E. COPE.

STEAM-VALVE.

No. 191,226. Patented May 29, 1877.

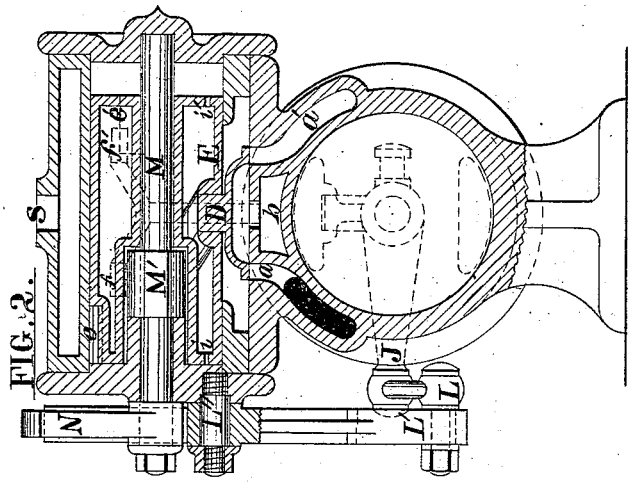

FIG. 2.

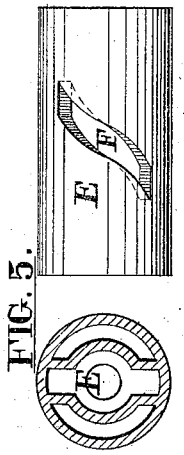

FIG. 5.

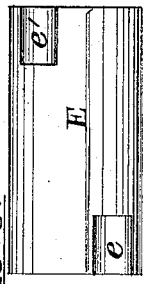

FIG. 6.

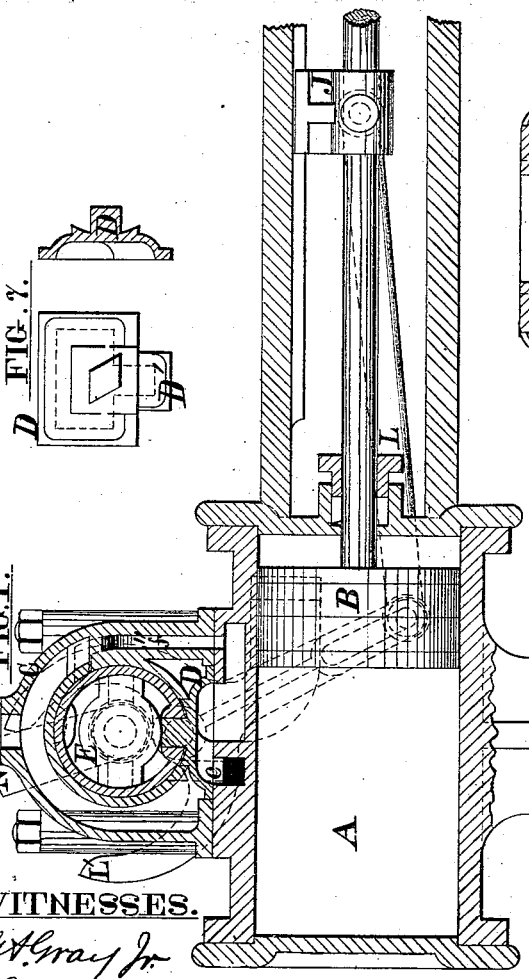

FIG. 1.

FIG. 7.

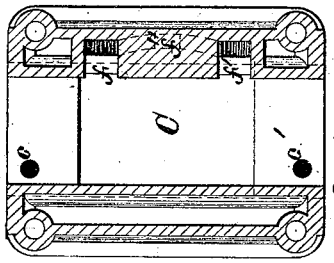

FIG. 4.

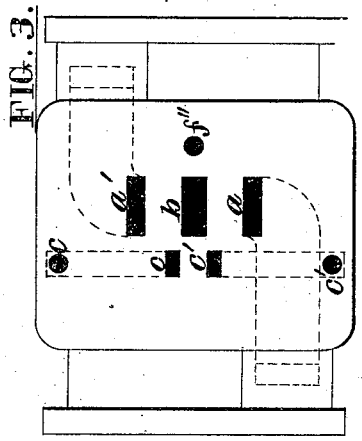

FIG. 3.

WITNESSES.

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EZRA COPE, OF HAMILTON, OHIO.

IMPROVEMENT IN STEAM-VALVES.

Specification forming part of Letters Patent No. **191,226**, dated May 29, 1877; application filed July 12, 1876.

To all whom it may concern:

Be it known that I, EZRA COPE, of the city of Hamilton, county of Butler, and State of Ohio, have invented certain new and useful Improvements in Valves for Steam-Engines; and I declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

The object of my invention is to provide a simple and reliable method of operating the valves of direct-acting engines; and consists in the combination of a plain slide-valve and a valve-piston, in such a manner that the latter, by an oscillating motion, gives the former its initial motion, and at the same time brings certain parts into communication, to give the valve-piston an end motion by the direct pressure of steam, carrying the main valve to the end of its stroke.

This invention will be found to be an improvement on the patent of James R. Maxwell and Ezra Cope, No. 94,015, August 24, 1869.

In the drawings, Figure 1 is a sectional elevation taken longitudinally through the steam-cylinder, and transversely through the steam-chest and valves, the axis of the latter being at right angles to that of the former. Fig. 2 is a sectional elevation taken transversely through the steam-cylinder and lontudinally through the steam-chest and valve. Fig. 3 is a plan of the steam-cylinder, showing the position of the ports. Fig. 4 is a sectional plan of the steam-chest and auxiliary cylinder. Fig. 5 is a transverse section and plan of the valve-piston. Fig. 6 is a view of the valve-piston, showing the exhaust-cavities *e e'*. Fig. 7 is a plan and sectional elevation of the main slide-valve.

A is the main steam-cylinder, and B the main piston. C is the steam-chest, having cast with it an inner shell, C', forming an auxiliary cylinder. The space between the outer and inner shells of the steam-chest forms a steam-jacket, keeping the auxiliary cylinder and valve-piston free from constant changes of temperature. D is the main valve—an ordinary slide-valve with a lateral extension, D'. On its back is a diamond-shaped lug, which enters a spiral slot, F, in the valve-piston E. The valve is guided by flanges on the base of the steam-chest, so that it cannot move to either side; consequently, if the valve-piston E is oscillated, the spiral slot F acts upon the lug on the valve in the manner of a screw, causing it to advance.

The oscillating motion of the valve-piston E carries the main valve to its central position. It then brings one of the cavities *e* or *e'* into communication with one of the ports *f* or *f'*, which unite in a single port, *f''*, communicating with the main exhaust, partially exhausting steam from the auxiliary cylinder C'. The pressures upon the ends of the valve-piston E are thus unbalanced, causing it to start forward. In so doing the main valve is carried forward until its extended portion D' uncovers one of the small ports *c c'*, and brings the other one into communication with the exhaust. Steam is then wholly exhausted from one end of the auxiliary cylinder C', and admitted to the other end, causing the valve-piston E to advance, carrying the main valve to the end of its travel.

The small holes *i i'* admit steam continuously to either end of the auxiliary cylinder, in order that the valve-piston may act promptly when the pressures are unbalanced. The valve-piston is cushioned in the usual manner—viz., by overrunning its exhaust-ports.

The oscillating motion of the valve-piston is imparted to it by means of a forked lever, L', and suitable mechanism, as hereinafter described. The lever has an independent bearing upon a pin, M'', in the steam-chest head. Its motion does not, therefore, affect the valve, except at the proper time, and in the proper manner.

J is an arm or cross-head attached to the piston-rod. L is a connecting-rod between the cross-head J and the swinging lever L'. M is a shaft extending through the valve-piston and steam-chest, having bearings in the steam-chest heads. M' is a dog secured to the shaft M, and entering a recess in the end of the valve-piston, in such a manner that the turning of the shaft will oscillate the valve-piston, and at the same time the latter is allowed free motion endwise. N is an arm attached to the shaft M outside the chest, with which the forks of the lever L are alternately brought into contact, causing the shaft, and

hence the valve-piston, to oscillate, effecting the result hereinbefore described.

The lever L′ may be straight, and attached to the end of the shaft M, the other end being attached to a rod or bar, upon which are tappets. Against these the arm J comes in contact, causing the valve-piston to oscillate in the same manner as before.

The operation is as follows: As shown in the drawings, the main piston has nearly completed its stroke to the right, bringing the right fork of the lever L′ into contact with the arm N, forcing it to the left, and causing the valve-piston E to oscillate in the same direction. The spiral slot F, therefore, causes the main valve to move forward until it reaches its central position.

The cavity e' in the valve-piston E is then brought into communication with the exhaust-port f', partially exhausting steam from the right of the auxiliary cylinder, thus unbalancing the pressures upon the ends of the valve-piston. The latter will then start forward, in the manner hereinbefore described, until the extended portion D′ of the valve uncovers the small port c, through which steam is then admitted to the left of the auxiliary cylinder, and the port c' is brought into communication with the exhaust, exhausting steam from the right end of the auxiliary cylinder.

The valve-piston will then be forced to the right by the pressure of steam, carrying with it the main valve. Steam will then be admitted to the right end of the main cylinder through the port a', and exhausted from its left end through the port a, reversing the stroke of the main piston. At the end of this stroke the same operation will be repeated, again reversing the stroke of the main piston, and so on continuously while steam is supplied.

Should steam fail to move the valve-piston E endwise promptly, the oscillation of the valve-piston will itself carry the main valve over the steam-admission port far enough to admit steam to reverse the main piston.

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

1. The combination of the main valve D and the valve-piston E, the latter having a spiral slot, F, into which a lug upon the main valve enters, whereby the oscillation of the valve-piston causes the main valve to move forward, substantially as described.

2. The main valve D, having a lateral extension, D′, on one side, forming an auxiliary valve, in combination with the ports c c' in the main-valve seat, leading to the ends of the auxiliary cylinder, the auxiliary exhaust-cavity b in the main valve, and the valve-piston E, with its diagonal groove for giving the valve a longitudinal movement, substantially as shown and described.

EZRA COPE.

Witnesses:
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