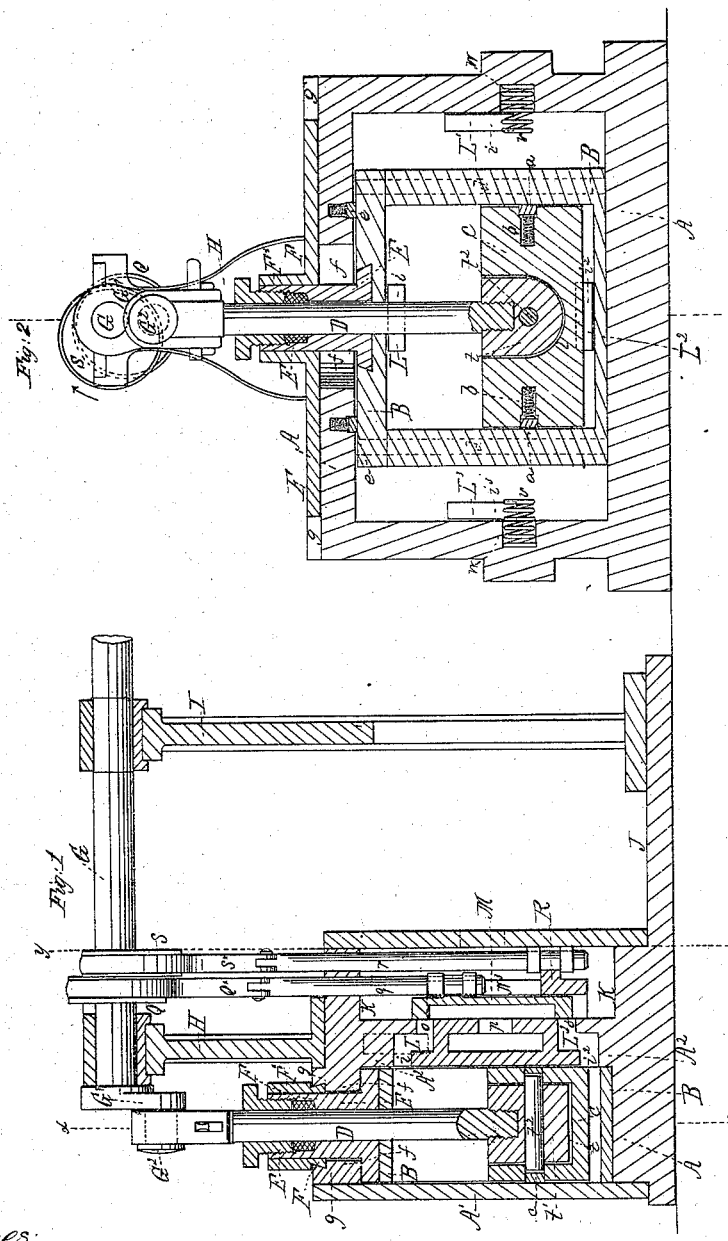
2 Sheets—Sheet 1.

# R. WYATT.

## STEAM ENGINE.

No. 48,139. Patented June 6, 1865.



Witnesses:
William Larder
Henry T. Brown

Inventor
Robert Wyatt

2 Sheets—Sheet 2.

# R. WYATT.

## STEAM ENGINE.

No. 48,139.

Patented June 6, 1865.

Fig. 4.

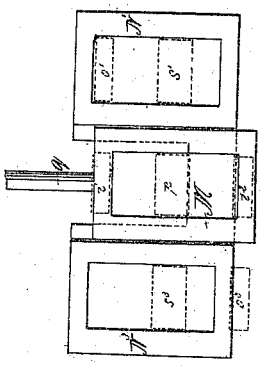
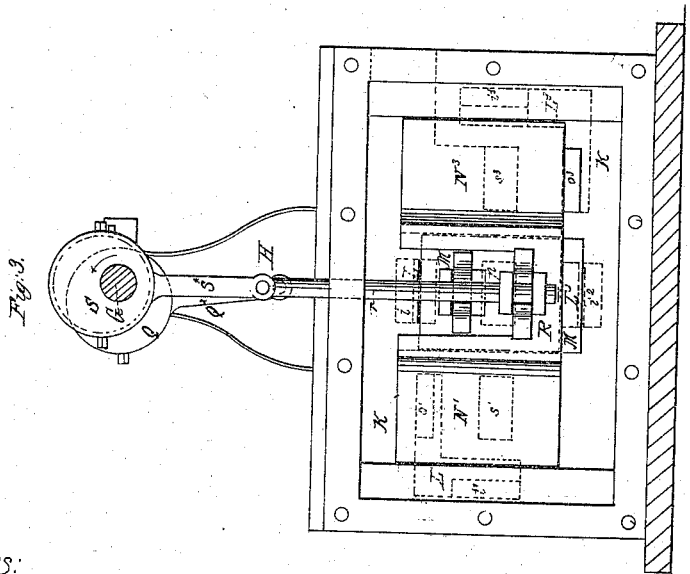


Fig. 3.



Witnesses:
William Lauder
Henry T Brown

Inventor:
Robert Wyatt

# UNITED STATES PATENT OFFICE.

ROBERT WYATT, OF BROOKLYN, NEW YORK, ASSIGNOR TO HIMSELF AND W. LARDER, OF SAME PLACE.

## IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **48,139**, dated June 6, 1865.

*To all whom it may concern:*

Be it known that I, ROBERT WYATT, of the city of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a central vertical section of an engine with my improvements. Fig. 2 is a transverse vertical section of the same in the plane indicated by the line *x x* in Fig. 1. Fig. 3 is a transverse vertical section of the same in the plane indicated by the line *y y* in Fig. 1. Fig. 4 is a face view of the three valves.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to compound reciprocating engines having a cylinder and piston such as are described and claimed in John B. Root's Letters Patent dated September 15, 1863. In these engines, as described in the Letters Patent aforesaid, and as manufactured by Root, the crank-shaft passes through the center of one of the cylinder-heads, the crank is within the cylinder, and the crank-wrist works in a bearing in the inner piston, and the consequence is that the crank-wrist becomes so heated when the engine is in operation as soon to wear out itself and the bearing, even, in some cases, melting the bearing.

With a view to remedy this defect a part of my invention consists in certain means, or a certain method, of connecting the two pistons with a crank outside the cylinder.

Another part of my invention consists in a novel combination of slide-valves for effecting the induction and eduction of steam through the four ports of the cylinder to act upon the two pistons.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A is the cylinder. B is the outer piston, fitted to work horizontally within the cylinder, and C is the inner piston, fitted to work vertically within the outer one, all substantially as described in Root's patent, hereinbefore referred to. The inner piston is grooved and fitted with packing-strips *a a*, Fig. 2, pressed out by springs *b b* against the sides of the interior of the outer piston, and with packing-strips *c c*, Fig. 1, pressed out by similar springs against the cylinder-heads A′ and A². The outer piston is grooved and fitted with packing-strips *d d*, Fig. 2, of similar character, to keep it steam-tight between the cylinder-heads. The upper side of the cylinder is grooved and fitted with packing-strips *e e*, which are pressed downward by springs against the upper part of the outer piston, B, to prevent leakage between the piston and the top of the cylinder as the said piston wears down.

The inner piston, C, has firmly connected with it by a mortise, *t*, tenon *t′*, and pin *t²*, or by any suitable means, an upright piston-rod, D, which works longitudinally through a stuffing-box secured firmly to or constructed upon the top of the outer piston, B, at the middle of the length thereof. This stuffing-box passes through a slot, *f*, in the top of the cylinder, long enough to permit the movement of the stuffing-box with the piston B, as the latter makes its stroke. This stuffing-box fits within and projects through a socket, F*, provided in a sliding plate, F, which is fitted to a dovetail groove, *g*, extending the whole length of the exterior of the top of the cylinder. This sliding plate, moving parallel with the piston B, tends to keep the stuffing-box and piston-rod upright in their horizontal movement with the said piston. The stuffing-box prevents leakage of steam around the piston-rod, and the packing strips *d d* prevent leakage through the slot *f*.

G is the crank-shaft, arranged with its axis perpendicular to the planes of movement of the pistons B and C in a position sufficiently elevated above the cylinder to permit the upper end of the piston-rod D to be connected with the wrist G² of its crank G′, and permit the revolution of the crank. The said shaft is supported in this position in two bearings, one of which is on a standard, H, erected upon the cylinder, and the other on a standard, I, erected on the bed-plate J, with which the cylinder is cast, or to which it is otherwise firmly secured.

The valve-chest K of the engine, with which the induction-pipe of the engine is connected, is cast with or bolted to the cylinder-head A², and has communication with the cylinder by

means of four passages, L L′ $L^3$ $L^3$, the inner ports, $i'$ $i^3$, of L′ $L^3$ communicating with the cylinder near the ends thereof, and outside of the piston B, and the inner ports, $i$ $i^2$, of L $L^2$ communicating with the cylinder within the piston B, close to the top and bottom of the said piston and outside of the piston C. This arrangement of the inner ports is the same as in Root's engine, and the induction and eduction of the steam to and from the cylinder, through the said ports, taking place in the same manner as it does in that engine, produces a similar movement of the two pistons B and C, the latter moving vertically within the former, while the two move horizontally together within the cylinder, and the combined operation of the two causing the rod D, which works longitudinally and vertically through the stuffing-box E, while it moves laterally and horizontally with the two pistons, to produce the revolution of the crank and crank-shaft.

Within the steam-chest K there are three slide-valves, M, N′, and $N^3$. The valve M effects the induction and eduction of the steam to and from the cylinder, through the passages L $L^2$, to produce the upward and downward reciprocating movement of the inner piston. N′ effects the induction and eduction through the port L′, and $N^3$ effects the induction and eduction through the port $L^3$, the two latter valves operating to produce the horizontal reciprocating movement of the outer piston.

Springs $v$ $v$ are applied in cavities $w$ $w$, at the end of the cylinder, to gradually check the movement of the outer piston, B, at the ends of the stroke, and so prevent any strain on the piston-rod.

The valve M resembles an ordinary three-port slide-valve, such as is commonly used for reciprocating steam-engines, and works in a similar manner over the outer ports, $o$ $o^2$, Figs. 1, 3, and 4, of the passages L $L^2$, and over an intermediate exhaust-port, $p$, which communicates with an exhaust-chamber, P, which is situated between the chest K and the cylinder, and with which the main eduction-pipe of the engine is connected. The said valve is operated by an eccentric, Q, on the shaft G, the stem $q$ of the said valve passing through a stuffing-box in the top of the chest K, and being connected with the rod Q* of the said eccentric.

The valves N′ and $N^3$ are arranged on opposite sides of the valve M, and are connected together by a yoke-piece, R, which also serves to connect the two with the same stem $r$, passing through a stuffing-box in the top of the valve-chest. The valve N′ works over the outer port, $o'$, of the passage L′, and over an exhaust-port, $s'$, Figs. 3 and 4, which communicates with the exhaust-chamber P; and the valve $N^3$ works over the outer port, $o^3$, of the exhaust-passage $L^3$, and over an exhaust-port, $s^3$, Figs. 3 and 4, which communicates with the exhaust-chamber P. The exhaust-port $s'$ is below the port $o'$, and the exhaust-port $s^3$ below the port $o^3$, and hence, though the valves N′ and $N^3$ are alike and connected together, the operation of one of the said valves is the reverse of that of the other, each performing the induction of steam to the cylinder at one end while the other performs the eduction of steam from the other end. The stem $r$ of the valves N′ and $N^3$ is connected for operating the said valves with the rod S* of an eccentric, S, on the crank-shaft G, the said eccentric being set at right angles to the eccentric Q, and the two eccentrics being so set relatively to the crank G′ that the induction and eduction of the steam to and from the cylinder, through the passages L $L^2$ will commence as the crank arrives at the highest and lowest points in its revolution, and the induction and eduction through the passages L′ $L^3$ will commence as the crank arrives at half-stroke—that is to say, in the horizontal position on either side of the shaft.

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

1. Connecting the two pistons B C with a crank outside of the cylinder by means of a piston-rod, D, which is attached to the inner piston, C, and passes through the outer piston, B, and which has a longitudinal movement with the inner piston, C, and a lateral movement with the two pistons B C, substantially as and for the purpose herein specified.

2. The stuffing-box E, through which the piston-rod D works, attached to the outer piston, B, and working in a slot, $f$, in the cylinder, substantially as and for the purpose herein set forth.

3. The sliding plate F and its socket F*, fitting the stuffing-box E and working within a groove or guide, $g$, on the exterior of the cylinder, substantially as and for the purpose herein set forth.

4. The combination of the slide-valve M and the two connected slide-valves N′ $N^3$, the three worked by two eccentrics, Q S, and operating as described in relation to a system of ports, $o$ $o'$ $o^2$ $o^3$ $p$ $s'$ $s^3$, arranged substantially as herein specified.

ROBERT WYATT.

Witnesses:
HENRY T. BROWN,
WILLIAM LARDER.