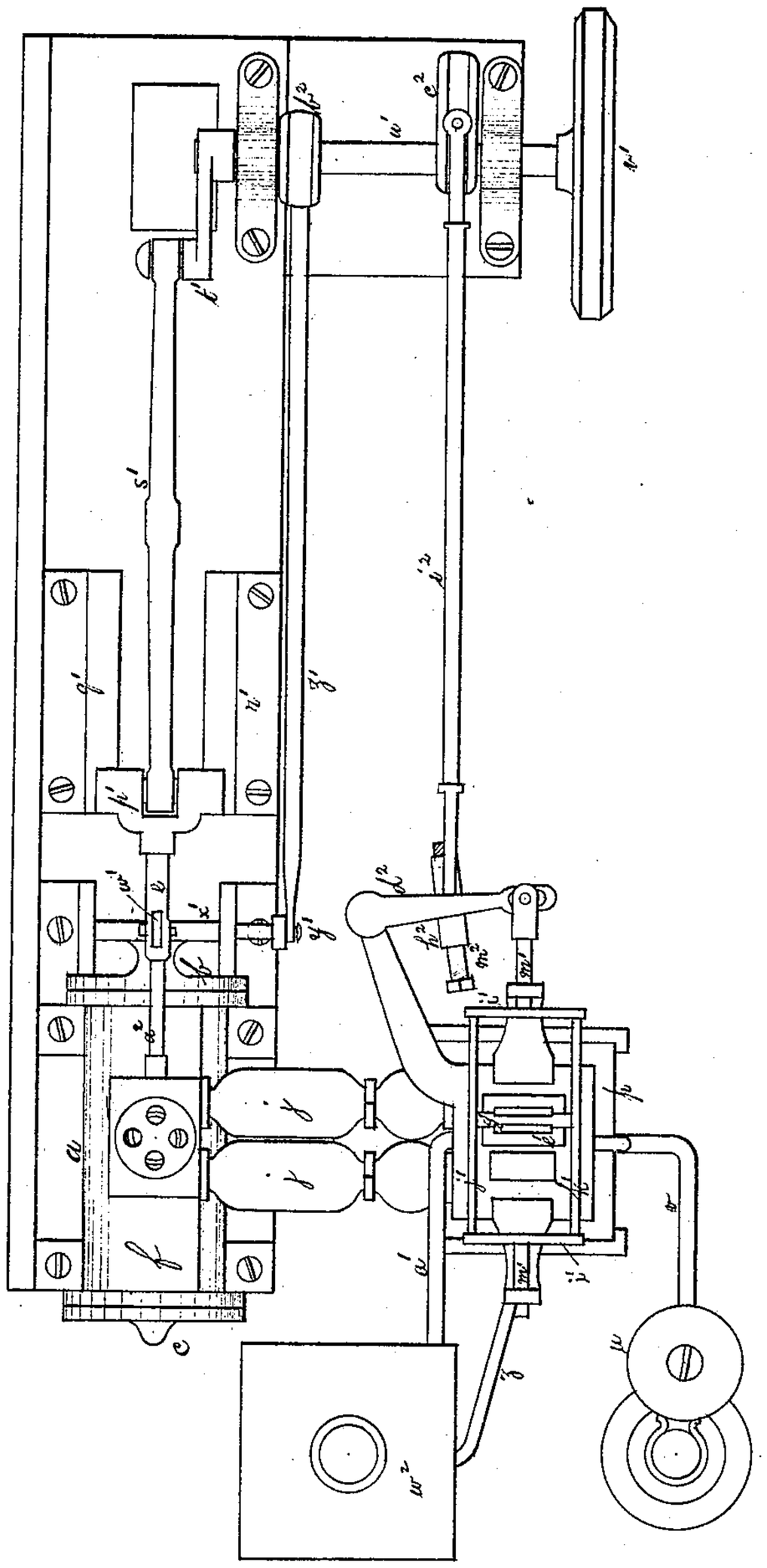
J. S. Morton,

3. Sheets. Sheet. 1.

Air Engine.

No. 102,300. Patented Apr. 26. 1870.

Fig. 1



Witnesses: George L. Buckley, Wm. J. Burns.

Inventor: John S. Morton

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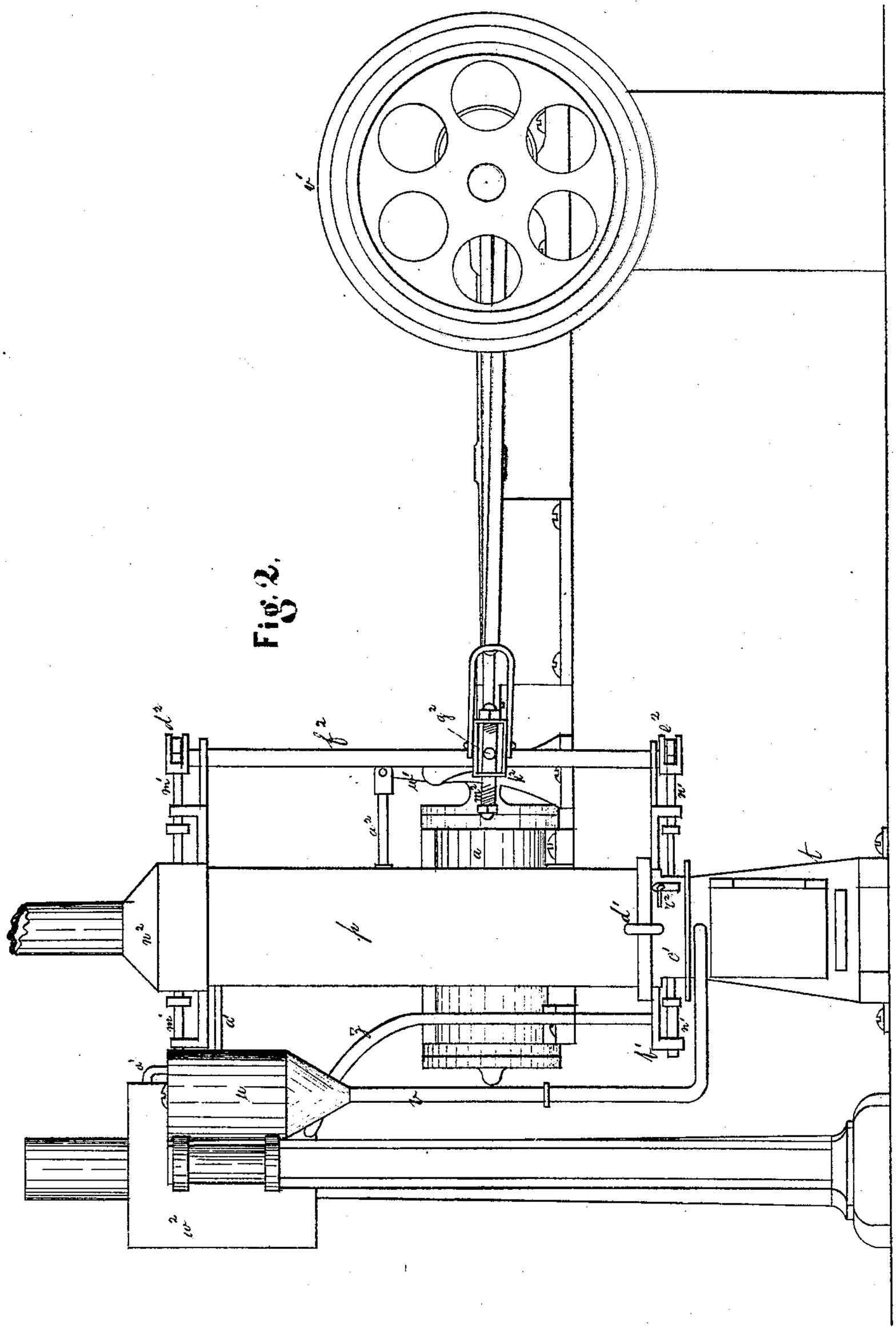
Fig. 2.



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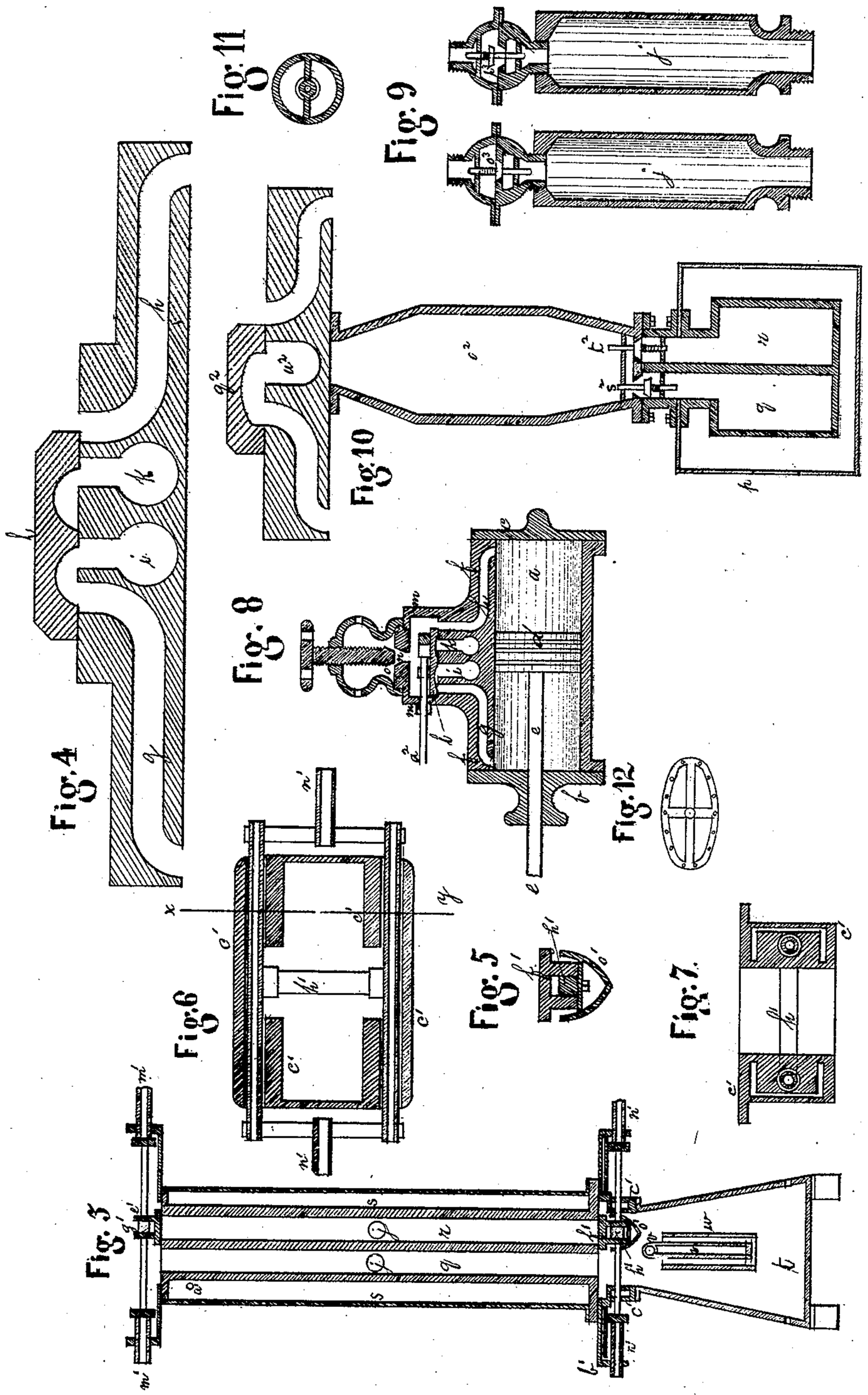

Witnesses: George E. Buckley, Wm. J. Burne.

Inventor: John S. Morton

United States Patent Office.

JOHN S. MORTON, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 102,300, *dated April* 26, 1870.

PNEUMATIC VACUUM-ENGINE.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN S. MORTON, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in the Pneumatic Vacuum-Engine, of which the following is a specification.

The improvements herein described relate to the pneumatic vacuum engine described in the application filed by said JOHN S. MORTON, together with Joseph H. Laning, December 16, 1869.

Referring to the drawings—

Figure 1 represents a plan, and

Figure 2 a side elevation of the complete engine.

The remaining figures represent details.

Figure 3 being a vertical section of the vacuum vessel, which includes two vacuum-chambers, the surrounding water-jacket, and top and bottom valves for said chambers, and showing, also, the fire-box.

Figure 4, an enlarged view, in vertical section, of the slide valves and valve-seat which I employ for opening and closing the air-ports of the cylinder, and the exhaust-ports or openings into the vessels, which connect the cylinder with the vacuum-chambers.

Figure 5, a vertical section of the valve f^1 and V-shaped shield o^1.

Figure 6, a horizontal section through the upper part of the furnace, showing the rest h^1 for the valve f^1, and the solid and tubular rods constituting the frame of which the valve f^1 is moved.

Figure 7, a vertical section on the line $x\ y$ of fig. 6, being intended to show the hollows in base c^1, for the circulation of water through this base, as hereinafter described.

Figure 8, a vertical section of the cylinder, piston, piston-rod, air-ports, vacuum-ports, valve and air-chest.

Figure 9, a longitudinal section of the two vessels j, for connecting cylinder a with the vacuum-chambers.

Figure 10 represents a transverse section of the vacuum-vessels, and a longitudinal section of a single vessel, o^2, which may be employed in place of the two connecting-vessels, j, for connecting the vacuum-chambers q and r with the cylinder a, showing, also, a D-valve, q^2, and one exhaust-port, u^2, instead of the two exhaust-ports, shown in fig. 4.

Figure 11 is a plan of the guides for the valve-stems shown in figs. 9 and 10.

a, figs. 1 and 8, is the cylinder. It has removable heads, b and c.

d is the piston, which is constructed in the usual manner, of metallic elastic split-rings, so as to be self-packing or adjusting.

e is the piston-rod.

f is the valve-seat, which is a casting attached to the cylinder.

It is provided with the ports g and h for the induction of air, and with the ports i and k, which lead into the vessels j, fig. 1, which connect the cylinder a with the vacuum-chambers.

In fig. 8, l is a slide valve for opening and closing ports $g\ h\ i\ k$, and m is the air-chest, into which atmospheric air is admitted, more or less freely, as required, through the aperture n, which is controlled by the valve o.

p, fig. 2, is the vacuum-vessel. It comprises the two vacuum-chambers q and r, fig. 3, which are surrounded by the water-jacket s. The chambers q and r are connected by the two vessels j, (see fig. 1,) with the cylinder a.

t, figs. 2 and 3, is the fire-box or furnace, in which a flame is generated by the combustion of naphtha or oil, supplied from an elevated reservoir, u, figs. 1 and 2, and conducted by means of a pipe, v, near to the bottom of the tube w, which is open at each end, in the furnace or fire-box t, fig. 3.

A burner or device, a plan of which is shown in Figure 12, with two or more perforations for the escape of the naphtha or oil, is applied to the extremity of the pipe v. The oil or naphtha being ignited at the start, soon, by its combustion, heats that part of pipe v within the tube w sufficiently to convert the escaping naphtha or oil into gas, which supports the flame.

w^2, figs. 1 and 2, is an open-topped tank, containing water. It is connected with the water-jacket s, fig. 3, by pipes, z and a^1, figs. 1 and 2, the pipe z being attached at its lower end to the hollow arm b', fig. 2, which projects from the hollow base c^1, which is connected with the upper part of the jacket s by an outside pipe, d^1, as shown in fig. 2.

The pipe a^1 is attached to the top of the water-jacket, thus providing means for the constant circulation of water through the tank and water-jacket.

e^1 and f^1, figs. 3 and 5, represent the slide valves by which the vacuum-chambers q and r are alternately opened and closed.

The valve e^1 is impelled by the bar g^1, which is part of the valve-frame i^1, a plan of which is shown in fig. 1.

The valve f^1, when not in action, rests loosely on the bar h^1, figs. 3, 5, and 6, and is impelled by said bar h^1, which forms part of a frame similar to the frame i^1.

The connecting-pieces j' and k^1, fig. 1, of the valve-frames are tubes, each made open at both ends, in order that the air may pass freely through them to keep them cool.

m^1 and n^1, the guide-rods of the valves e^1 and f^1, are also tubes, left open at each end, as appears in fig. 3.

o^1, figs. 3 and 5, is a V-shaped guard, which ex-

tends along under the valve f^1 for its full length, it being attached to bar h^1, and serving to shield said last-named valve from the direct influence of the flame, which it at the same time directs into the vacuum-chambers q and r alternately.

The piston-rod e, (see fig. 8,) is connected in the usual manner to the cross-head p^1, fig. 1, which slides in the guides q^1 and r^1.

s^1, fig. 1, is the rod which connects the cross-head p^1 with the crank b^1, which is on the shaft u^1 of the fly-wheel v'.

The valve l (see fig. 8) is worked in the manner usually employed for steam-valves of like construction, its stem, a^2, being attached to an upright lever, w^1, fig. 1, which proceeds from the rock-shaft x^1, which has a crank, y', which is operated by a lever, z^1, which is attached to an ordinary eccentric, b^2, on the shaft u^1 of the fly-wheel.

The valves e^1 and f^1, figs. 1, 3, and 5, for opening and closing the vacuum chambers q and r, are operated primarily by an eccentric, c^2, fig. 1, which, also, is placed on the shaft of the fly-wheel.

The valve-stems m^1 and n^1, figs. 2 and 3, are attached by flexible joints to arms d^2 and e^2, respectively, fig. 2, of the upright rock-shaft f^2, which is attached by a short arm, g^2, to the self-adjusting device h^2, fig. 1, the frame k^2, fig. 2, of which is connected by a pivot-joint to the yoke of the eccentric lever i^2, fig. 1, and has an independent longitudinal motion on its spindle m^2, sufficient to allow the eccentric c^2 to turn through a large part of its revolution without moving the valves e^1 and f^1, fig. 3, while it at the right time gives the instantaneous throw to these valves.

w^2, fig. 2, represents a removable chimney or device for increasing the draught of the flame into the vacuum-chambers q and r, fig. 3.

o^3 and p^3 (see fig. 9) are valves in vessels j, figs. 1 and 9.) These valves open toward the vacuum-chambers q and r, alternately, as the vacuum is produced in said chambers respectively.

r^2, fig. 2, is a faucet for emptying the water-jacket s, when it is desired to do so.

The following describes the operation of the engine:

The chamber q being open at both ends, as shown in fig. 3, the flame or heat and rarefied air from the fire-box enter through the lower aperture of said chamber q, consuming and expanding the air therein, and driving it out through the upper aperture of this chamber. At the same time, the atmosphere presses through the open port h, fig. 8, on the piston d, and drives it to the opposite end of the cylinder toward the vacuum already formed in chamber r. The arrangement of the valve-rods a^2, m^1, and n^1, and their connected operating parts being such, that, the instant the piston d reaches the end of its stroke, the air-port h and the upper and lower apertures of the vacuum-chamber q are closed, the valve f^1 having the lead, and the air-port g and upper and lower apertures of the vacuum-chamber r are at the same time opened. The opening of the apertures last named allows the heat or flame and rarefied air from fire-box t to enter the vacuum-chamber r through the lower apertures of this chamber, consuming and expanding the air therein, and driving it out of this chamber through its upper aperture. At the same time, the atmosphere, through the open port g, fig. 8, presses on the piston d, and drives it toward the opposite end of the cylinder a.

Thus, it will be seen, that a partial vacuum is alternately formed in the chambers q and r, in front of the piston d, and that the motion of the said piston into or toward either such vacuum, is due wholly to the pressure of the atmosphere exerted alternately on opposite faces of the piston.

The body of the vacuum-chambers q and r is a casting of iron, and surrounded with a casing, which constitutes the outer wall of the water-jacket. The casing may be of light boiler-iron, attached to the body of the vacuum-chambers by bolts or rivets, or in any other substantial manner.

The top and bottom portions of the vacuum-chambers q and r, fig. 3, on which the valves e^1 and f^1 slide, may be made removable, so that they can be renewed or repaired with facility in case of wear.

The pipe z, fig. 2, is shown to be attached to the hollow arm b^1 of the support for the lower valve-frame. It may, however, be attached directly to the side of the water-jacket s.

Instead of employing the two connecting-vessels marked j, one connecting-vessel, o^2, fig. 10, provided with two valves, s^2 and t^2, may be employed, and, in that case, a D-valve, q^2, fig. 10, and a single exhaust-port, w^2, may be used.

Instead of naphtha or oil for fuel, the ordinary illuminating-gas may be employed.

The object of surrounding the vacuum-chambers with a water-jacket, s, and connecting the jacket with an open reservoir to keep up circulation, being to maintain a uniform temperature not exceeding 212° Fahrenheit in the chamber, by allowing the evaporation of the water to go on, similar results will be accomplished, but in a less convenient and efficient manner, and without circulation through a separate reservoir, by leaving the top of the jacket open, or by attaching to its top open pipes, or a single open pipe, to allow the evaporation of the water to go on.

I claim and desire to secure by Letters Patent—

1. The single vacuum-vessel p, comprising two distinct vacuum-chambers, and a surrounding water-jacket, and single valves for the top and bottom apertures of the chambers, respectively, substantially as set forth.

2. The combination of the said vacuum-vessel p, the two connecting-vessels j, with their respective valves, the cylinder a, piston d, and air-valve l, substantially as set forth.

3. The combination of said vacuum-vessel p, the single connecting-vessel o^2, with its two valves s^2 and t^2, the cylinder a, piston d, and valve q^2, substantially as set forth.

4. The eccentric c^2, in combination with the self-adjusting device h^2 and valves e^1 and f^1 at the top and bottom of the vacuum-chambers q and r, substantially as set forth.

5. The frames for the valves e^1 and f^1, constructed wholly or partly of open tubes to admit the passage of air through them, substantially as set forth.

6. The V-shaped guard o^1, to shield valve f^1 from the direct influence of the heat, and for directing the heat alternately into the two vacuum-chambers q and r, substantially as set forth.

7. The vacuum-vessel p, in combination with the described devices for generating heat.

JOHN S. MORTON.

Witnesses:
GEORGE E. BUCKLEY,
WM. J. BURNS.