(No Model.)

M. S. HARLOW.

STEAM ACTUATED VALVE.

No. 301,982. Patented July 15, 1884.

Fig. 1.

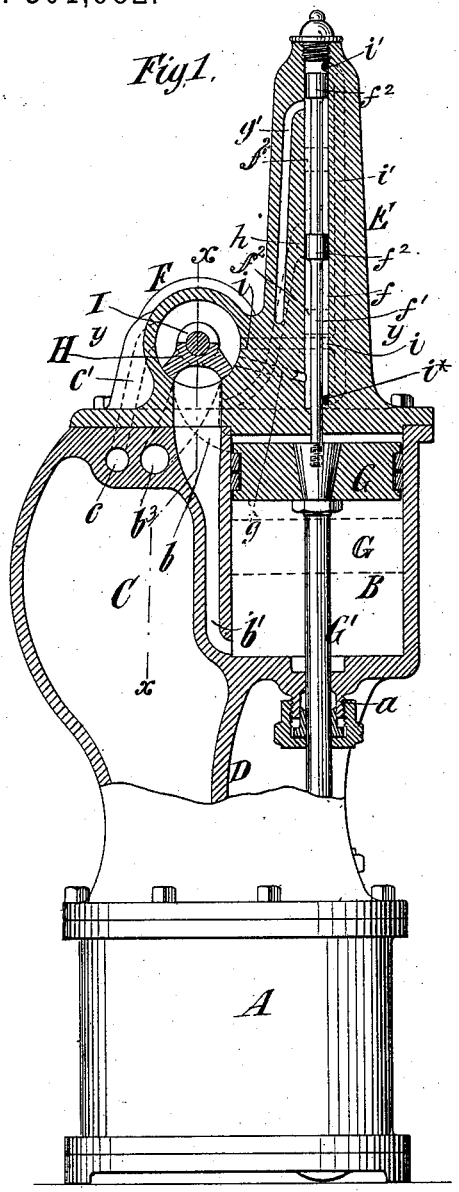


Fig. 2.

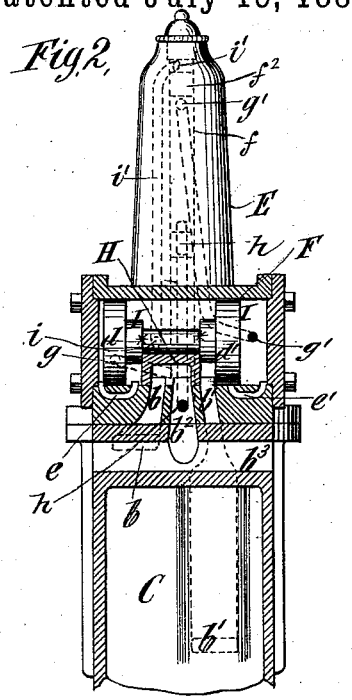
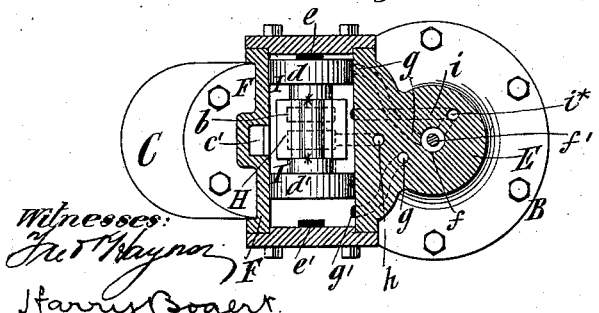


Fig. 3.



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UNITED STATES PATENT OFFICE.

MELLEN S. HARLOW, OF HOBOKEN, NEW JERSEY.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 301,982, dated July 15, 1884.

Application filed February 20, 1884. (No model.)

To all whom it may concern:

Be it known that I, MELLEN S. HARLOW, of Hoboken, in the county of Hudson and State of New Jersey, have invented a new and useful Improvement in Steam-Actuated Valves for Pumps, of which the following is a specification.

My invention relates to direct-acting steam-pumps in which are employed, in addition to the main cylinder and piston and the main valve, an auxiliary cylinder and piston and an auxiliary valve. In pumps of this class the auxiliary valve is operated positively by the moving main piston of the pump, and serves to admit steam to the auxiliary cylinder, there to operate on the auxiliary piston and cause it to move the main valve.

The principal objects of my invention are to secure a very simple and inexpensive construction and combination of the above-mentioned parts, and to provide a valve mechanism which will be sensitive and certain in its operation without the use of any tappets or outside connections, as hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a partly sectional elevation of a pump embodying my invention. Fig. 2 is a sectional elevation of a part thereof on the dotted line *x x*, Fig. 1; and Fig. 3 is a horizontal section on the dotted line *y y*, Fig. 1.

Similar letters of reference designate corresponding parts in all the figures.

The pump chosen for illustration is vertical, and consists of three principal parts or castings, one of which, A, comprises the water-cylinder and valve-chest, a second comprising the main steam-cylinder B, an air-chamber, C, and a trunk or brace, D, between the steam-cylinder B and the water-cylinder, and a third comprising the upper head of the main cylinder, the auxiliary valve-chest E, and the auxiliary cylinder and main valve-chest F. I do not confine myself to this construction and arrangement of parts, but consider it very desirable because of its compactness and strength, the air-chamber C serving to greatly increase the strength of the cylinder-brace D.

G designates the main piston, which may be provided with any suitable packing, and which is fixed on a piston-rod, G′, working through a stuffing-box, *a*, in the lower end of the cylinder B.

From the auxiliary cylinder and main valve-chest F ports or passages *b b′* extend to opposite ends of the cylinder B, as best shown in dotted lines in Fig. 2, and between the ports *b b′* is the main exhaust port and cavity b^2, which communicates with an exhaust-passage, b^3, best shown in Fig. 2, and having an exhaust-pipe connected to either end or both ends thereof.

Adjacent to the cross-passage b^3 is a cross-passage, *c*, with either end of which a steam-supply pipe may be connected as desired, and from said cross-passage a passage, *c′*, leads upward into the auxiliary cylinder and chest F, as best shown in Fig. 3.

H designates the main valve, which is a simple slide-valve capable of controlling the supply of steam from the cylinder and chest F through the port *b* or *b′*, to one end or the other of the main cylinder B, and the simultaneous exhaust of steam through the port *b′* or *b*, and the intermediate exhaust-port, b^2.

The auxiliary piston I consists of a double-headed plunger, the ends or heads *d d′* of which fit the cylinder B, and which has shoulders * *, between which the main valve H is held.

At each end of the cylinder and chest F are small cushion-ports *e e′*, which are best shown in Fig. 2, and which extend from the extreme ends of the cylinder to a point inward of the ends. The two plunger-heads *d d′* are of such thickness that they are incapable of covering the two mouths of one port or passage, *e* or *e′*, at the same time. The bore *f* of the auxiliary valve-chest or casing E is in line with the piston-rod G′, and the auxiliary valve consists of a long stem, *f′*, rigidly secured in or fixed to the piston G, and provided with two heads or little pistons, f^2, which are formed integral with or fixed rigidly to said stem *f′*. The auxiliary valve *f′ f²* has the same range of movement as the main piston G, and moves simultaneously therewith in both directions.

From the auxiliary cylinder and chest F at points near the ends thereof lead ports or passages *g g′*, which extend to the bore *f* of the auxiliary valve chest or casing E at points near the two ends thereof, and from a point about midway of the length of the bore *f* a port or passage, *h*, leads to the exhaust-cavity b^2.

From the auxiliary cylinder and chest F leads a port and passage *i*, which has two

branches, i' and i^*, leading to opposite ends of the bore f of the auxiliary valve-chest E, as best shown by dotted lines in Fig. 1.

As represented in the drawings, the piston G is on its upward stroke, and during such movement the main valve H and auxiliary piston I are in the position shown in Figs. 2 and 3.

I have represented the piston G by full lines in Fig. 1, as near the upper end of its stroke, and the auxiliary valve f' has reached the position necessary to admit steam to move the auxiliary piston and main valve; but the auxiliary piston has not yet moved, and the steam which has previously forced it toward the left hand of Fig. 2 is still confined in the right-hand end of the auxiliary cylinder. During the upward movement of the main piston G—as, for example, when said piston reaches the position shown by dotted lines in Fig. 1—the upper head or piston f^2 of the auxiliary valve is below the point at which the port g' enters the auxiliary valve-bore f, and consequently the communication between the ports g' and h is cut off. As soon, however, as the said upper head or small piston f^2 passes above the said port g' and comes to the position shown in Fig. 1, communication is established through the port g', the bore f, and the port or passage h between the right-hand end of the auxiliary cylinder and the exhaust-cavity b^2, and as the right-hand end of the auxiliary piston I is thus relieved of pressure the steam which has passed through the cushion-port e to the left-hand end of the auxiliary piston moves the said piston toward the right, and thus commences the shifting of the main valve H. The port g during this time is filled with live steam from the chest F through the ports i i^*, and as soon as the auxiliary piston I moves far enough to the right to uncover the port g in the auxiliary cylinder the live steam there entering completes the movement of the auxiliary piston and main valve toward the right, and completely uncovers the main steam-port b and brings the main port b' into communication with the exhaust-cavity b^2. Before the said auxiliary piston completes its movement toward the right the cushion-port e' admits steam around the head d' and to the right-hand end of the auxiliary cylinder, and so cushions the auxiliary piston and prevents its slamming. As the piston G has nearly completed its downward movement, the lower valve-head or small piston f^2 passes beyond the port g, thus placing the ports g and h in communication through the valve-bore f, and the pressure on the left-hand end of the auxiliary piston I being relieved, the said piston is moved toward the left by the cushioning steam in the right-hand end of the auxiliary cylinder. The ports i i' g' are now in communication, and as soon as the port g' is uncovered in the auxiliary cylinder the steam thus admitted to the right-hand end of the auxiliary cylinder completes the throw of the auxiliary piston and main valve, said piston being cushioned by the steam passing through the cushion-port e around the piston-head d.

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

1. The combination, with the main cylinder and piston, the auxiliary cylinder and piston, and main valve of a direct-acting pump, of an auxiliary valve-bore extending axially from the main cylinder, and an auxiliary valve consisting of a rod or stem rigidly attached to the main piston and working in said bore, substantially as herein described.

2. The combination, with the main cylinder and piston, the auxiliary cylinder and piston, and the main valve of a direct-acting pump, the auxiliary piston being movable in a direction transverse to the axis of the main cylinder, of an auxiliary valve-bore extending axially from the main cylinder, and an auxiliary valve consisting of a rod or stem extending from and rigidly attached to the main piston and working in said bore, substantially as herein described.

3. The combination, with the main cylinder and piston of a direct-acting pump, of a cylinder-head containing an auxiliary valve-bore extending axially from the main cylinder, and an auxiliary cylinder which extends transversely to the axis of the main cylinder, an auxiliary piston and main valve in said auxiliary cylinder, and an auxiliary valve consisting of a rod or stem attached rigidly to the main piston and working in said bore, substantially as herein described.

4. The combination, with the water-cylinder of a direct-acting pump, of a main steam-cylinder, an air-chamber, and a connecting cylinder-brace formed integral with each other, an auxiliary cylinder, auxiliary piston, and main valve arranged above the air-chamber, and an auxiliary valve for controlling the operation of the auxiliary piston and main valve, substantially as herein described.

5. The combination, with the main cylinder and piston of a direct-acting pump, of the auxiliary cylinder F, constructed with the cushion-ports e e', the main ports b b' b^2, and the ports g g', of the auxiliary piston and main valve, and an auxiliary valve attached to and moving with the main piston for controlling the alternate exhaust from the ends of the auxiliary cylinder, substantially as herein described.

6. The combination, with the main cylinder and piston, of the auxiliary valve chest or casing E, and auxiliary cylinder F, constructed with ports and passages b b' b^2 e e' g g' h i i' i^*, the main valve H, and auxiliary piston I, and the auxiliary valve consisting of the rod or stem f' and heads or small pistons f^2, substantially as herein described.

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Witnesses:
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