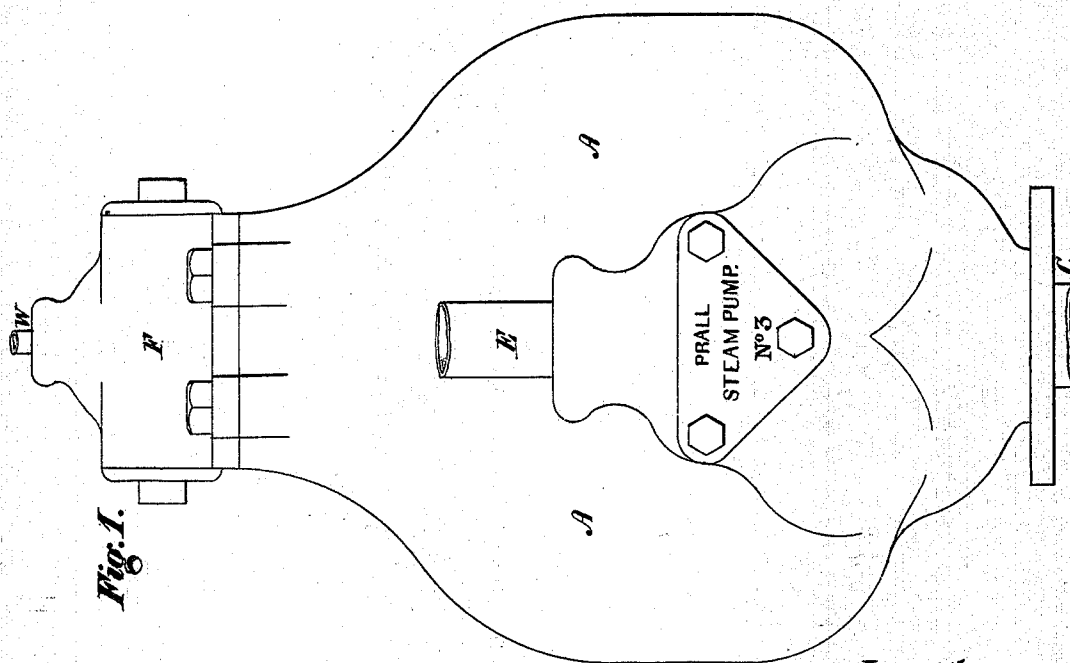
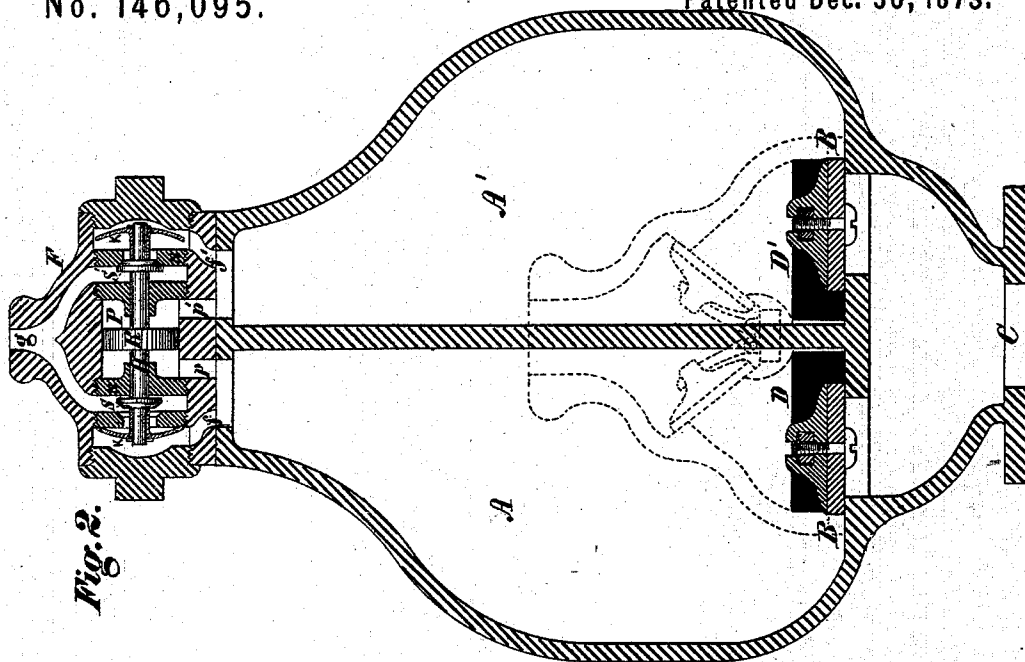


W. E. PRALL & D. A. BURR.
Steam Vacuum-Pumps.

No. 146,095.

Patented Dec. 30, 1873.



Witnesses.

J. Snowden Bell.
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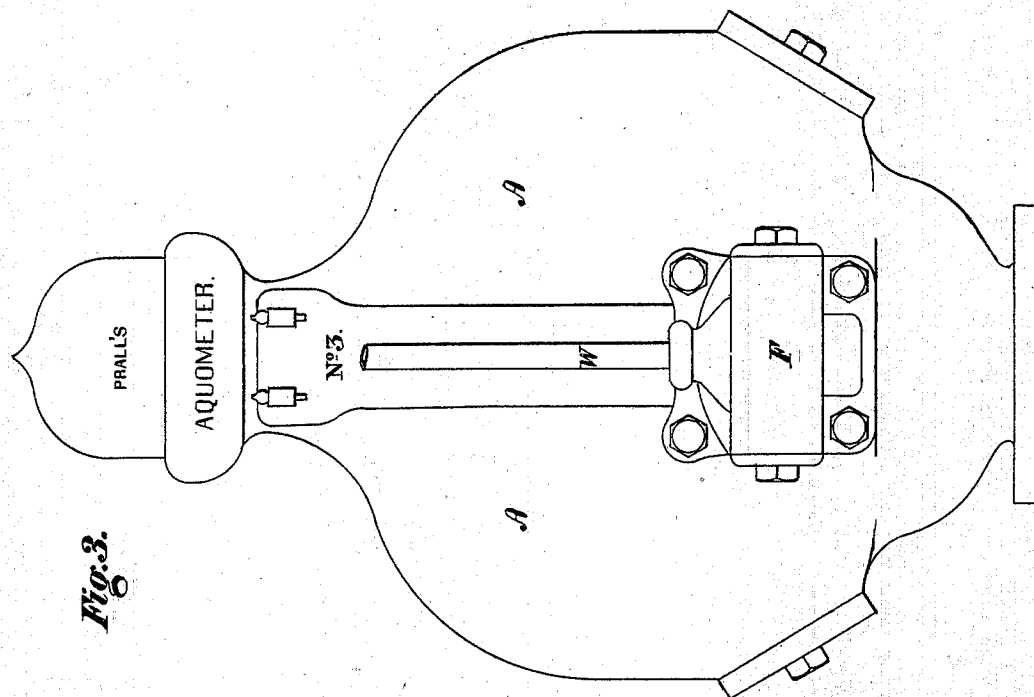
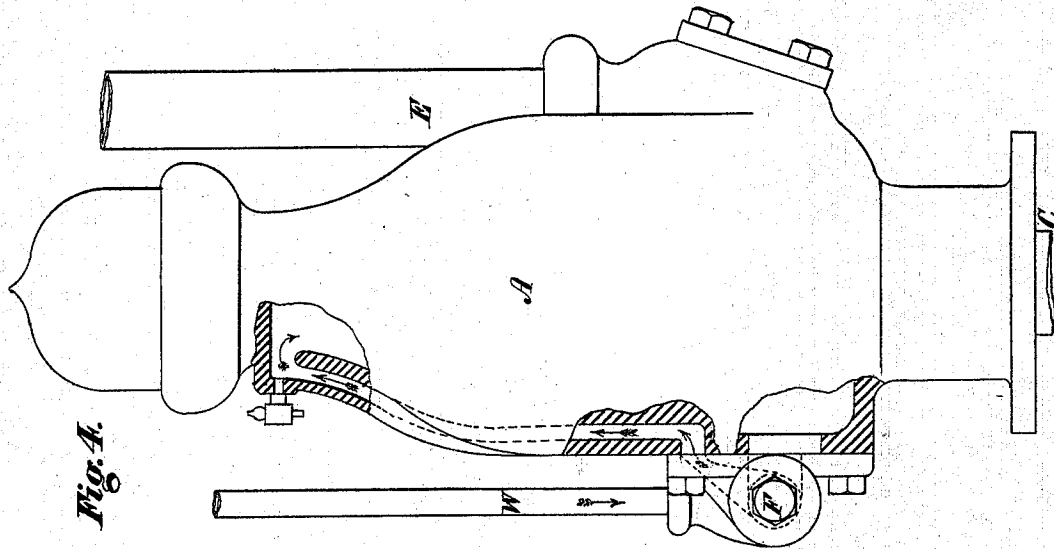
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Fig. 5.

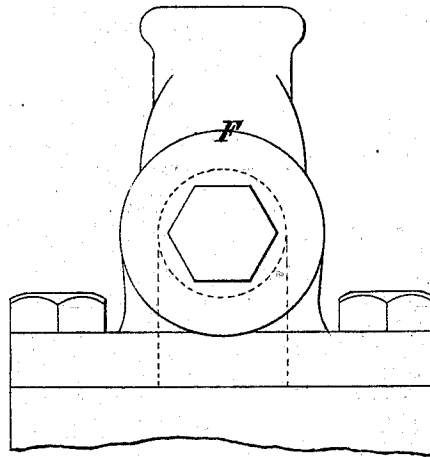
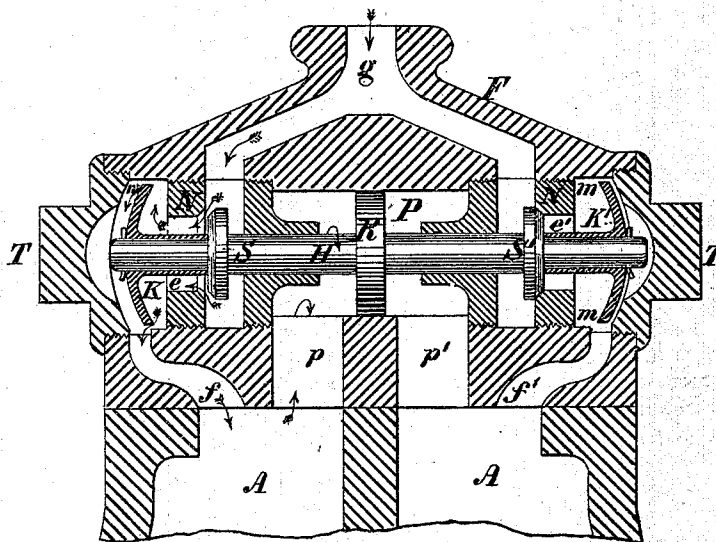


Fig. 6.



Witnesses.

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UNITED STATES PATENT OFFICE.

WILLIAM E. PRALL AND DAVID A. BURR, OF WASHINGTON CITY, D. C.

IMPROVEMENT IN STEAM VACUUM-PUMPS.

Specification forming part of Letters Patent No. **146,095**, dated December 30, 1873; application filed November 21, 1873.

CASE A.

To all whom it may concern:

Be it known that we, WILLIAM E. PRALL and DAVID A. BURR, of Washington city, in the District of Columbia, have invented certain Improvements in Steam Vacuum-Pumps, of which the following is a specification:

Our invention relates to that class of steam-pumps in which live steam is brought to bear directly, without the intervention of a piston or other mechanical appliance, upon the surface of the water or other liquid to be expelled therefrom, and wherein the admission of the steam is automatically controlled by means of a piston, diaphragm, or movable piece so placed in a channel of communication between the working chambers or cylinders of the pump as to be moved by the reduction of pressure produced within either of them by reason of the sudden vent of the steam through, and its partial condensation within, the discharge-port of the chambers. It consists in connecting with or securing to the said movable piece, or to the valves which are combined with or actuated by it, vanes, disks, or reaction-plates so placed as to intercept and partially obstruct or confine the current of steam passing through the steam-induction ports of the pump; the object of our said invention being to open and close the said induction-ports by the operation of the steam upon said vanes or disks under influence of such a reduction of pressure in either cylinder of the pumps as will operate to move the aforesaid movable piece.

In the accompanying drawings, Figure 1 is an elevation of our double-acting steam vacuum-pump, illustrating the same when constructed with the steam-valves arranged at its upper end, Fig. 2 being a central vertical section thereof. Fig. 3 is an elevation of our improved pump when constructed in its most approved form, with a lateral attachment of the steam-valves, Fig. 4 being a side view thereof, showing portions of the pump broken away to illustrate the steam-passages, and also the port communicating with the central piston. Fig. 5 is an end view on an enlarged scale; and Fig. 6, a central longitudinal section

of the valve-chest, the steamways therein being illustrated, for convenience, as arranged for connection with the upper end of the pump, as shown in Figs. 1 and 2.

A A' are the working cylinders or chambers of our improved double-acting steam-pump; B B, the valves covering its induction-ports; C, its suction-pipe; D D, its eduction-ports, the eduction-valves and discharge-pipe E, Figs. 1 and 4, being illustrated by dotted lines in Fig. 2. F is the shell or casing inclosing the valves S S', governing the steam-induction ports *e e'* of the pump. These ports are made to communicate on one side with the respective chambers A A' by means of suitable passages, *f f'*, formed within the valve-chest, as shown in Fig. 6, and on the other communicate with a single induction-opening, *g*, which receives the main supply-pipe W from the steam-generator. The valves S S' close horizontally against the ports *e e'*, as illustrated in the drawings, said valves being secured upon and supported by a connecting-rod, H, playing in suitable bearings in the partitions N N of the valve-chest. K K' are enlarged circular disks, which fit within cylindrical recesses *m m*, formed in the casing F between the ports *e e'* and passages *f f'*, so as to form part of the steamway, as illustrated in Fig. 6. These reaction-disks K K' are secured to the ends of the valve-rod H, which is made to project through the ports *e e'* for said purpose, and they are, by preference, concaved on their inner sides, and are made of such a diameter as that the area of the interval between the perimeter of each disk and the inner surface of the cylindrical recess *m m* in which it plays shall about equal that of the induction-port *g*, the face of the disk being sufficiently removed from the valve-port when open to allow a full, free passage of the steam to its said perimeter. P is a central cylindrical chamber formed in the valve-chest F intermediate between the valves S S', from which it is entirely separated by the partitions N N, and which communicates freely at either end with the respective working cylinders of the pump by means of suitable ports *p p'*. Within this chamber a pis-

ton, R, is fitted, so as to traverse freely therein, and yet so closely as to prevent any considerable leakage of steam or water about its periphery. This piston is secured to the valve-rod H, which passes centrally through the chamber, as shown in the drawings, and it closes the channel of communication otherwise established between the working cylinders A A' of the pump through the ports *p p'* of the chamber P, and serves, in fact, as a movable partition, subject to and actuated by the differences of pressure within said cylinders. When the valve-chest F is placed upon the top of the pump, as shown in Figs. 1, 2, and 6, this plunger R is subjected only to the influence of the steam and air confined in the pump; but when placed near the bottom of the pump, as shown in Figs. 3 and 4, it is exposed to the additional pressure of the column of water in the one and the other of said cylinders A A' when filled.

The valve-seats and ports *e e'* are formed in plugs, which screw into place within the valve-chest; and the ends of the chest are closed by means of caps or plugs T T, so that the valves can be readily reached or removed for inspection, repair, or renewal.

If, in the operation of our improved pump, when thus constructed, steam be admitted from the boiler to the valve-chest, it will pass through that port *e* (see Fig. 4) which is open, and will enter the cylinder A of the pump, diffuse itself in the air-space provided over the surface of the water, and, bearing quietly thereon, will force it out through the discharge-opening D, at the bottom of the cylinder, up into the discharge-pipe of the pump. Its pressure within the cylinder will also be exerted, through the passages *p*, against the corresponding side of the plunger R, the which, being of larger diameter than the valves S S', will operate to hold and keep them securely in their respective positions until, by means of a small communicating tube or passage, the pressure in the two cylinders has become equalized, or nearly so. When, however, the steam, following the water, reaches the discharge-port D, it not only finds suddenly an enlarged vent into the discharge-pipe, but condenses rapidly therein, so that a great reduction of pressure instantly takes place at that moment within the discharging-cylinder. The pressure in said cylinder A is thus reduced below that in the full cylinder A', and a tendency in the piston R to move toward the cylinder A of lowest pressure is the result, while simultaneously the pressure upon the outer side of the disk K of the open valve S, being also reduced below that exerted by the steam against the inner side of said disk, causes a like tendency in the valve to move outward and close. This excess of steam-pressure against the inner side of the disk K combines with the plus pressure in the same direction against the plunger R to move and force the valve-rod H in that direction, and thereby quickly close

the valve S of the discharging-cylinder A, and simultaneously unseat and open the valve S' of the full cylinder A', said movement of the rod being, in like manner, automatically reversed when the steam admitted through the open valve S' has, in displacing the water from the cylinder A', reached its discharge-vent. So soon as the admission of steam to the discharging-cylinder is checked, a vacuum is rapidly created therein by the entrance of water from the suction-pipe, the which, condensing, as it advances, the steam remaining in the cylinder, rushes up to fill the consequent vacuum, and quickly fills the chamber.

A premature displacement of the steam-valves by the shock or jar produced by the sudden filling of either cylinder when a vacuum is created therein is prevented by an admission of air to the cylinders through suitable air-valves.

Although we have found it more advantageous to contract the steam-passage by means of a disk placed, as herein described, outside of the port, so as to be acted upon by the steam after it has escaped from the port, we nevertheless contemplate the use of an enlarged disk in combination with each valve, when said disk is placed within the port so as to be acted upon by the steam before it reaches said port, provided the disk be, as hereinbefore described, so proportioned with respect to the chamber in which it plays as that the area of the interval between its periphery and the inner circumference of the chamber shall be equal, or nearly so, to that of the steam-supply pipe or main induction-port. In such case, the disk may be formed in one piece with the valve, although made to project radially therefrom, so as to obtain its proper enlarged diameter. We contemplate, also, the use of the disks and valves, as described, independently of the piston or diaphragm, although we deem the latter important in combination therewith; and, finally, we contemplate the combination of said disks or vanes with the piston or movable piece placed, as aforesaid, in a channel of communication between the working chambers of the pump, when said piston or movable piece is made to operate directly in itself to control the steamways into the pump, as shown in a separate application for Letters Patent herewith filed.

We claim as our invention—

1. The within-described method of automatically moving the valve or valves controlling the admission of steam to a steam and vacuum pump, by means of vanes or disks combined with said valve or valves, to obstruct or partially confine the steam-current in its passage to either chamber of the pump.

2. In combination with a valve or movable piece controlling a steam-port, a disk or vane placed exterior to said port, yet connected with said valve, and against which the steam-current passing through the port shall impinge,

substantially as and for the purpose herein set forth.

3. In combination with each other, and with the valves controlling the steam-induction ports of a double-acting steam-pump, a rod connecting said valves, a piston or diaphragm secured to said rod, and placed in a channel of communication between the working-cham-

bers of the pump, and disks or vanes attached to each valve, all substantially as and for the purpose herein set forth.

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Witnesses:

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