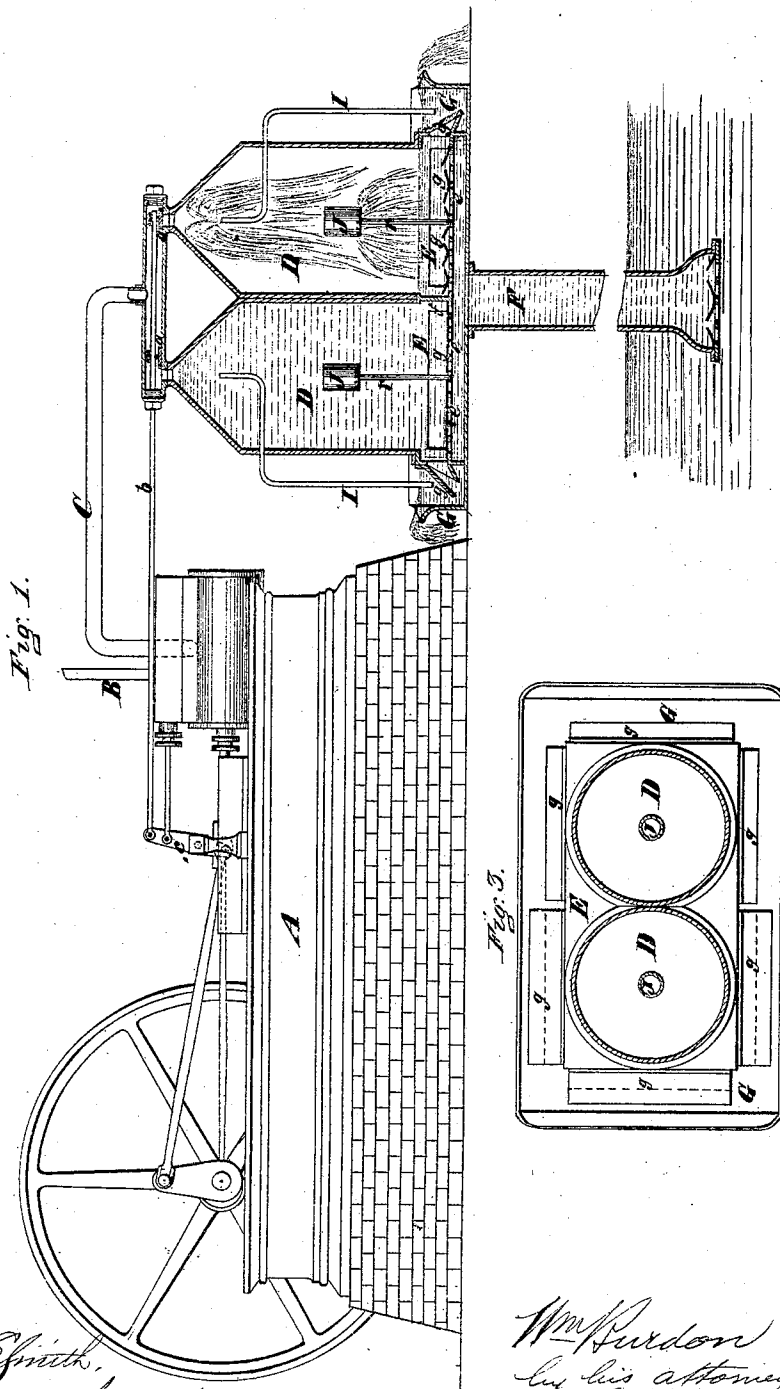


W. BURDON.

Steam Vacuum-Pumps operated by Exhaust Steam.

No. 135,203.

Patented Jan. 28, 1873.



Witnesses.

*James E. Smith.*  
*N. Morris Smith*

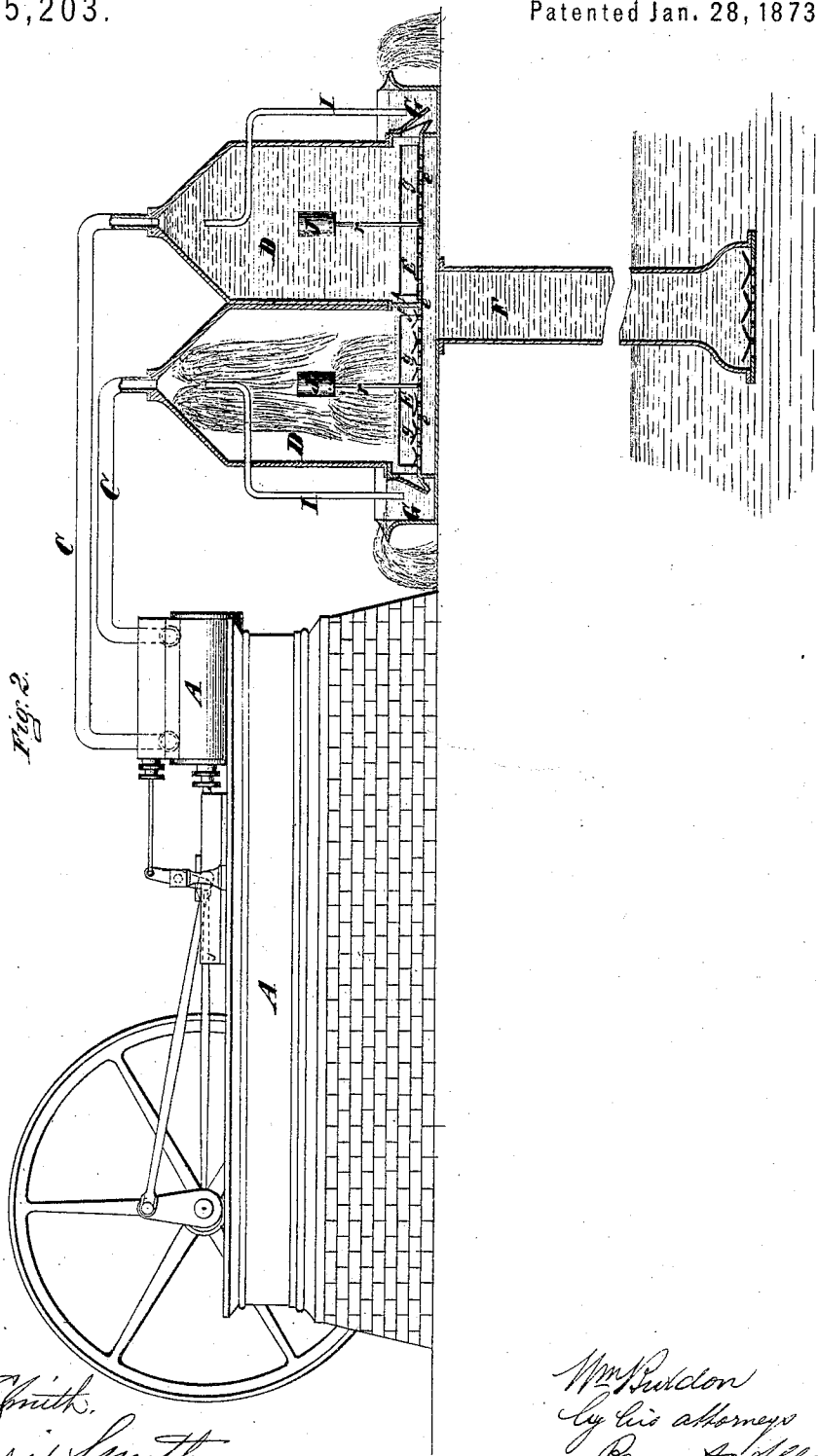
*Wm. Burdon*  
*by his attorneys*  
*Brown & Allen*

W. BURDON.

Steam Vacuum-Pumps operated by Exhaust Steam.

No. 135,203.

Patented Jan. 28, 1873.



Witnesses.

*James Smith.*  
*W. Morris Smith*

*Wm Burdon*  
*by his attorneys*  
*Brown & Allen*

# UNITED STATES PATENT OFFICE.

WILLIAM BURDON, OF BROOKLYN, NEW YORK.

## IMPROVEMENT IN STEAM VACUUM-PUMPS OPERATED BY EXHAUST STEAM.

Specification forming part of Letters Patent No. 135,203, dated January 28, 1873.

N<sup>o</sup>.

*To all whom it may concern:*

Be it known that I, WILLIAM BURDON, of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Means of Employing the Exhaust Steam of a Steam-Engine for Raising Water, of which the following is a specification:

This invention consists in the combination of such an apparatus as I term a steam vacuum-pump with the exhaust-pipe of a steam-engine, whereby the apparatus is made to serve the additional purpose of a condenser for the steam-engine. It also consists in the combination of the inlet steam-valves of the vacuum-pump with the valve-gear of the steam-engine, whereby the aforesaid valves are operated by the said valve-gear simultaneously with those of the steam-engine. Finally, it consists in condensing-vessels supported in the upper part of the chambers for the retention of a portion of the water, and perforated near the bottom to permit the escape of the water for effecting the condensation of steam in the chambers to form vacuums for the repetition of the operation.

In the accompanying drawing, Figure 1 is a view of a steam-engine and steam vacuum-pump connected with its exhaust-pipe; Fig. 2 is a similar view, showing the apparatus in a slightly-modified form; and Fig. 3 is a horizontal section of the vacuum-pump alone.

Similar letters of reference indicate corresponding parts in the several figures.

A is a high-pressure steam-engine of ordinary construction, furnished, as usual, with a steam-inlet pipe, B, and exhaust-pipe C, with which the apparatus that I formerly termed a steam vacuum-pump is connected. This pump consists of two chambers, D D, bolted to a box, E, side by side, and connected at the top by a cylindrical valve-box, with which communicates the exhaust-pipe of the steam-engine. In this valve-box are valves *a a*, consisting of flat plates attached to a rod, *b*, which is connected with the end of the lever *c*, by which the steam-valve of the steam-engine is operated. The said valves *a a* alternately cover and uncover ports in the tops of the chambers. The box E is open to the bottoms of both chambers D D, and below them, in the box, there is a perforated horizontal parti-

tion, *e*, covered with inlet-valves. The portion of the box below this partition is in communication with the inlet-pipe F leading from a well, but the portion above said partition is divided by a vertical partition, *f*, the portions on each side of which form extensions to the chambers D D, and have the outlet-valves arranged about them. These valves are situated on three sides of each of said portions of the box E, and consist of long gates *g g*, having seats inclined at a salient angle. A trough, G, surrounds the box E and forms a seal to the valves by keeping water around them. I are pipes which lead from this trough into the upper part of the chambers D D to lead a stream of water thereto at the proper time for the purpose of condensing the steam therein. This condensation is further effected by what I term retaining-cups J J. These are arranged in the middle portion of the chambers and are supported by rods *r r*. They are open-topped to receive water when the chambers fill, and are perforated near the bottom to permit the water in them to escape when the chambers discharge.

The apparatus represented in Fig. 2 differs from the other only in having no separate valves for the pump, the engine having two exhaust-pipes, one at each end of the cylinder, such pipes being connected one with each of the two chambers of the vacuum-pump, the exhaust-valves of the steam-engine serving as the steam-inlet valves of the vacuum-pump.

Before starting the pump the trough G is filled with water to seal the valves *g g*. The valve of the steam-engine is then shifted to admit steam to the chambers D D. The air is thereby expelled from the chambers, and a vacuum is thereby formed, and the chambers and their retaining-cups J J are caused to fill by atmospheric pressure. The engine is now started, and, as soon as its valve is shifted to open an exhaust from either end of the steam-chest, the exhaust steam is conducted to the valve-box, and thence into one of the chambers, represented in the drawing as being the right. As soon as the steam comes in contact with the water it balances the pressure of air below, and the water in the chamber then falls by its own weight, opening the valves *g g*, and flowing into the trough G. When the valves

are reversed the steam is shut off from the right chamber and admitted to the left. The steam admitted to the latter balances the pressure of the air below and permits the chamber to discharge. As soon as the steam is shut off from the right chamber its valves *g g* close, and the steam remaining in it is condensed by water escaping through the perforations in the retaining-cup J and by a stream of water forced into the chamber by atmospheric pressure from the trough G. At the completion of the discharge of the left chamber condensation takes place, and thus the operation continues.

Instead of a double-acting steam vacuum-pump, as represented, a single-acting apparatus of the same class may be advantageously used in all cases where the engine, in connection with which it is used, has a long stroke, the exhaust-valve of the steam-engine being the inlet steam-valve of the pump.

In the country there are many factories driven by a steam-engine in conjunction with water-power, the latter being insufficient alone to produce the necessary power. Often in the dry months of summer the water greatly decreases, and sometimes gets so low as to be unable to work the water-wheel at all. When such is the case, by the use of my invention the water may be raised and allowed to escape over the wheel, and so operate it. This may be done without in the least detracting from the power of the engine; in fact, by acting as a condenser to the latter, it facilitates the es-

cape of exhaust steam, and so tends to assist the engine.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of an apparatus, such as is herein termed a steam vacuum-pump, with the exhaust-pipe of a steam-engine, whereby the said apparatus is made to serve the additional purpose of a condenser to the steam-engine.

2. The combination of the steam-inlet valves of the steam vacuum-pump with the exhaust-valve or valves of the steam-engine, substantially as herein described, whereby the said inlet and exhaust valves are worked by the same rod or valve-gear.

3. The condensing-vessel J, supported in the upper part of either chamber for the retention of a portion of the water, and perforated near its bottom for the discharge of said water to effect condensation, substantially as herein described.

4. The arrangement of the exhaust-steam valve or valves of the engine, substantially as herein described, to serve as the steam-inlet valves of the vacuum-pump.

5. The combination of two separate exhaust-pipes of the engine with two separate vacuum-chambers, one pipe being connected with one chamber and the other with the other chamber, substantially as herein described.

Witnesses:

WM. BURDON.

HENRY T. BROWN,

FRED. HAYNES.