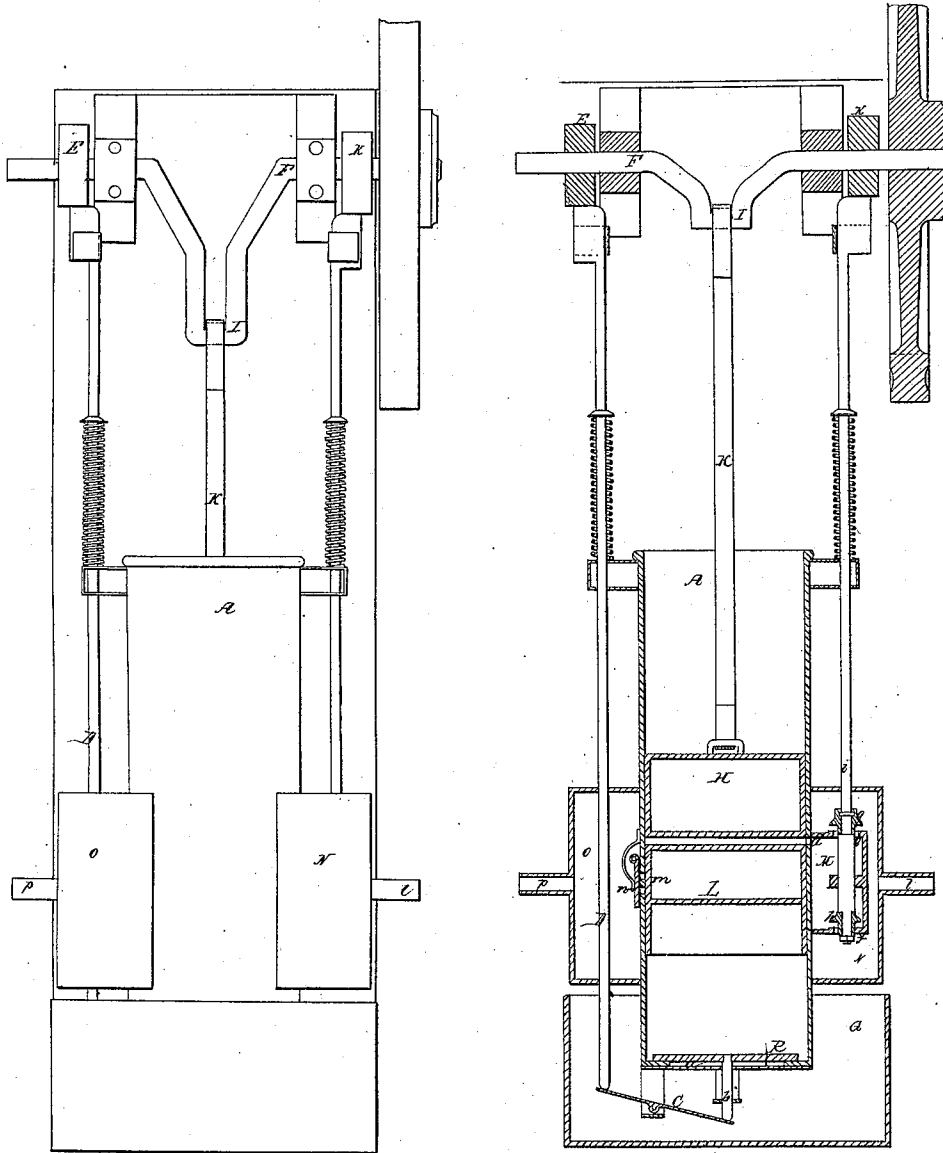


F. A. Calvert,

Reciprocating Steam Engine,

No. 52,965,

Patented Mar. 6, 1866.



Witnesses
J. P. Dale J.
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UNITED STATES PATENT OFFICE.

F. A. CALVERT, OF LOWELL, MASSACHUSETTS.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 52,965, dated March 6, 1866.

To all whom it may concern:

Be it known that I, FRANCIS A. CALVERT, of Lowell, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Steam-Engines; and I do hereby declare the same to be fully described in the following specification and represented in the accompanying drawings, of which—

Figure 1 is a front elevation, and Fig. 2 a vertical section, of an engine provided with my invention.

The said engine is somewhat analogous to that for which Letters Patent No. 39,715, and dated September 1, 1863, have been granted to me, there being employed with the cylinder of my present engine an auxiliary piston, a tank of water or fluid, and certain valve-openings, valves, and valve-operating mechanism, as hereinafter described.

The distinguishing difference between my present invention and that above mentioned as patented is to be found in the employment not only of the tank or mass of water and the valves and the valve-seats of the lower part and side of the cylinder, but the mechanism for moving the lower valve of the cylinder in manner as hereinafter explained.

When steam, gas, or hot air is the medium employed in operating the main piston of the engine the auxiliary piston becomes necessary to the engine, but when water under pressure is used to give motion to the moving piston the auxiliary piston may be dispensed with, as the water of the tank will alone answer the purpose.

In the operation of the steam on the main piston of this engine it is intended to act at first with great effect percussively and in a small quantity, possessing a high degree of elastic force. After having thus acted on the piston the steam may be cut off and suffered to expand, and by its expansive force aid in propelling the piston. The purpose of the lower piston is to obviate the necessity of supplying the cylinder with steam until the crank of the driving-shaft of the engine may have attained its proper position for receiving the full force or greatest useful effect of the steam. In general, in various other kinds of steam-engines, the steam is admitted to the cylinder while the crank may be passing either "dead-point," and thus before the steam acts on the crank with the greatest useful effect the crank

will have to reach at, or about at, the position where it may be at a right angle with the connecting-rod leading from it to the piston-rod. Hence there arises a waste of steam, or the power thereof, which does not result by the employment of the auxiliary piston, which in reality becomes a movable bottom or head to the cylinder, or moves upward in the cylinder with the primary piston until the latter may have attained the proper position therein for the application of the steam to it in order that it may act on the crank to the best advantage. On attaining this position the auxiliary piston remains at rest during the further ascent of the primary piston. The further operation of the auxiliary piston will be hereinafter described.

In the drawings, A denotes the cylinder, which is open at the top and closed at the bottom, except in being provided with an opening, *a*, in which there is a valve, B, to open upward within the cylinder. The stem *b* of the said valve rests on one arm of a lever, C, on whose other arm a vertical rod, D, rests. The rod D is to be supported so as to be capable of sliding longitudinally, and its upper end abuts against the periphery of an eccentric, E, fixed on the crank-shaft F of the engine. The lower part of the cylinder extends into a tank, G, to contain a mass of water or liquid.

The primary piston of the engine is represented at H as united to the crank I of the shaft F by a connecting-rod, K.

The secondary or auxiliary piston is exhibited at L, it being a cylindrical float arranged between the main piston and the valve at the foot of the cylinder. Just below the main piston, when the crank is at a right angle with the connecting-rod, there is a passage, *d*, leading through the side of the cylinder and into a valve-box, M, situated in a steam-chest, N, and provided with two openings, *e f*, made in its top and bottom. Valves *g h* are applied to such openings and to a rod, *i*, which extends upward through the top of the steam-chest, and to the periphery of a cam, *k*, fixed on the driving-shaft, the said rod being suitably supported in order that it may be moved longitudinally.

An induction-pipe for leading steam into the chest N is represented at *l*.

One or more openings, *m*, made through the side of the cylinder and below the steam-

inlet opening thereof, are provided with a valve, *n*, arranged on the outside surface of the cylinder and in a chamber or chest, *o*, fixed to the cylinder and provided with an eduction-pipe, *p*.

The mode of operation of the engine so constructed may be thus described: When the piston arrives at the extreme of its upward motion and the crank passes the upper dead-point the downstroke commences and the foot-valve is raised so as to allow the water within the cylinder and underneath its float or auxiliary piston to escape from the cylinder during the descent of such float or piston. In consequence of the downward movement of the main piston caused by the momentum of the fly-wheel the steam in the cylinder will be contracted so as to force the auxiliary piston downward. While descending the float or auxiliary piston will uncover the exhaust-opening *m*, and thus allow the steam in the cylinder to escape through such opening during the descent of the main piston. On the crank having reached the lower dead-point the main piston will be close to the top of the float or auxiliary piston. As the main piston rises in the cylinder the flap-valve of the exhaust-port will be closed, and the float or auxiliary piston will be compelled by atmospheric pressure to follow the main piston, this being owing to the vacuum induced in the cylinder by the rise of the said main piston. The foot-valve will also be forced off its seat, and the water of the tank, by atmospheric pressure, will be driven into the cylinder and will rise therein

with the auxiliary piston. As soon as the crank has arrived at or near the position for rendering the full leverage available the steam is again admitted between the main piston and the top of the float or auxiliary piston, the descent of the latter being prevented by the pressure on it, causing the foot-valve to close on its seat. The main piston will next be caused by the percussive action and pressure of the steam to ascend in the cylinder. The water so used in the cylinder thus acts as an abutment to resist the pressure of the steam when exerting its force to drive the main piston upward in the cylinder.

Having thus described my improved engine, what I claim therein is as follows:

1. In the said engine, the application of water or other non-elastic fluid to act as an abutment to the steam or motive agent of the engine, in manner and under circumstances substantially as described.

2. The improved engine, constructed substantially as described—viz., with the foot-valve and its operative mechanism and the float and cistern, combined and arranged with the cylinder, the main piston, and the steam induction and eduction ports and their valves, and the operating mechanism thereof, in manner and so as to operate substantially as hereinbefore described.

F. A. CALVERT.

Witnesses:

R. H. EDDY,
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