2 Sheets—Sheet 1.

A. CARR & J. ARTHUR.

PUMPING ENGINE.

No. 186,539. Patented Jan. 23, 1877.

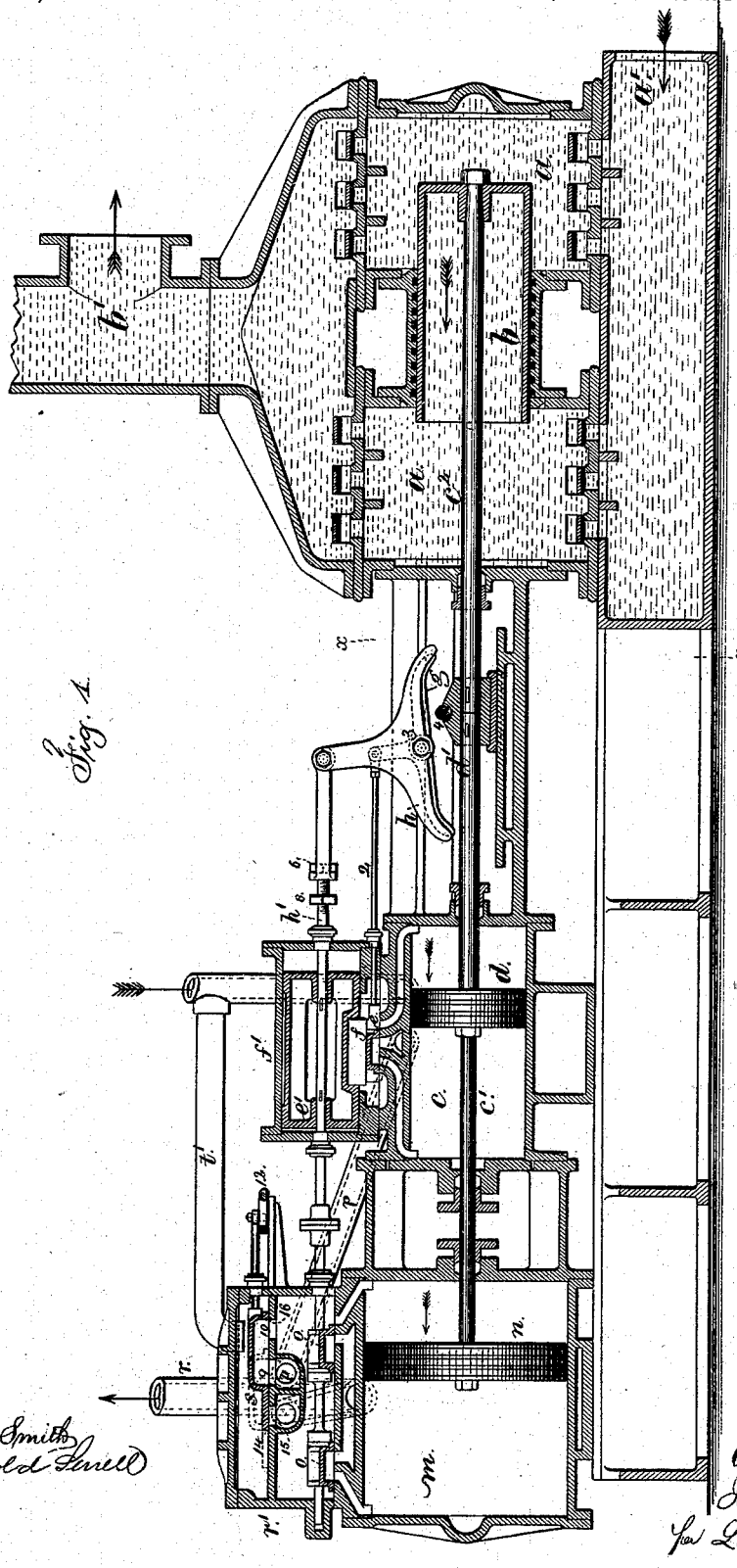

Fig. 1.

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2 Sheets—Sheet 2.

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Fig. 2.

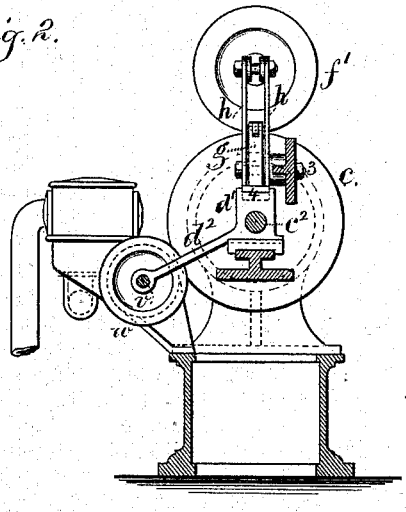
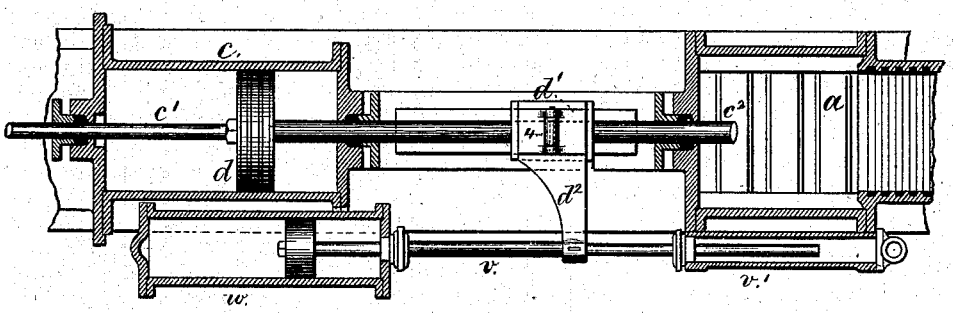


Fig. 3.



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UNITED STATES PATENT OFFICE.

ADAM CARR, OF PATERSON, AND JAMES ARTHUR, OF JERSEY CITY, NEW JERSEY, ASSIGNORS TO SAID CARR.

IMPROVEMENT IN PUMPING-ENGINES.

Specification forming part of Letters Patent No. **186,539**, dated January 23, 1877; application filed January 17, 1876.

To all whom it may concern:

Be it known that we, ADAM CARR, of Paterson, in the county of Passaic, and JAMES ARTHUR, of Jersey City, in the county of Hudson, both in the State of New Jersey, have invented an Improvement in Condensing Pumping-Engines, of which the following is a specification:

Engines have been made with two cylinders, into the smallest of which the steam at high pressure is admitted, and this is exhausted into the larger cylinder and afterward condensed.

Our present improvements relate to a direct-acting pumping-engine, in which the pistons of the two steam-cylinders and the piston of the pump are connected by piston-rods in line with each other, so that the power is direct-acting, and we employ, with the compound engine, a valve-moving piston that operates the valve of the smaller engine, and also the valve of the larger engine, simultaneously; and we arrange the respective steam and exhaust pipes and valve in such a manner that by moving the valve live steam from the boiler may be admitted to the larger cylinder in aid of the steam that exhausts from the smaller cylinder, or the exhaust from the smaller cylinder may be turned directly to the condenser, and the larger cylinder be operated by steam directly from the boiler; the object of this being to increase the power of the pumping-engine as occasion may require, especially where the pumping-engine is employed in water-works where the demand for water may be increased by fires. We also arrange the direct-acting engine so that the air-pump and feed-water pumps are operated directly from the cross-head of the engine.

In the drawing, Figure 1 is a vertical longitudinal section of the engine and pump. Fig. 2 is a cross-section at the line *x x*, and Fig. 3 is a partial sectional plan.

The pump-cylinder *a*, piston *b*, inlet *a'*, outlet *b'*, and valves, are of any desired character, and those shown illustrate the connection of a pump with the other parts. The small steam-cylinder *c* is provided with a piston, *d*, and the piston-rod c^1 extends to the cross-head *d'*, and is in line with the rod c^2 of the pump. The steam-ports, small auxiliary valve *e*, main valve *f*, and valve-operating piston *e'* in the cylinder *f'*, are substantially the same as those shown in Letters Patent No. 143,807, granted October 21, 1873, to Adam Carr, and therefore do not require to be further described herein, except to say that the secondary valve is connected by the valve-rod 2 to a rocker, *g*, that moves upon the center gudgeon 3, and is actuated by the roller 4 upon the cross-head as the piston completes its stroke at the respective ends.

When the engine is cold it sometimes happens that the steam-pressure admitted by the secondary valve does not act with sufficient rapidity in the cylinder *c* to move the piston *d* and main valve; hence the engine-piston may thump against the cylinder-heads. To obviate this, and to prevent the possibility of accident from any temporary derangement of the parts, we employ the guard-rocker *h*, that is preferably made in two parts, so as to be at each side of the rocker *g*, and swing upon the same gudgeon, and from the upper end of this guard-rocker there is a loop-link, notched in the middle to sit upon the rod *h'*, that is connected with the valve-operating piston *e'*, so that if that piston does not move fast enough by the action of the steam its movement at the proper time may be insured by the cross-head acting upon the rocker before the stroke is completed. The piston-rod *h'* has upon it lock-nuts 6 for the loop-link to operate upon, and these should be sufficiently far apart to allow the valve-moving piston to act by the steam alone under ordinary circumstances, so that the guard-rocker only comes in action when the steam does not properly move the main valve and its piston.

The larger or secondary cylinder *m* of the compound engine is provided with a piston, *n*, the rod of which passes to the piston *d* of the high-pressure cylinder, so that the two pistons move together, one in aid of the other, and both exerting their power upon the piston-rods.

This feature of a compound engine we do not claim, but we have improved this character of

engine by combining it with a direct-acting pump, and by connecting the valve *o* of the secondary cylinder with the valve-moving piston *e'* of the primary engine, so that the steam, acting upon this piston *e'*, moves the valves of both engines simultaneously to open and close the respective ports. Ordinarily the exhaust steam from the primary engine passes by the pipe *p* to the valve-chest of the secondary engine, and the exhaust steam from the secondary cylinder passes by the pipe *r* to the condenser.

In order to arrange this engine so that the secondary engine may be partially or entirely supplied by live steam from the boiler, as occasion may require, we lead the exhaust steam through the ports 9 and 10 in the divided steam-chest *r'*, and through the D slide-valve *s* that is placed over these ports, and said valve *s* is operated by a handle, 12, or other means, and the face 14 of this valve *s* is wide enough to cover the secondary exhaust-port 15 when the face 16 of the valve *s* is over the port 10, and this face is narrow, so that the exhaust steam can pass through the port 10 at one side of such face 16, and the live steam will pass by the pipe *t'* in at the other side.

The relative widths of these openings can be varied by moving the valve *s*, and by shifting the valve to the position shown by dotted lines in Fig. 1, the exhaust from the primary engine will pass from 9 through the port 15 and pipe to the exhaust *r*, and the steam from the boiler will go to the secondary cylinder by the port 10, so that the secondary cylinder may be operated by the boiler-steam or else by the exhaust steam from the primary cylinder, as occasion may require. The cross-head d^1 is extended out as an arm, d^2, (see Figs. 2 and 3,) and connected with the piston-rod *v* of the air and water pump *w* of the condenser, which rod also extends into the pump *v'*, which pump serves to supply the boiler with water.

By this arrangement the feed-water pump and the condenser-pump serve as guides to the piston rod that is common to both, and this piston-rod serves as a guide to insure the parallel movement of the cross-head that unites the respective piston-rods and actuates the valve-rocker.

It will be apparent that the guard-rocker might be connected to the second or main valve of the engine, instead of the piston shown, to move the said valve.

We are aware that feed-water pumps and ordinary force-pumps have been connected to the cross-head of an engine.

We claim as our invention—

1. The guard rocker *h*, connected to the the valve-moving piston, in combination with the small auxiliary valve *e*, substantially as set forth.

2. The combination, with the small auxiliary valve and its rod and rocker, of a guard rocker or lever connected with a second valve in the engine, substantially as set forth.

3. The combination, with a compound engine and pump in which the piston-rods are in line with each other, of a rocking-lever valve and valve-rod receiving motion directly from the piston-rod of such engine, substantially as set forth.

4. The pump and high and low pressure steam-cylinders arranged in line with each other, in combination with the arm d^2, feed-water pump *v'*, and air-pump *w*, at opposite ends of the piston-rod *v*, substantially as specified.

Signed by us this 15th day of January, A. D. 1876.

ADAM CARR.
JAS. ARTHUR.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.