(No Model.) 3 Sheets—Sheet 1.

M. W. HALL.

STEAM ENGINE.

No. 255,854. Patented Apr. 4, 1882.

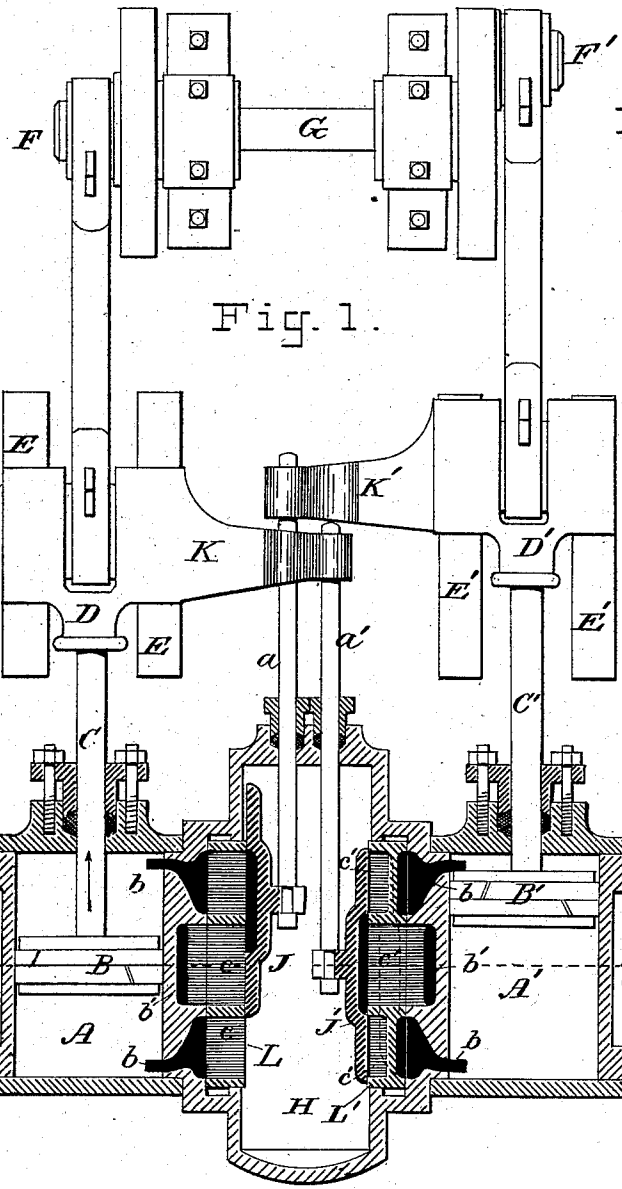


Fig. 1.

Fig. 4.

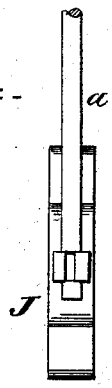
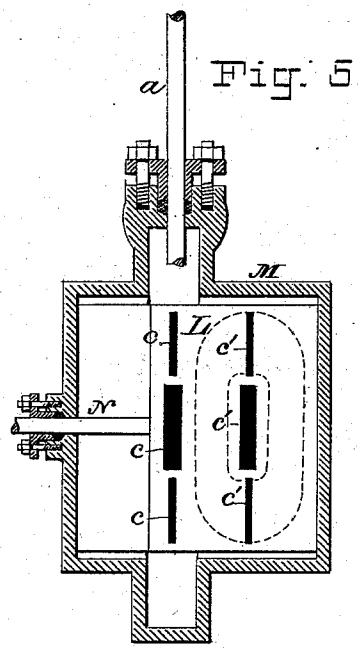


Fig. 5.



ATTEST:

E. B. Bolton

Walter W. Smith

INVENTOR:

Milan W. Hall

by Atty.

Burke, Fraser & Bennett.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

M. W. HALL.

STEAM ENGINE.

No. 255,854. Patented Apr. 4, 1882.

Fig. 2.

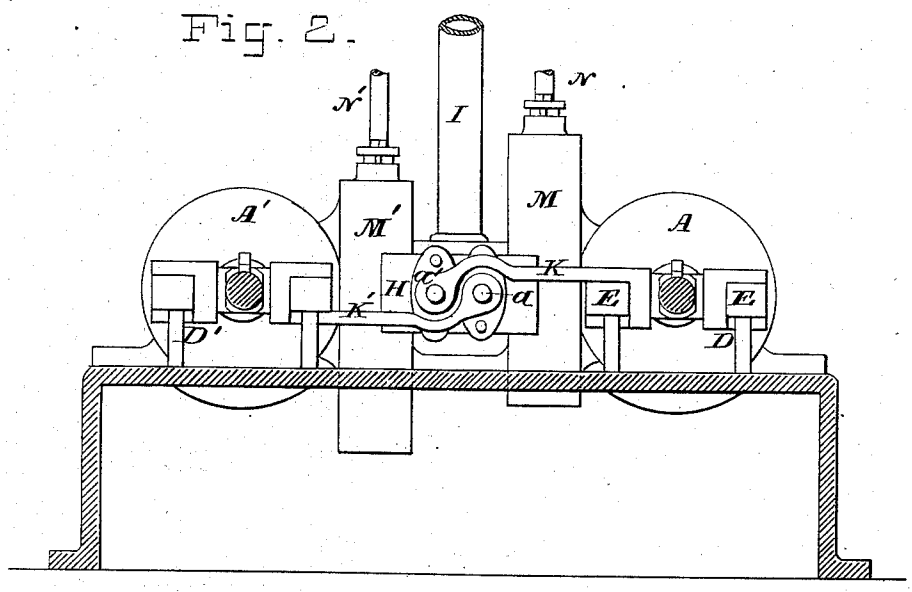
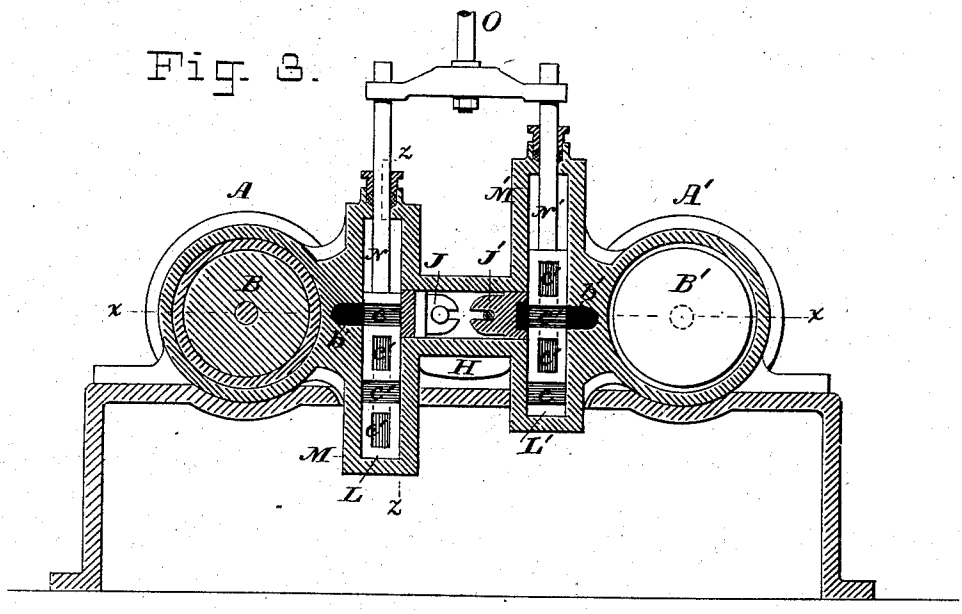


Fig. 3.



ATTEST:

E. B. Bolton

Walter W. Scott

INVENTOR:

Milan W. Hall

by Attys.

Burke, Fraser & Connett

N. PETERS. Photo-Lithographer, Washington, D. C.

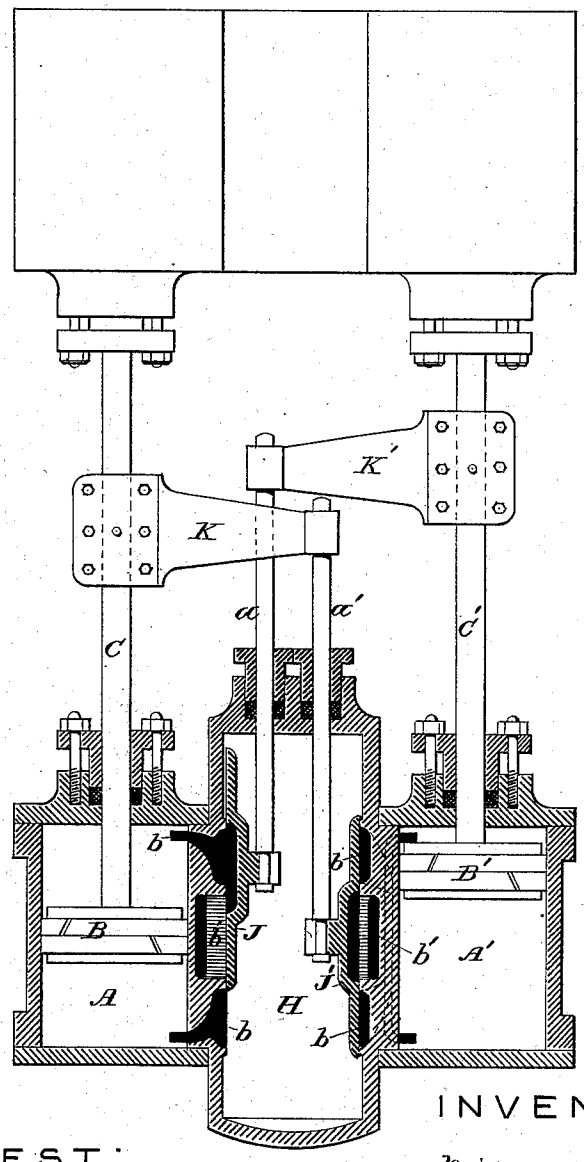
(No Model.) 3 Sheets—Sheet 3.

M. W. HALL.

STEAM ENGINE.

No. 255,854. Patented Apr. 4, 1882.

Fig. 6.



ATTEST:

E. B. Bolton

Walter W. Scott

INVENTOR:

Milan W. Hall

by Attys.

Burke, Fraser & Connett

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

MILAN W. HALL, OF PLAINFIELD, NEW JERSEY, ASSIGNOR OF ONE-HALF TO ALBERT E. HALL, OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 255,854, dated April 4, 1882.

Application filed February 5, 1881. (No model.)

To all whom it may concern:

Be it known that I, MILAN W. HALL, a citizen of the United States, residing in Plainfield, Union county, New Jersey, have invented certain Improvements in Steam-Engines, of which the following is a specification.

This invention relates to that class of engines which employ two cylinders, the piston in one cylinder operating the valve which controls the admission of steam to the other cylinder.

The novel features consist partly in the construction and arrangement of the valves, ports, &c., and partly in the construction and arrangement of the reversing mechanism.

In the drawings, which serve to illustrate my invention, Figure 1 is a sectional plan, the cylinders, valve-chest, &c., being in horizontal section in the plane of the line *x x* in Fig. 3. Fig. 2 is a front elevation of the engine from in front of the cross-heads. Fig. 3 is a cross-section of the engine, taken in the plane of the line *y y* in Fig. 1. Fig. 4 is a plan of the valve detached. Fig. 5 is a detached sectional view on line *z z*, Fig. 3, arranged to illustrate the reversing mechanism. Fig. 6 is a sectional plan arranged to illustrate my improved engine without the reversing mechanism, as applied direct.

Referring to the first five figures of the drawings, A A′ are twin cylinders, provided with the usual pistons, B B′, piston-rods C C′, cross-heads D D′, cross-head guides E E, suitable connecting-rods, and cranks F F′, fixed at right angles to each other on shaft G.

H is a steam-chest, arranged to receive steam in the usual manner through a pipe, I. This steam-chest is arranged for convenience between the cylinders, and is employed in common for the valves in both engines. It might, however, be divided by a partition into two chests, and each be arranged to receive steam independently of the other.

J J′ are the valves, which operate generally as ordinary slide-valves, but have some peculiarities of construction and arrangement. These valves are connected by means of rods *a a′* with arms K K′, which project inwardly from the cross-heads D D′. It will be seen that the arrangement is such that the valve which controls the ports of one engine is moved or shifted by the movement of the piston in the other, and that the valve-stroke equals the piston-stroke, the two being coupled indirectly together. The valve is long and narrow, and the ports *b b b′* in the cylinders are also long and narrow to correspond, their form and arrangement in this particular being precisely the reverse of that in other engines as ordinarily constructed.

L L′ are what I denominate "port-plates," which are interposed between the valves and the ports. These are supplied with ports or apertures *c c′* and passages which form a means of communication between the ports in the cylinder, and the valve and steam-chest. The port-plates are arranged to form seats for the valves, and play vertically when the engines are to be reversed, as will be described.

In Fig 1, I have shown the steam-ports *b b* arranged to open directly into the cylinders in both engines; but it is necessary in my arrangement that these ports should be crossed in one engine—that is, that the port uncovered at the "out" end of the cylinder shall admit steam to the "in" end, and vice versa. This will be obvious without further explanation. To accomplish this result, however, I cross the ports or port-passages in the port-plate instead, as the preferable construction, as indicated by the dotted lines in Fig. 5.

I have shown the piston B at half-stroke and moving in the direction of the arrow, and the piston B′ at the end of its out-stroke and ready to return. The first movement of the piston B beyond the half stroke will carry forward the valve J′ of cylinder A′ and uncover an inlet-port, *c*, in the port-plate, which admits steam (through a port, *b*, in the cylinder) in front of the piston B′ and starts it back on its return-stroke. In moving back it carries back the valve J of the other cylinder, and when the piston B reaches the end of its out-stroke, the piston B′ will have reached the middle of its stroke, and carried the valve J far enough to uncover the port and admit steam in front of piston B. Thus each piston in its travel alternately opens and closes the ports of the cylinder adjacent, and the valves travel the same distance as the pistons, and are coupled rigidly but indirectly to them.

Referring to Figs. 3 and 5, I will now describe the mechanism for reversing the engines.

The port-plates L L′ are arranged to slide up and down in the slide-chests M M′, connected with the steam-chest. Only one of these port-plates, L, is shown in Fig. 5; but it will be understood by reference to Figs. 1 and 3 that the crossed ports *c′ c′* in the plate L′ are arranged above the plain ports *c;* or it may be assumed that the plate L′ is precisely like the plate L, but inverted in position, so that when both plates are down, as in Fig. 3, the plain ports in L will coincide with the cylinder-ports, while in L′ the cross-ports will so coincide.

To the port-plates are affixed stems N N′, by which they can be moved up and down, and these stems may be yoked together, as in Fig. 3, so that they can be operated simultaneously by one stem or rod O. I have not shown any mechanism for operating the port-plates, and any means may be employed. When the engines are to be reversed the port-plates are simultaneously lifted until the lower ports in each plate are brought to coincide with the cylinder-ports, and as this shifts the crossed ports from one engine to the other, as will be readily understood, the conditions of admission of steam will be reversed and the shaft G will be rotated in the opposite direction.

In lieu of shifting the port-plates vertically, I may arrange them to be moved horizontally; or they might be made in the form of segments or quadrants and arranged to turn on an axis. The main point is to shift the crossed ports from one side to the other.

Instead of arranging the valves in the same horizontal plane and causing the arms K K′ to lap past each other and arch over the valve-stems, I may set the valves in the same vertical plane, one above the other, and arrange the ports and passages to suit; or I may even arrange the valves in different horizontal planes, but not in the same vertical plane.

The cylinders may be set in a vertical, horizontal, or inclined position.

In Fig. 6 I have shown my improved engine applied directly to a pump without the intervention of a rotative mechanism. In this construction the piston-rods are not connected in any way, and the reversing mechanism is omitted. Otherwise the construction is the same as that shown in Fig. 1, except that the ports or port-passages in the cylinder A′ are crossed, for obvious reasons.

As my valve is narrow, it will be found that notwithstanding its unusual length it has little more area for the steam to press on than the ordinary slide-valve; and to lessen the area of pressure still more I raise the seat of the valve slightly, so that when the valve passes its central position over the ports the laps at its ends pass out beyond the seat, so that the steam may get beneath them, and thus relieve the pressure.

I am aware that it is not new to operate the valve controlling the admission of steam to one cylinder by the piston which plays in the adjacent cylinder, and that sliding port-plates for reversing are not, broadly considered, new; but I am not aware that my herein-described construction and arrangement of these parts has ever before been known or used.

Having thus described my invention, I claim—

1. A steam or other engine employing a slide-valve and the usual inlet and exhaust ports, in which the valve has a stroke equal in length to the piston, and the longest axis of the port-opening under the valve is in the plane of travel of the valve, substantially as set forth.

2. The combination, with the two cylinders and their pistons, rods, cranks, common shaft, and valves, actuated as shown, of the two port-plates L L′, yoked together and arranged to be shifted simultaneously, said port-plates being provided with one set of plain and one set of crossed ports, arranged inversely in the two plates, whereby, when the plates are shifted, the crossed ports of one plate will be brought into play and those of the other plate thrown out, substantially as and for the purposes set forth.

3. In a duplex engine, the combination of two steam-cylinders, one provided with direct steam-ports, and the other with crossed steam-ports, two slide-valves controlling said ports, two piston-rods, and mechanism connecting the piston-rod of each engine with the valve of the opposite engine, for moving said valves in the same direction as said piston-rods, substantially as specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

MILAN W. HALL.

Witnesses:
HENRY CONNETT,
GEO. BAINTON.