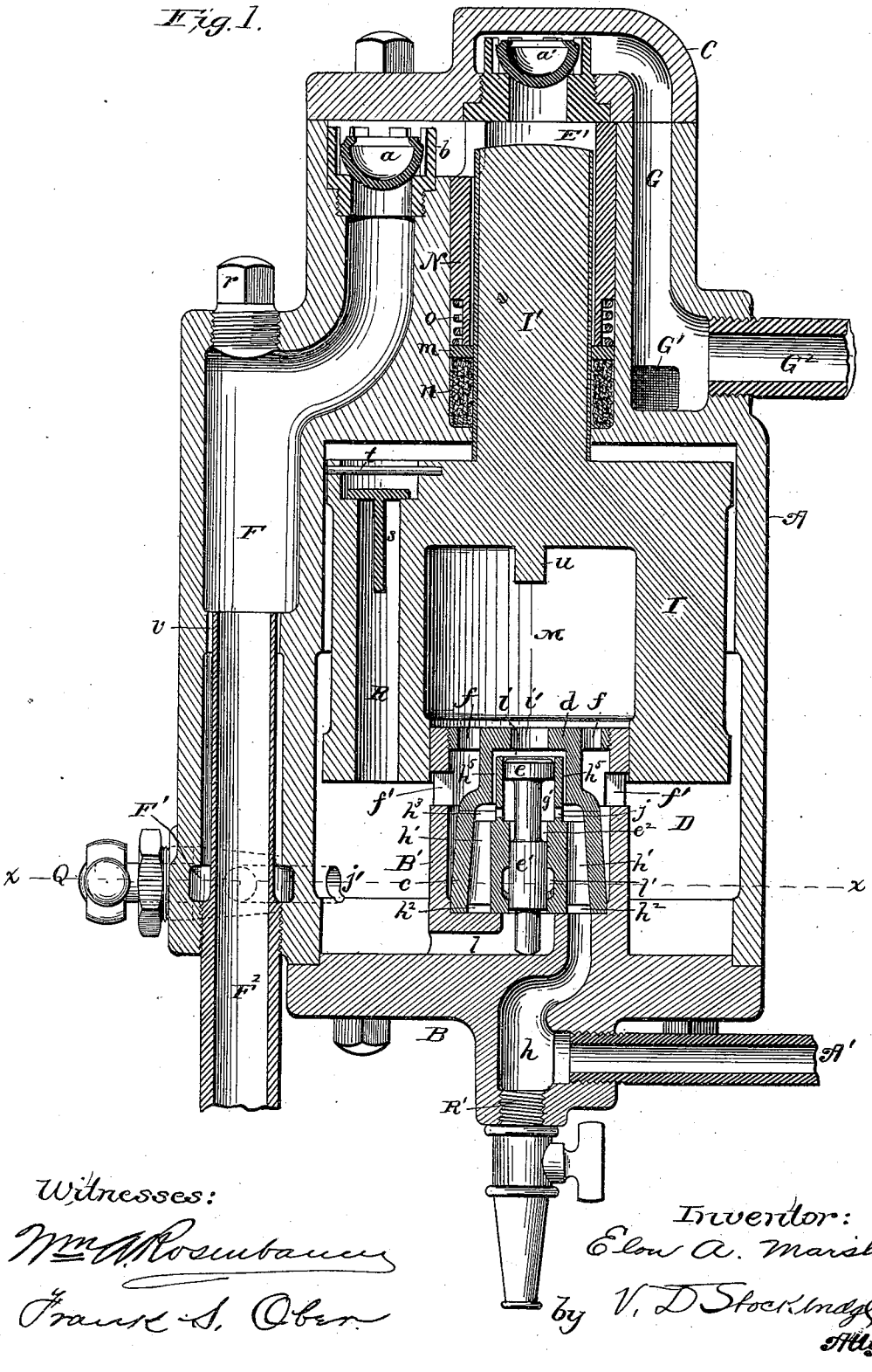
(No Model.) 2 Sheets—Sheet 1.

E. A. MARSH.

STEAM PUMP.

No. 345,311. Patented July 13, 1886.

Fig. 1.



Witnesses:

Wm. A. Rosenbaum

Frank S. Ober

Inventor:

Elon A. Marsh

by V. D. Stockbridge

Atty.

(No Model.) 2 Sheets—Sheet 2.

E. A. MARSH.

STEAM PUMP.

No. 345,311. Patented July 13, 1886.

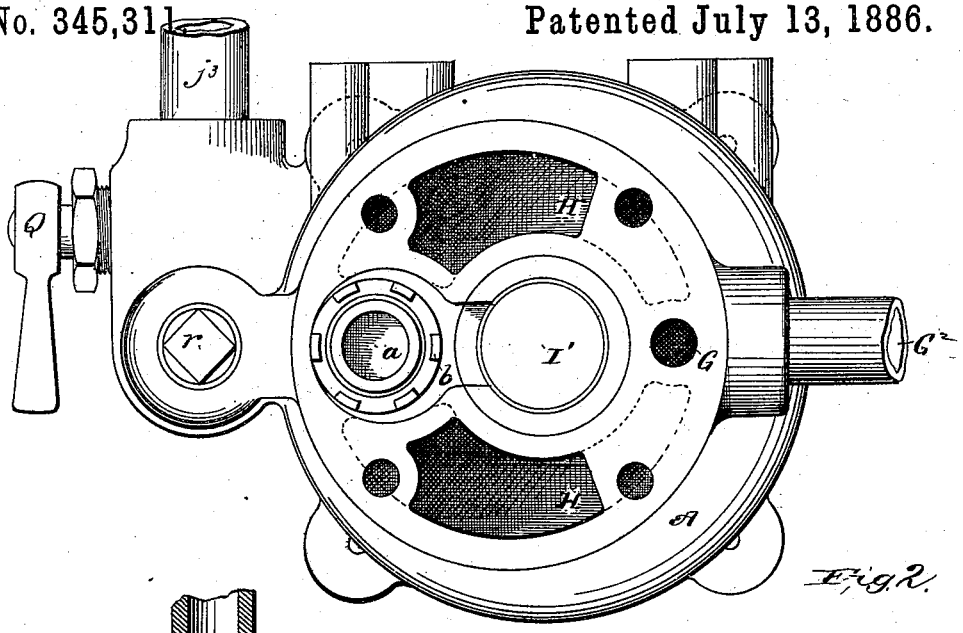


Fig. 2.

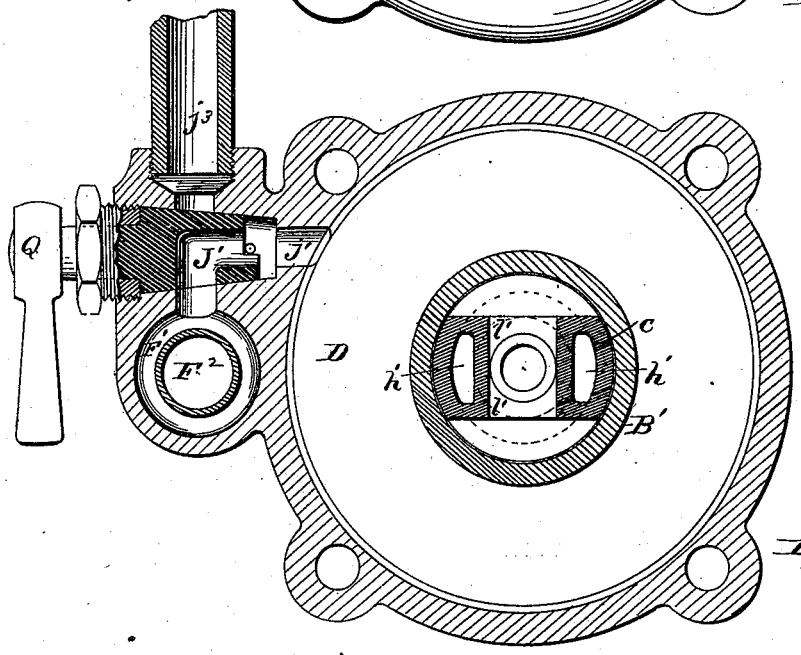


Fig. 3.

Witnesses:
Wm. A. Rosenbaum
Frank S. Ober.

Inventor:
Elon A. Marsh
by V. D. Stockbridge
Atty.

UNITED STATES PATENT OFFICE.

ELON A. MARSH, OF BATTLE CREEK, MICHIGAN.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 345,311, dated July 13, 1886.

Application filed October 31, 1885. Serial No. 181,453. (No model.)

To all whom it may concern:

Be it known that I, ELON A. MARSH, a citizen of the United States, residing at Battle Creek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in steam-pumps, and is designed to secure simplicity, steadiness, and efficiency in that class of apparatus, as well as to secure economy in the amount of power required to operate the same.

While the general features of my improvements are designed to produce a steam-pump of general utility, I have also introduced special features which adapt it for use in feeding boilers or other reservoirs—such as railway-tanks—where it is desirable that the water supplied should have, if possible, some degree of heat. To this end I provide means for utilizing, in warming the water to be pumped, the heat of the exhaust-steam.

Other improvements relate to the construction of my water-valves, and to details which will hereinafter be described, and more particularly pointed out in the claims.

Mechanically my invention consists, essentially, of the combination, with a pump-piston, of an upright single-acting engine, whose piston is weighted so as to overcome the pressure of the column of water to be drawn into the pump.

Heretofore it has been deemed necessary in self-contained steam-pumps to control the movements thereof by controlling the power through the medium of valves and valve-gearing; and where the reciprocation of the piston is required to be rapid a crank and fly-wheel have been employed to secure uniformity in the movements of the piston. In practice the ordinary steam-pump, unless provided with a governor, is subject to wide variations of speed under slight variations of pressure, the pump running slow under a low pressure and running wild under a high piston-pressure. In the latter condition the pump becomes impotent, inasmuch as the atmospheric pressure cannot force the water into the pump fast enough to follow the rapid movements of the plunger. According to my invention, the engine and the pump-pistons are caused to reciprocate under the alternate action of steam to force the water from the pump and that of gravity to draw from the reservoir into the pump. Under my combination or arrangement of parts the velocity of the pistons in one direction will be that of a falling body, and therefore no racing can take place, whatever the piston-pressure may be.

In the accompanying drawings, which illustrate my invention and form a part of this specification, Figure 1 is a vertical section of my steam-pumping apparatus. Fig. 2 is a plan of the same with the cap removed; and Fig. 3 is a horizontal section through the dotted line *x x* in Fig. 1.

The same letters refer to the same parts throughout.

The main portion of my pump consists of the casting or shell A, within which, in the chambers D and E′, respectively, the steam-piston I and the plunger I′ reciprocate. The piston and plunger are preferably made in one piece, and the plunger is provided with a sleeve of brass, as shown, to prevent corrosion. Both the piston and the plunger move freely in their respective chambers. The chamber D is reduced in size at the top and bottom, so that the gases will be compressed to form a cushion for the piston at each end of the stroke. When the piston is in its lowest position, the top comes below the limits of the upper reduced portion, so as to allow any water that may have accumulated above the piston to pass off freely.

B is the cylinder-head, which is secured to the shell by bolts in the usual manner. Formed in one piece with it is a cylindrical hollow casting, B′, which extends upward centrally into the chamber D. This casting corresponds with a cylindrical opening, M, in the piston, and receives the valve by which the movements of the piston are controlled. The valve mechanism itself is made up of several parts, one of which is the casting *c*, which fits into the lower portion of the space or cavity in the casting B′. At the top and bottom, respectively, of the casting *c* are annular grooves h^3

and h^2. Two passages, h' h', connect the grooves within the walls of the casting. Besides these openings there is a cylindrical central opening of differential diameter for the reception of the actuating-valve e e'. The upper part of this opening g' is fitted by the head e, and the lower part, e^2, is fitted by the part e' of the valve. There are also openings l' l', communicating through the walls of the casting c, from the central bore thereof, to the cavity in B', for a purpose which will be hereinafter explained. The lower part of the valve is reduced, so that when in its raised position there will be a passage from the cavity in B' down through the bottom of the casting c by way of the ports l' l' through eduction-passage l. There are two ports, j j, extending through the casting from the groove h^3. A cap for the casting c is formed by the casting d, which fits upon it and has a screw-thread at the top, by means of which it may be screwed down upon the casting c, to make a steam-tight joint therewith, as well as between the casting c and the bottom of cavity in B'. The casting d is also provided with ports f f, and a central port, i'. These afford communication from the cavity B' with the chamber M and the valve-chamber. A lug, u, formed centrally on the piston I, and smaller than the opening i', serves the function of opening the valve, as will be hereinafter described. A central bore within the cap so fits over an upward projection on the casting c as to leave a reduced annular passage, h^5, from h^3 into the chamber i at the top of the projection, which chamber communicates direct with the central opening, i'. The lower chambers and passages described are all ample enough to admit the steam rapidly at substantially boiler-pressure; but the annular passage connecting chambers is made very narrow, so as to greatly wiredraw the steam in and beyond that passage. The exhaust-openings f f are also ample, as are the ports f' f'. Ports f' f' communicate between the cavity in B' and D. A vertical passage, R, containing a valve, s, extends through the piston from top to bottom. The movement of the valve s is limited by a bar, t. The inlet-pipe for the steam is shown at A'. It communicates with the passage h in the cylinder-head, which in turn communicates with the chamber formed by the annular groove h^2.

It being understood that the exhaust is from the chamber D through the pipe j', as will be described in detail hereinafter, the operation of the parts above enumerated is as follows: In the normal condition of the engine the piston I is down, the ports f' f' are closed, and the lug u is within the opening i', having forced the valve e' e' to its lowermost position, as it appears in Fig. 1. The steam being admitted, passes through a pipe, A', and passage h, into the chamber h^2. From there it goes through the passage h' h', the chamber h^3, and the reduced passage h^5, into the chambers i and M, above the top of the valve e. The steam also passes through the ports j j into the chamber g', where it exerts its power in both directions upon the valve e e', but with a preponderance of lifting-power. This preponderance is, however, overcome by the effect of the steam in the chamber i tending to keep the valve down. The valve accordingly remains in its place while the pressure lifts the piston. The lifting is continued until the ports f' f' are uncovered, when the steam rushes out of the chamber M through the ports f f and f' f', and is discharged through the exhaust-pipe j'. The outlet-passage being comparatively large, the escape of steam is practically instantaneous, and by reason of the sudden removal of the force acting on the top of the valve to keep it down, the preponderance of power in the chamber tending to lift the valve has a chance to assert itself, and the valve is thrown up so as to close the opening i'. The piston now begins to descend in obedience to gravity, the valve s affording a vent, so as to prevent the formation of a retarding vacuum behind the piston. After the valve e e' is thrown up the exhaust-steam passes out into chamber D, not only through the ports f' f', but also through the ports l' l', down into the passage l, into the chamber D, and after the piston has descended far enough to close the ports f' f' all the exhaust-steam passes out that way. When the piston has descended to a certain point, the lug u drives the valve e e' back into its original open position, after which the same operation is repeated. The movements of the plunger I' are coincident with those of the piston I. It moves in a chamber, E', formed for the most part by a brass bushing, N, which fits in a recess in the casting A. At its lower end the bushing N is reduced to receive a spiral spring, o, which bears at one end against the bushing and at the other end against the top of the collar m, which rests upon fibrous or other packing n at the bottom of the recess. The tension of the spring o, acting upon the collar, keeps the packing pressed down tight into the recess. The water-inlet or suction pipe F^2 is secured in the bottom of the casting, as shown, and extends into a passage, F, within the walls of the casting. At the top of the passage F is located the valve a, which controls the admission of the water. The valve is usually mounted in a brass cage, b, which is screwed into the casting A near the top, and is provided with posts or uprights to keep the valve from being moved too far from its seat, and at the same time to allow free passage to the water. The valve a opens into a chamber which communicates through an opening with the plunger-barrel E'. A cap, C, properly secured by bolts, covers the whole top of the casting A, and prevents the valve from being turned far enough to uncover the passage which it controls. The cap is provided with a similar valve, a', communicating between the plunger-barrel E' and a passage, G, formed partly in the cap C and partly in the casting A. The water-delivery pipe G^2 is screwed into the casting A, so as to communi-

cate with the passage G. Two side passages, G′ G′, lead in either direction from the passage G to the air-chambers H H. The valves *a a′* are hemispherical in shape, and are hollowed out, so as to be as light as possible.

The action of the parts last described is as follows: At each downward movement of the plunger, as it accompanies the piston, a suction is produced which raises the valve *a* and draws the water up through pipe F′ and passage F, into the passage L and the chamber E. The return-stroke closes the valve *a*, opens the valve *a′*, and forces the water out through the passage G and pipe G^2.

The elements already described are enough to produce an efficient pumping apparatus for all ordinary purposes. In order, however, to adapt my apparatus for feeding boilers or other similar reservoirs, or rather to adapt it to be used for general purposes or for the special objects named, I have provided the mechanism shown at the left of the several figures. It consists, essentially, of a two-way cock, Q, located in the exhaust-pipe *j′*, by means of which the exhaust-steam may be directed either into the atmosphere through the pipe j^3, or through the pipe J′ into a chamber, F″, surrounding the water-inlet or suction pipe. These elements, together with the reduced passage *v* between the chamber F′ and the passage F in the casting A, constitute the mechanism mentioned. It is evident that the exhaust-steam on passing into the chamber F′ will give off most of its heat to the water in the inlet-pipe, and that it will then pass in a semi-vaporous state through the reduced passage *v* into the passage F. The temperature of the water to be pumped will of course be raised in the process—a desideratum in feeding boilers or railway-tanks. In cases where it would not be desirable for the water to be warmed in pumping, the two-way cock can be turned so as to divert the exhaust-steam into the open air. A drip-cock is inserted in the opening R′, to admit of drawing off the waters of condensation. The plug *r* serves the function of sealing the hole left by the core in making the casting. The hole in which it is screwed might be made use of in certain cases—as when water is taken very hot from a heater and a stand-pipe is desirable. In cases where the lift is considerable a vacuum-chamber might be secured into this opening and used with a good effect.

I am aware that hemispherical valves have been used already, but they have been provided with a pintle or nipple at the bottom to limit their movements. Such valves are objectionable in practice, as the pintle both adds to their weight and tends to clog the passage of the water when the valve is raised. My valve is equally free from liability to leave the passage which it controls uncovered, its action is quick by reason of its lightness, and when it is raised it affords the largest possible opening for the lift and a very fluent passage of the liquid.

With regard to the apparatus as a whole, it should be observed that its action one way is controlled by the constant law of gravity, and is necessarily uniform. While its action in the other direction may vary under varying conditions, there is in the nature of the case positively no danger of racing.

I do not in this application claim the hollow hemispherical valve described, nor the condensing-chamber for automatically joining the waters of condensation with the column of water, as I propose to embrace them in separate applications to be hereafter filed; but,

Having described my invention, what I desire to claim in this application is—

1. A piston chamber or cylinder, a water chamber or barrel, and a piston and plunger combined and operating as herein described, the piston and plunger being driven in one direction by a fluid under pressure to force the water from the pump and in the other direction by gravity to draw water into the pump, substantially as described.

2. A steam-pump consisting of the combination, with the plunger, of an upright single-acting engine with a weighted piston, as described, the piston and plunger being driven upward by the action of an elastic fluid to force the water from the pump and downward by gravity to draw the water into the pump, substantially as and for the purpose set forth.

3. The combination, with a pump, of a single-acting engine consisting of a weighted piston containing a central cylindrical chamber and a casing which extends up into said chamber and contains the valve mechanism by which the movements of the plunger and weighted piston are controlled, substantially as described.

4. The combination, with the plunger I′, the piston I, provided with chamber M, and the lug *u*, of the casting B′ and the inclosed valve mechanism, substantially as described.

5. The combination, in a steam-pump, of a valve, as *e′ e*, valve-seats, ports, and a piston, the valves being operated to close and cut off the supply of steam by direct steam-pressure and being operated to open and admit steam by the mechanical action of the falling piston.

6. The combination, in a pump whose piston is operated in one direction by an elastic fluid and in the other direction by gravity, of a valve, valve-seats, and ports, the valve being operated in one direction by direct action of steam and in the other direction to admit steam by mechanical action, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ELON A. MARSH.

Witnesses:
WM. A. ROSENBAUM,
V. D. STOCKBRIDGE.