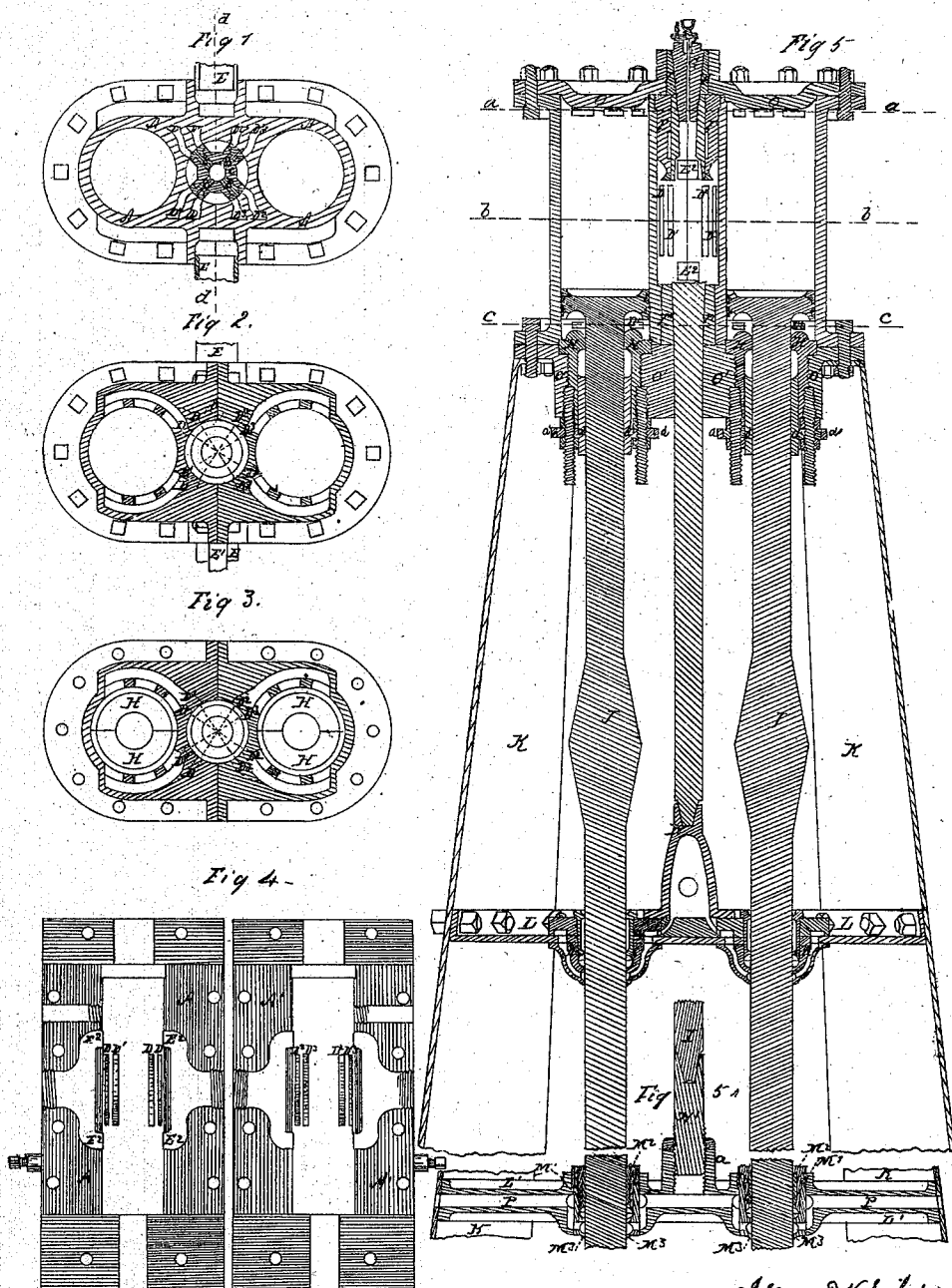


I. W. FORBES.

Improvement in Steam Engines.

No. 115,301.

Patented May 30, 1871.



Witnesses

W. H. Fowler
J. J. Payton

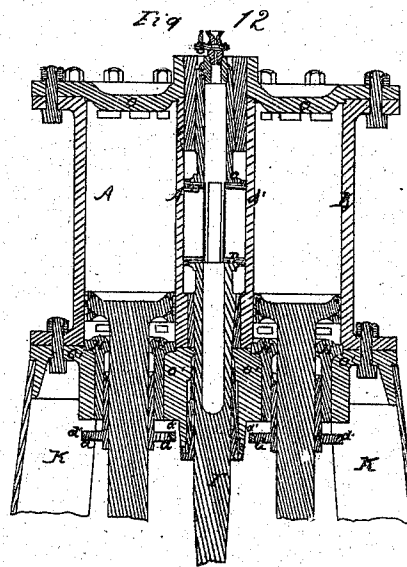
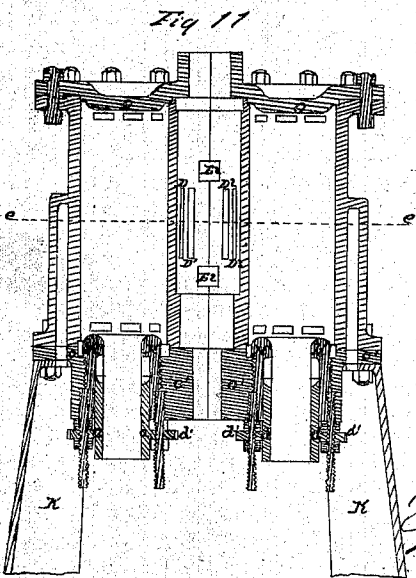
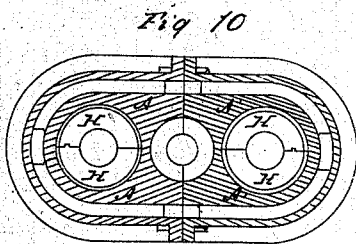
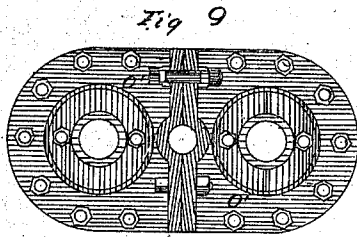
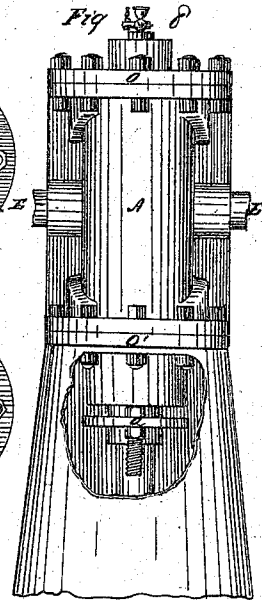
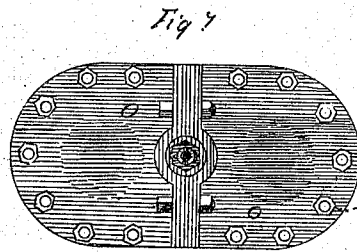
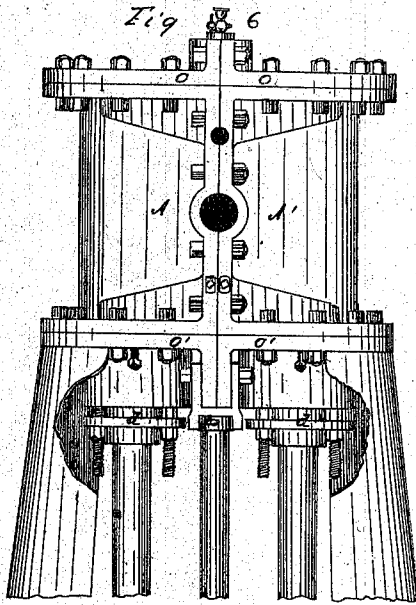
Isaac W. Forbes
Inventor

I. W. FORBES.

Improvement in Steam Engines.

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Inventor
Isaac W. Forbes

Witnesses
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W. J. Lytton

UNITED STATES PATENT OFFICE.

ISAAC WILLIAM FORBES, OF LA PORTE, INDIANA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 115,301, dated May 30, 1871.

To all whom it may concern:

Be it known that I, ISAAC WILLIAM FORBES, of La Porte, in the county of La Porte and State of Indiana, have invented certain Improvements in Steam-Engines, of which the following is a specification:

The object of the invention is to produce a steam-engine by means of which a variable stroke of the piston-rod may be had, if required, at least in one direction. Such engines are used more especially in direct-acting quartz-batteries, pumps, reciprocating saws, steam-hammers, rock-drills, mortise-machines, and others of a like character.

In the accompanying drawing, Figure 1 is a cross-sectional view of the cylinders and valve, shown by dotted line *b b* in Fig. 5, which has the valve out at that line while this has it in. Fig. 2 is a cross-section of the same cylinders, as viewed from the top, at dotted line *a a* in Fig. 5, with everything removed out of the valve-seat. Fig. 3 is a cross-sectional view of the same cylinders, as viewed from the top, at dotted line *c c* in Fig. 5, with everything removed out of the cylinders and valve-chamber. Fig. 4 shows the cylinders and heads apart, ready for being bolted together, looking at them internally when separated at the dotted line *d d* in Fig. 1. Fig. 5 is a longitudinal central sectional view of this improved steam-engine when used as a stamp-battery with a portion of the frame and the stamp-stems broken off, with the guide-plate through which the stamp-stems pass, with water-chamber under the stand of the valve-stem for conveying water around each stamp below the stuffing-box and bearing off the stamp-stems, a portion of the valve-stem and the valve being removed from the valve-chamber, the induction-ports and exhaust-ports being exposed. Fig. 5^a is a longitudinal central sectional view of a guide-plate for the quartz-battery, forming that portion of the frame which connects the two sides together, and through which the stamp-stems pass, with bearings, showing the passage for water bored out through guide-plate. This differs from that shown in Fig. 5, and may be used instead. Fig. 6 is a full front view of the engine with a portion of each side of the frame torn out, and the lower portion of the frame piston-rods and valve-stems broken off. Fig. 7 is a top view of the upper end of Fig. 6. Fig.

8 is a side view of Fig. 6 with a portion of the frame torn out and the lower end broken off. Fig. 9 is a bottom view of the lower head or heads of the cylinders when made in two pieces. Fig. 10 is a cross-section, showing the method of coring out the cylinders so as to exhaust through the lower head, or it may pass around one cylinder and then pass off. The sectional surface in this figure is shown by dotted line *e e* in Fig. 11. Fig. 11 is a longitudinal central sectional view of Fig. 10 with a portion of the frame attached, the lower portion being broken off. Fig. 12 is a longitudinal central section of the same engine, excepting in the method of taking in steam, and a slight variation in the valve-frame, and the depth of the hole in the stem through which steam passes from the feed-pipe to the valve. In this case steam is taken in through the flange of the lower head (which is cast together) of the valve-stem between the double stuffing-boxes. This method is preferable to that described in previous figures.

General Description.

A A' are cylinders. B B are valves. C is the valve-frame. Steam is received in the stem or frame of this fourfold valve and passes through the center of each valve-piece to its proper port, as the openings through the valves pass over the respective ports. D D and D² D² are companion-ports. D D lead to the upper end of cylinder A. D² D² lead, at the same time, to the lower end of cylinder A' A'. Steam being taken in at the upper end of cylinder A and the lower end of cylinder A', it will move the piston of cylinder A down at the same time that the piston of cylinder A' is moved up, when the valve is reversed and steam exhausted in the upper end of cylinder A and the lower end of cylinder A' in the valve-chamber outside of valves through exhaust-ports, when the steam is at once taken in ports D¹ D¹ D³ D³, which are companion-ports, D¹ D¹ leading to the lower end of cylinder A, while D³ D³ lead to the upper end of cylinder A' and reverses the motion of pistons; hence one piston is always being driven up while the other is being driven down. To make this more complete when used as an automatic direct-acting quartz-battery the steam-passage through the valve had better be on one side

of the center, next to the ports leading to the upper end of each cylinder. E E are exhaust-pipes. E¹ is an induction steam-pipe. E² E² are exhaust-ports. F F is the thimble in the upper end of the valve, fitting the valve-chamber and the valve-stem; also, through which steam passes, through the induction steam-pipe, into the valve-stem and frame. F¹ F¹ is taper thimble fitting in the hole bored out in the upper head to receive it. F² is taper thimble fitting in the lower end of the valve-chamber at the lower end of the cylinder, and which is also designed as a bearing for the valve-stem. As it wears it may be raised up by a set-screw or washer, &c., slipped under, which will take up lost motion and form a complete bearing. G is a taper plug designed to fit in the upper end of the valve-stem, screwed down with an oil-cup in the top, through which the cylinders are oiled, and which also fits the taper thimble to form an upper bearing for the upper portion of the valve-stem, designed to screw down as it wears and take up lost motion. H H are pieces dressed up to form a steam-tight joint in their center, with groove and tongue upon one side, holding them in position while being bored out for stuffing-boxes, and fitting their piston-rods, and turned off at the upper end for fitting the lower portion of the piston and the piston-rod, and filling the recess in the lower end of the engine, and turned off on the outside to fill the holes which are bored out through the lower heads to receive them. They are driven in their position after the piston-rods are passed through the heads, forming a complete joint as though the head were of one piece, or they may be screwed in. Holes are drilled in the joints between these pieces and the flanges in which they are driven for receiving the studs of the glands of the stuffing-boxes. I is the valve-stem. J J are inclines or swells on the piston-rods and stamp-stems. K K is the frame. L L, center plates or frame-work bolted to the frame, to which bearings are connected through which stamp-stems pass; M M, bearings, with glands and stuffing-boxes, their bearings being in the glands, with water-chambers below for conveying water through the channels around the stamp-stems for keeping the same clean and supplying the battery below with water when wet crushing is required. When dry crushing is required air or

steam may be substituted for water. N' is a bearing for the lower portion of the valve-stem; also, a chamber, which receives water for keeping the stamp-stems clean and supplying the battery. O O, the upper head or heads of cylinders. O' O', lower head or heads of cylinders. In Fig. 5^a, L' is the guide-plate, varying from that in Fig. 5; P P, water-passages, cored out through the plate which passes through the frame and conveys water around the stamp-stem, and so in the battery; M¹ M¹, stuffing-boxes and water-chambers, which are driven in plate L', and in which glands are screwed for forming the bearing for the stamp-stems to work in. M² M² are glands. M³ M³ are chambers in the lower portion of stuffing-boxes, which pass entirely around the stamp-stem, which convey water around the same, and keeping it clean while not crushing, or, if dry crushing, air or steam may be used instead of water to keep the dust out of the bearing.

When cylinders are cast solid, and it shall be found inconvenient to dress the ports, the valve-seat may be bored out of sufficient area to receive a thimble of sufficient thickness and strength, with ports dressed out to correspond with the valve and ports in the cylinder.

The glands *d d* are divided in the center so as to be slipped on the piston-rods between the piston and swell, after the piston-rods have been put through the lower heads, when bands *d' d'* are shrunk upon the flanges of the glands, securely binding them and making them as of one piece.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The ports D to D³ for receiving and conveying steam to their respective cylinders at opposite ends, as described.
2. The pieces H H, in combination with the lower heads O' O', substantially as and for the purpose described.
3. The combination of the bearing M¹, having a chamber, M³, and a gland, M², substantially as described.
4. The plate L' L' and water-passage P P, substantially as set forth.

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Witnesses:

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W. J. PEYTON.