning water, if any remains in the pipe D above it; or if all the water has been expelled from the pipe D, as may often be the case, then the atmospheric pressure will close and hold this valve in its place.

E in the drawing is a pipe, of iron or other metal, called the condense-pipe, leading from the bottom of the tank at the top of the house, or from the cold-water pipe from the tank, to the hot-water boiler, (or it may lead from any other elevated source of water, if any other exists,) down a little below the top of the cylinder A, then turning sharply upward and entering the cylinder A near its top. The outlet of this pipe within the cylinder A, as well as the pipe itself, from its bend should be quite small—not above half-inch in diameter, and generally less than that—while the size of the pipe above the bend should be somewhat larger. This condense-pipe will conduct to and deliver into the cylinder A a stream of cold water, which will flow whenever the pressure of steam in the cylinder A shall be much less than the weight of the column of water in this pipe. This will occur whenever the water has all been expelled by the steam from the cylinder A and the outlet-pipe D, and may, and frequently will, take place with a low pressure of steam when the water has been driven up the outlet-pipe D beyond the valve D'.

Whenever the water flows into the cylinder A through this pipe, condensation of the steam in the cylinder A takes place, producing a vacuum in it, which is immediately filled by the water from the well or cistern flowing through the inlet-pipe B, the delivering capacity of which should be so much greater than that of this pipe E that it will fill the cylinder A before any considerable quantity will have entered it through this pipe E. The flow of water through this pipe will also fill the pipe F and the steam-generator, if it has not otherwise been filled by the flow of the water-supply pipe.

E' in the drawing is a valve in the upward turn of the lower part of the pipe E, opening upward and toward the entrance of the pipe E into the cylinder A, and will be opened by the flow of water through the pipe E into the cylinder A, and when such flow ceases will close by gravity, and when steam is generated and exerts a pressure in the cylinder A will be held by it in its place, and prevent the egress of steam or water up the pipe E. F in the drawing is a pipe, extending from the steam-generator or hot-water back M, thence running upward somewhat higher than the top of the cylinder A, then bending downward, and entering the top of the cylinder A, and is termed the steam-pipe, its office being to conduct the steam generated in the generator or hot-water back M to and into the top of the cylinder A. In the upper portion of this pipe an obstruction is placed inside, closing it, except a small opening on the upper side. A sectional view of the pipe F with this obstruction is shown on an enlarged scale in the detail marked F'. The object of this obstruction is to check the flow of water between the cylinder A and the steam-generator while allowing steam to pass from M to A

through the perforation. G, shown in Fig. 1 only, is the usual copper boiler, connected with a cooking range or stove, for heating water by means of pipes from it, conducting water into the hot-water back, and when there heated, returning it to this boiler. This is described and shown here on account of its proximity to the pump, and because, in some cases, the supply of water for the generator or hot-water back, when pumping, may be taken from this boiler. H and I in Fig. 1 are the pipes connecting the boiler G with the hot-water back in the range or stove.

I will also in many, and perhaps in most, cases be used for a water-supply pipe to the generator or hot-water back, when it is connected with and operating the pump, replenishing the supply of water in the hot-water back or steam-generator, exhausted by the steam generated and used to expel the water from the cylinder A. For this purpose the pipe I will be carried from its junction with the boiler G downward a little way below the level of the bottom of the hot-water back or steam-generator, thence toward it horizontally, thence perpendicularly upward to its junction with the hot-water back or steam-generator, and if there are two openings in the hot-water back I should connect this pipe with both of them. In the upward vertical turn of this pipe nearest its connection with the hot-water back I place the valve J, below described.

The supply of water for the generation of steam in the hot-water back need not be taken from the boiler G in the manner here described, unless it is more convenient or economical. It may be taken from the lower part of the bend in the condensing-pipe E, as in Fig. 2, or from the cold-water pipe as it enters the top of the room, or it may be brought directly from the tank at the top of the house, or any other suitably-elevated source; but in either case the valve J must be placed as described to prevent the egress of steam or water, through this supply-pipe, from the steam-generator M.

J in the drawing is a valve in the upward vertical portion of the pipe I, next to the entrance of it into the hot-water back or steam-generator, opening upward and toward the hot-water back or steam-generator.

When the steam in the cylinder A is condensed by the flow of water through the condense-pipe E, and water flows into it from the well or cistern, then water will flow through this supply-pipe I past the valve J, and re-fill the hot-water back or steam-generator with water, and the steam-pipe F also, if that has not been filled through the cylinder A.

K, in Fig. 1, is what is termed a three-way cock or faucet placed in the junction of the steam-pipe F and the water-pipe H, with the hot-water back or generator in the range or stove, with an indicator on the outside, to show when it opens a passage from the hot-water back or generator to the cylinder A,

and when it opens a passage from the hot-water back to the hot-water boiler G, it being so constructed that the opening from it toward the hot-water back or steam-generator cannot be closed, and only one of the other two openings toward the cylinder A and the hot-water boiler G can be closed at a time, making it certain that, if the passage from the hot-water back or generator to the cylinder A is closed, the passage from it to the boiler G is open, and vice versa, making it absolutely impossible to close the water and steam into the hot-water back or generator and produce explosion. When the cock K is turned to open the passage from the hot-water back to the boiler G, the usual operation of heating water in the hot-water back as supplied by the pipe I, and returning it to the boiler G by the pipe H goes on, and when the cock J is turned so as to open the passage from the hot-water back or steam-generator through the steam-pipe F to the cylinder A, steam will, if generated, pass into the cylinder A and operate the pump. The part of the drawing at the extreme right-hand of Fig. 1 may be considered as a front view of a cooking range or stove, showing its relative position and relation to the cylinder A, boiler G, and hot-water back or steam-generator, as well as to the other parts mentioned. M in the drawing is the hot-water back or steam-generator, which may be the hot-water back, or a special generator inserted conveniently, so as not to interfere with the usual cooking and other uses of the stove or range. It must be made of iron or other suitable metal, and of sufficient strength and soundness to bear such pressure of steam as may possibly come upon it in the use of the apparatus here described without danger of breaking, and it must have an inside capacity for holding water sufficient to make steam to drive all the water out of the cylinder A and outlet-pipe D, and still remain partially filled with water, or, in other words, it must hold enough water so that, in making steam enough to work the pump, it will never be exhausted of water.

The passage or passages from this hot-water back or generator should always be so large that the force of steam generated in it cannot prevent the flow of water into it through either the water-supply pipe or the steam-pipe when condensation in the cylinder A takes place.

In putting this pump in operation in a house, I should in all cases insert either a special generator or a hot-water back of suitable inside capacity, and openings for the work required of it, and extend the end of it from which the pipes are taken outside the range or stove, for convenience and certainty of making the connections properly and the passages of suitable size.

When a special generator is put in a range or stove it can be placed on the side of the fire-pot opposite the hot-water back, leaving sufficient space between them for the fire.

If a special generator is used, it may be allowed to pump continuously, and if more water is raised than is desirable it can be returned to the source from whence it came by a pipe arranged for that purpose, or by making a connection with the pipes already described, the steam generated may be turned into the hot-water boiler.

With the pump constructed and connected substantially as described, and made as nearly tight as possible, it is only necessary to turn the three-way cock K, so as to open the passage from the hot-water back or generator M, through the steam-pipe F to the top of the cylinder A, and, with an ordinary cooking-fire in the range or stove, steam will begin to generate and press upon and close the valve J in the supply-pipe I, at the same time heating all the water in the steam-pipe F to the boiling-point; then steam will accumulate in the top of the cylinder A, and pressing upon the water in it will drive the whole body of it through the outlet-pipe D to the tank placed to receive it above. The water in the inlet-pipe B extended within the cylinder A will flow out of it through the fine perforations in the metal or interstices in the wire-cloth, keeping on a level with the water in the cylinder around it, and passing with it to the tank.

When the water is all expelled from the cylinder A the steam will continue to force it up and out of the outlet-pipe D, until that pipe is partially or wholly cleared of water according to the existing pressure of steam. If there is a strong pressure of steam the water will be wholly expelled from the pipe D, or if the pressure is lighter it will be driven up that pipe part way, but not wholly out.

When the steam has followed the water up the pipe D with pressure enough to drive it all out, or with less pressure, it has driven the water in the outlet-pipe a few feet above the top of the cylinder A, the water in the condense-pipe E will, by its weight, overcome the now lighter pressure of steam and flow past the valve E' into the cylinder A, condensing the steam there; at the same time the pressure of the atmosphere forces the water in the well or cistern up the pipe B, and condensation becomes complete in the cylinder A and the steam-pipe F, while at the same time water flowing through the supply-pipe I will have replenished the hot-water back or steam-generator M, replacing all that has been converted into steam, and filling the steam-pipe F, if it has not already been filled through the cylinder A. The apparatus is now ready to make another stroke or action, which will take place as soon as steam enough is generated, and the operation as described will be repeated as long as sufficient steam is generated. To stop pumping, turn the cock K so as to open the passage from the hot-water back M or generator to the hot-water boiler, and the process of heating water in the boiler goes on again.

I am fully aware of all the features of the automatic steam-pump described in Letters

Patent issued to me as trustee for J. C. Wightman, April 27, 1869, No. 89,534, and in the Letters Patent issued to him March 29, 1870, No. 101,334, and in the Letters Patent issued to H. M. Wightman, August 16, 1870, No. 106,525, and do not claim as my invention anything described in either of said patents.

In apparatus constructed in accordance with said patents granted to J. C. Wightman, the steam-generator has been only of such size as to contain water enough for making steam sufficient to expel all the water from the pump-cylinder.

The result has been that, between the time of filling the pump-cylinder with steam, and the time of the condensation thereof, the empty steam-generator became so hot as to cause the incoming water to flash into steam, which, however, was insufficient in quantity to expel the water from the pump-cylinder, so that with a fire the apparatus soon ceased to operate, and the steam-generator was rapidly destroyed because of lack of water therein.

In H. M. Wightman's apparatus the same limited capacity of steam-generator exists, and an attempt is made to remedy the defect by placing outside of the fire-chamber a reservoir of water, designed to keep the steam-generator from becoming entirely emptied of water. But this reservoir is so connected with the steam-generator that a regular hot-water circulation is established between it and the reservoir, so that no steam is generated until the water in the reservoir becomes as hot as it is in the steam-generator, and, moreover, the heat which the water receives in the generator is rapidly radiated from the exposed surface of the reservoir; but in my invention the steam-generator, being made of such size as to contain enough water to generate steam sufficient to effect several complete discharges of the pump-cylinder, even without intermittent introduction of water into the generator between the successive discharges from the pump-cylinder, and water being introduced into the generator intermittently between said discharges, the result in practice is that my generator never becomes so hot as to prevent the entrance of water therein, and does not

burn out any more quickly than an ordinary hot-water back connected with a hot-water boiler or tank in the usual manner; moreover, the action of the apparatus is rendered certain and regular, from the fact that the steam-generator is never overheated or exhausted of water, and with a fire the pumping action goes on with a degree of rapidity proportioned to the intensity of the heat.

In Fig. 2 my apparatus is shown without connection with the hot-water tank or boiler seen in Fig. 1.

I claim—

1. In combination, with the pump-cylinder A, the water supply-pipe I, the steam-pipe F, and a steam-generator, so located as to be subjected to the action of the fire in a cooking or heating apparatus, and of sufficient capacity to contain at all times a quantity of water large enough to make steam for more than one full discharge of the pump-cylinder, when arranged so that the supply of water in the generator will be replenished intermittently, in the manner and by the means described, for the purpose set forth.

2. The puppet-valves E' and J, located and arranged as described, in the condense-pipe E and in the water supply-pipe I, as and for the purpose specified.

3. In connection with an automatic steam-pump worked by steam generated in a cooking or heating apparatus, and a tank in which water is heated by circulation established by heat from such apparatus, the employment of a three-way cock, arranged and located as described, for the purpose specified.

4. In connection with the cylinder A of an automatic steam-pump, the perforated or wire-cloth inlet-pipe in the cylinder, substantially as described, for the purpose specified.

5. The combination, with an automatic steam-pump as described, the arrangement of the hot-water boiler G, as shown and described, as a source of supply of water for the steam-generator, as set forth.

CHS. HOUGHTON.

Witnesses:

C. WARREN BROWN,
L. H. LATIMER.