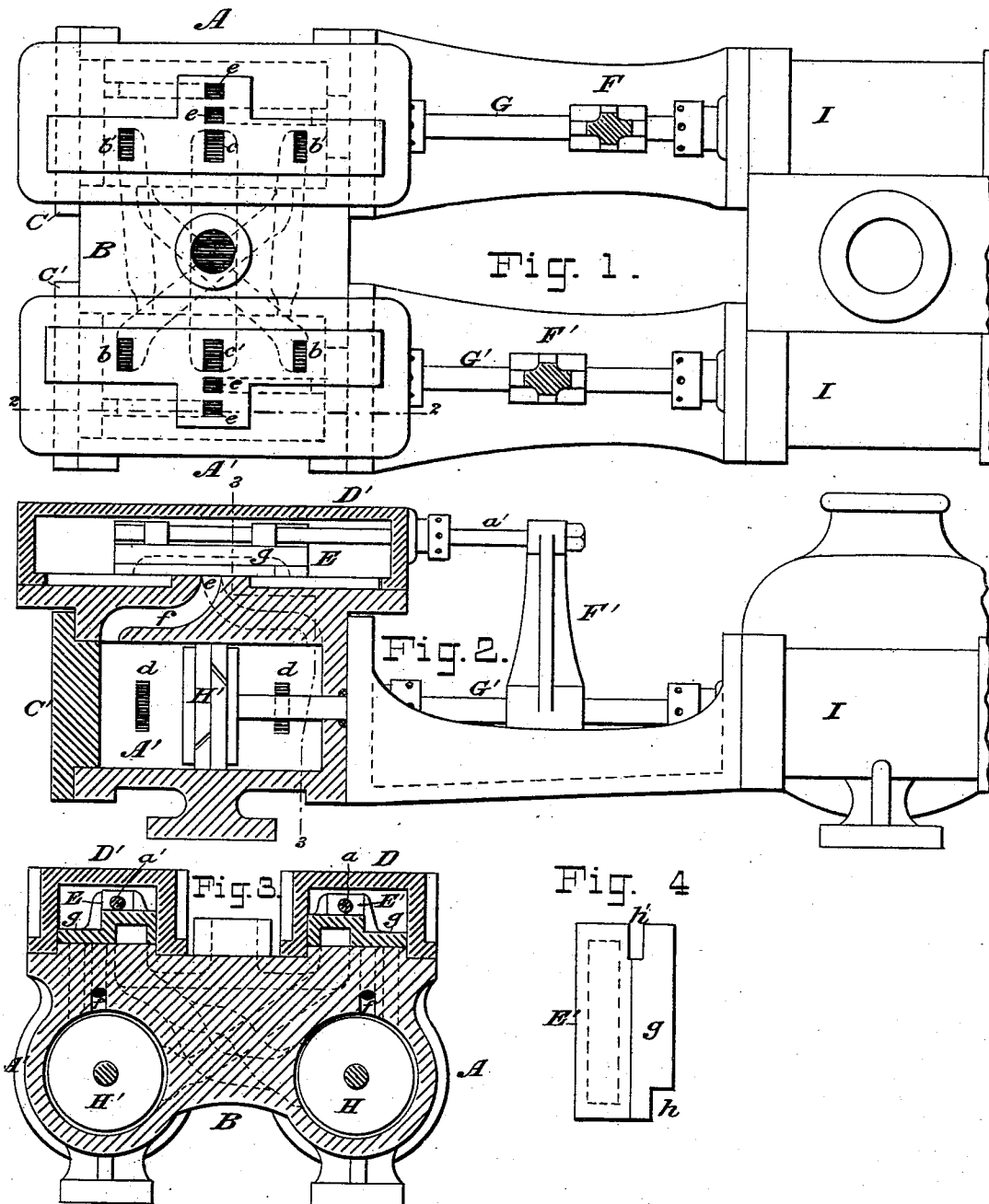


(No Model.)

M. W. HALL.
STEAM ENGINE.

No. 253,696.

Patented Feb. 14, 1882.



WITNESSES:

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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. 253,696, dated February 14, 1882.

Application filed June 3, 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 new and useful Improvements in Steam-Engines, of which the following is a specification.

This invention relates in the main to a double-cylinder engine arranged to act directly upon the pistons of a double-cylinder pump. The engine is of that class wherein the piston of one cylinder controls the admission of steam to the other cylinder, and the valve which controls the ingress and egress of steam has a stroke equal to the stroke of the piston, and is actuated directly by the piston.

The principal feature of the invention consists in the peculiar construction and arrangement of the valve, whereby it controls the ordinary inlet and exhaust ports of one cylinder and what may be called the "cushion"-ports of the other cylinder, whereby a regular reciprocating movement of the piston is attained.

The novel features of this invention will be definitely set forth in the claims.

In the drawings, which serve to illustrate my invention, Figure 1 is a plan of the engine with the steam chests and valves removed. Fig. 2 is a sectional elevation, the part in section being taken on the plane of the line 2 2 in Fig. 1. Fig. 3 is a transverse vertical section taken in the plane of the line 3 3 in Fig. 2. Fig. 4 is a plan of the valve.

A A' are two cylinders of like size, preferably cast in one piece, and the steam-ports cored out in the tie-piece B. The outer heads, C C', of the cylinders are removable. The others may be cast with the cylinders.

D D' are the steam-chests, and E E' the valves which control the ingress and egress of steam at the ports. The stems a a' of the valves are secured to arms F F', mounted on the piston-rods G G'. To one end of the piston-rods are secured the engine-pistons H H', and to the other ends the pistons of the pumps I I'.

Referring to Figs. 1 and 3, b b' b' are the inlet-ports, and c c' the exhaust-ports. The ports b b' admit steam by means of crossed passages (shown in dotted lines) to the cylinder

A, the admission being controlled by the valve E, and the ports b' b' admit steam through straight or direct passages to the cylinder A', the admission being controlled by the valve E'. The passages do not open into the cylinders at or near their ends, as in engines of ordinary construction, but at a little distance from the end, as shown at d d in Fig. 2. The object of this will be hereinafter explained.

So far as described the operation is as follows: The piston in the cylinder A has reached the end of its outstroke (see Fig. 1) and is ready to start back, while the piston in A' has reached the middle of its stroke, moving outwardly. The continued movement of the piston H' carries the valve E far enough to uncover a port, b, and admit steam in front of the piston H and drive it back. The piston H' moves on to the end of its outstroke, when the piston H will have moved the valve E far enough back to uncover a port, b', and admit steam in front of piston H'. Thus each piston, by actuating the valve which controls the movements of the other, is given a reciprocating movement. It is found in practice, however, that when the two piston-rods are not connected through the medium of a rotating shaft and cranks, or some similar device, the movements of the pistons will be irregular, and they will drive forcibly against the ends of the cylinders, and this difficulty is further increased by any irregularity or difference in the resistance offered by the pump-pistons. To obviate these difficulties each cylinder is provided with two ports, e e, which may be called "cushion"-ports, arranged side by side, and connected with port-passages f f, which open into the cylinder at its extreme ends. These ports are controlled by a laterally-projecting flange, g, on the valve, which is cut away at h h', so as to uncover the port at the proper moment. Thus the recess or notch h will coincide with the outside port, e, when the valve reaches the end of its instroke, while the other notch, h', will coincide with the inside port when the valve reaches the end of its outstroke. Now, when the piston H', for example, nears the end of its outstroke it presses the main steam-inlet d and cuts it off, and simultaneously the valve

E, borne along by piston H', uncovers a cushion-port, *e*, and admits steam at full pressure in front of the piston. This serves to catch it and prevent it from striking the cylinder-head, as well as to start it back past the inlet *d*. At the instant this inlet is uncovered the valve will have started back far enough to cover the cushion-port again and cut off steam through that passage. This is the position of the piston in cylinder A, Fig. 1, and at this juncture the movement of the piston in the adjacent cylinder should uncover the proper port and admit steam in front of this piston to continue its movement, and such will be the case under all ordinary circumstances. If it should not, however, the piston will stand still until the other has reached the proper point.

The object attained by placing the inlet *d* far enough from the end of the cylinder to close it as it nears the termination of its stroke will now be obvious. If it were left open to the exhaust, the steam entering at the cushion-port would be exhausted and do no good. With this arrangement the engine may be run under a full head of steam without danger of hammering or driving off the cylinder-head, and without the necessity of connecting the two piston-rods by a crank-shaft or other device.

By casting the cylinders in one piece and coring out the port-passages in the tie between them the valve may be seated in the same vertical plane with the piston-rod which actuates it, which is an important advantage. It also simplifies the arrangement of the cushion-port passages.

It will be seen by inspection of Fig. 4 that the flange *g* on the valve is equal in length to the valve, and if the recesses or notches *h h'* were not cut in it the ports *e e* would not be uncovered by the play of the valve. This construction is rendered necessary by the arrangement of the ports side by side. By arranging the ports differently this might be avoided. It is only essential that the proper port be uncovered at the proper time, and the ports might be arranged on opposite sides of the valve.

Having thus described my invention, I claim—

1. A steam-engine having two cylinders, two pistons with their piston-rods, and two slide-valves, the valves having a stroke equal

to that of the pistons and actuated directly thereby, and the piston in one cylinder actuating the valve which controls the admission of steam to actuate the piston of the adjacent cylinder, and which also controls the admission of steam as a cushion in front of the piston which actuates it, substantially as and for the purposes set forth.

2. A steam-engine comprising two cylinders, A A', two pistons arranged to move therein, two piston-rods attached to said pistons, two steam-chests, and two slide valves, E E', connected directly with the piston-rods, and having a stroke equal to that of the pistons, the valve E being arranged to control ports for admitting steam to actuate the piston in cylinder A, and to control also cushion-ports *e e* for admitting steam to cylinder A', and the valve E' being arranged to control ports for admitting steam to actuate the piston in cylinder A', and to control also cushion-ports *e e* for admitting steam to cylinder A, all arranged to operate substantially as and for the purposes set forth.

3. A steam-engine having two cylinders, two pistons, their piston-rods, and two slide-valves, the valve which controls the admission of steam to one cylinder being actuated by the piston in the adjacent cylinder, and also arranged to control the admission of steam as a cushion in front of the piston which actuates it, substantially as and for the purposes set forth.

4. A steam-engine having two cylinders, two pistons, their piston-rods, and two slide-valves, each cylinder having the usual steam-ports opening into it, and in addition to these two cushion-ports opening into it nearer its ends than the principal steam-ports, the valve which controls the admission of steam for driving the piston of one cylinder being actuated by the piston of the adjacent cylinder, and being arranged to control the cushion-ports of the cylinder whose piston actuates it, substantially as and for the purposes set forth.

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

MILAN W. HALL.

Witnesses:

HENRY CONNETT,
ARTHUR C. FRASER.