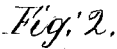
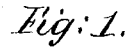


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Wm W Guild  
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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN VALVE-GEAR FOR DIRECT-ACTING STEAM-ENGINES.

Specification forming part of Letters Patent No. 51,454, dated December 12, 1865.

*To all whom it may concern:*

Be it known that we, WILLIAM H. GUILD and WILLIAM F. GARRISON, both of Williamsburg, in the county of Kings and State of New York, have invented a new and useful Improvement in the Valve-Gear of Direct-Action Steam-Engines; and we 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 longitudinal vertical section of the cylinder, valves, and valve-gear of a direct-action steam-pump illustrating our invention. Fig. 2 is a similar section, exhibiting the valve in a different position. Fig. 3 is a view of that side of the cylinder on which the external portion of the valve-gear is situated.

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

This invention relates to the employment, in direct-action steam-engines for working steam-pumps and other purposes, of steam-pistons, acted upon by steam for the purpose of completing the stroke of the valves commenced by mechanism connected with the main piston-rod; and it consists in a novel construction of such pistons and novel arrangement of passages therein and between the cylinder in which they work and the valve-chest, and in a novel arrangement of mechanism, in connection with the said piston and the valve, whereby, we believe, the desired operation is effected in a more certain and effective manner.

To enable others skilled in the art to make and use our invention, we will proceed to describe it with reference to the drawings.

A is the steam-cylinder, on which is a valve-chest, B, with which the steam-pipe is connected, and which contains the slide-valve C, the movement of which effects the induction and eduction of the steam to and from the cylinder through the three ports *a*, *a'*, and *b* in the valve-seat, the ports *a* *a'* communicating with opposite ends of the cylinder, and the intermediate one, *b*, with the exhaust-pipe *c*. The slide-valve has in its face two cavities, *e* *e'*, so arranged that when the valve is at its central position (shown in Fig. 1) the said cavities will each cover one of the ports *a* *a'*, the portion of the seat between the said port *a* or

*a'* and the port *b*, and the portion *i*, or *i'*, of the seat beyond the port *a* or *a'*, the latter portion of the seat being in a direction lengthwise of the valve only of a width about equal to that of the ports *a* *a'*, and the bottom of the valve-chest being recessed, as shown at *r r'* in Figs. 1 and 2, beyond the said portions *i* *i'* of the seat, that the steam may pass under one or other end of the valve and enter the port *a* or *a'* when the valve is moved from its central position, the other port *a'* or *a* being then in communication, through its respective cavity, *e'* or *e*, with the central or exhaust port, *b*. The slide-valve C thus constructed has in its back a mortise, *d*, for the reception of the end of one arm, I, of a rock-shaft, E, which works in bearings in the sides of the steam-chest, and one end of which projects through a stuffing-box, and has loosely fitted on it a lever, F, which is connected by a rod, G, with an arm, H, which projects horizontally from the main piston-rod J.

In order to prevent the piston-rod J from turning, it is furnished with a guide-arm, K, which works on a straight fixed guide, L.

The valve-arm I is fast on the rock-shaft E, and another arm, I', also fast on the said rock-shaft, passes through a slot, *l*, in the top of the steam-chest, and into a cylinder, M, above the valve-chest and parallel with the main cylinder, the said arm entering a mortise, *f*, in the connecting-stem *g* of two pistons, N N', which are fitted to work steam-tight in the said cylinder M. These pistons are hollow and open at their outer ends, and each has an exhaust-port, *m* or *m'*, through one side, ranging with one of two corresponding ports, *n* *n'*, in the cylinder. These ports *n* *n'* are at a distance apart as much greater than the distance between *m* *m'* as the width of the latter ports; and the said ports *n* *n'* communicate, by passages *p* *p'* (shown dotted in Figs. 1 and 2) made in the side wall of the steam-chest, with the exhaust-pipe *c* of the main cylinder A.

In the bottom of the cylinder M there are two ports, *q* *q'*, which communicate with the valve-chest B, the said ports being at such distance apart that when the valve C and pistons N N' are at the center of their stroke, as shown in Fig. 1, the said ports are only just covered by the said pistons.

On the rock-shaft E there are, outside of the

cylinder, two toes,  $s s'$ , and on the lever F there are two projections,  $t t'$ , which, by the movement of the lever F, are made to act against the said toes to produce a movement of the rock-shaft E, valve C, and pistons N N' as the main piston arrives near the end of its stroke, such movement of the valve and pistons N N' bringing them to a position from which the action of the steam on one of the said pistons will complete the movement of the valve to admit steam to the main cylinder to produce the stroke of the main piston in the opposite direction.

To explain the operation of our invention, we will first suppose the piston to be moving to the left with reference to Figs. 1 and 2, and to have nearly completed its stroke in that direction, as represented in Fig. 1. Just before the piston arrives in the position indicated in the latter figure, the lever F actuated by the arm H of the piston-rod and the rod G, brings its projection  $t$  into contact with the toe  $s$  on the rock-shaft E, and as the movement continues to that position it produces such a movement of the said rock-shaft that the arm I brings the valve C to a central position, in which it shuts off steam from both ports  $a a'$ , and brings the pistons N N' to such position as to slightly open the port  $q$  and to commence the opening of the port  $m'$  to the port  $n'$ , as represented. Steam then enters the cylinder M from the valve-chest B, and, acting upon the piston N, moves the two pistons rapidly to the right, and these pistons, by means of the rock-shaft and its arms I I', move the valve C to the left far enough for the latter to open the port  $a$  to the steam, as shown in Fig. 2, and steam, then entering the main cylinder A at the left-hand end, produces the movement of the main piston to the right. During the first part of the last-mentioned movement of the pistons N N' the steam which has been contained between the piston N' and the right-hand end of the cylinder M escapes through the ports  $n n'$ . As the main piston arrives near the end of its

stroke in a right-hand direction the projection  $t'$  on the lever F acts upon the toe  $s'$  of the rock-shaft in the same manner in which  $t$  previously acted on  $s$ , as hereinbefore described, but in an opposite direction, and so brings the valve C to its central position and the pistons N N' to such position that N' commences to open the port  $q'$  to the steam from the valve-chest, which, entering the cylinder M, produces the movement of the pistons N N' to the left and the valve C to the right, and so admits steam through the port  $a'$ , to again produce the movement of the main piston to the left. These alternating operations are repeated as the piston approaches alternately one and the other end of its stroke.

It should be remembered that in order that the ports  $q$  and  $q'$  may be slightly opened when the valve C arrives at its central position, closing both ports  $a a'$ , the arm I of the rock-shaft should have a slight amount of play within the mortise  $d$  in a direction lengthwise of the cylinders A and B.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The cylinder M, with ports  $q q'$  and  $n n'$  communicating with the main valve-chest and exhaust-pipe, and its two contained pistons, N N', having ports  $m m'$ , and connected with the valve C by means of the two arms I I' of the rock-shaft E, the whole arranged and operating substantially as herein specified.

2. In connection with the pistons N N' and the valve C, connected by the arms of a rock-shaft, E, running through the valve-chest, the lever F, oscillating loosely on the said rock-shaft, connected with the main piston-rod and furnished with projections  $t t'$ , operating on the toes  $s s'$  of the rock-shaft, all substantially as herein described.

WM. H. GUILD.  
W. F. GARRISON.

Witnesses:

J. W. COOMBS,  
A. LE CLERC.