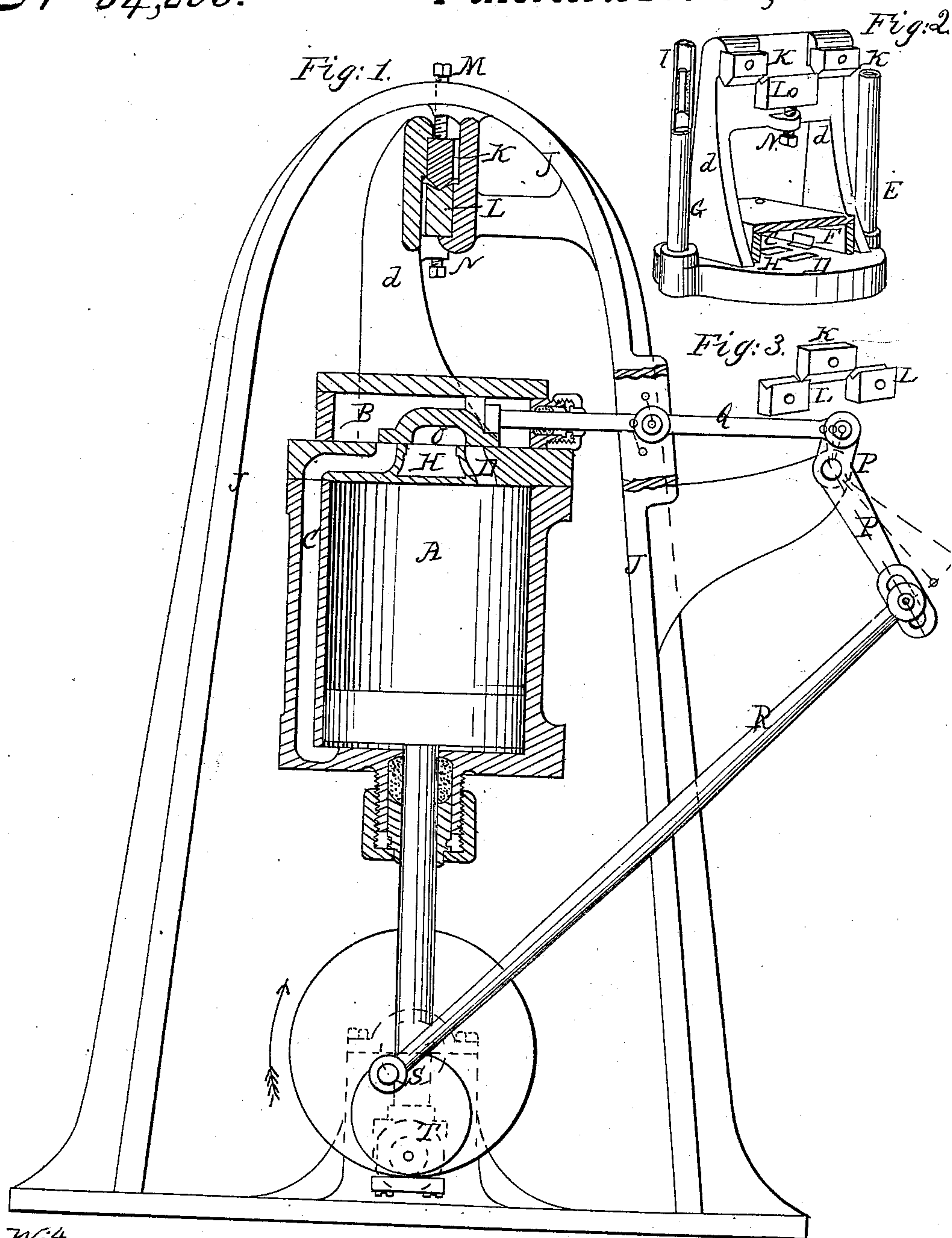


F. Millward,
Oscillating Steam Engine.
N^o 84,206. Patented Nov. 17, 1868.



Witnesses.
Andrew Magle
Chas. Muey

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FRANK MILLWARD, OF CINCINNATI, OHIO, ASSIGNOR TO HIMSELF, DEXTER D. HARDY,
AND HENRY C. DART, OF SAME PLACE.

Letters Patent No. 84,206, dated November 17, 1868.

IMPROVEMENT IN OSCILLATING STEAM-ENGINES.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, FRANK MILLWARD, of Cincinnati, Hamilton county, State of Ohio, have invented certain new and useful Improvements in Oscillating Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

My invention relates to that class of oscillating engines in which the centre of oscillation is at such a distance from the end of the cylinder as to permit of the valve being situated between the cylinder and centre of oscillation, so that the ports of the engine may be opened and closed by the movement of the cylinder; and my invention consists,

First, in the combination and arrangement of the v-shaped joints or hinges, upon which the cylinder of the engine oscillates or vibrates, the frame-work of the engine and its cylinder.

Secondly, in such an arrangement of the pivots with regard to each other, and to the means for adjusting them, that any wear between the parts thereof can be adjusted, and the bearings for the upward and downward pressure of the cylinder be always preserved in line with each other.

Thirdly, in a provision for taking steam and exhausting at points in line with the pivots.

Fourthly, in an independent valve-motion, by which the valve is moved a distance equal to the "lap," and the slight extra distance necessary to give a "lead" to the engine. In other words, this independent motion permits the use of a "lap-valve" in this class of engine, and puts the "lead" on properly.

In the accompanying drawings—

Figure 1 is a sectional elevation of an engine embodying my invention.

Figure 2 is a sectional perspective view.

Figure 3 is a detached view, exhibiting the construction and arrangement of the pivots on the frame.

A is the cylinder, between which and the centre of oscillation the valve-chamber C is situated. This chamber communicates with the ends of the cylinder, through ports C D, with the steam-pipe E through port F, and with the exhaust-pipe G through port H. The pipes E G terminate at the centre of oscillation, and are connected to the ordinary stationary pipes by the flexible interior tube of rubber, I. They may, if preferred, be connected at this point with ordinary swivel couplings, properly packed. It will be seen, in this connection, that the steam has no connection with the centre on which the cylinder oscillates, and therefore the latter is not so liable to become heated in operation.

The cylinder A is connected to the frame J by means of a pivot-joint or hinge, composed of hardened steel male v's, K, and female v's, L.

It will be seen that, of the three male v's, the two

outside are connected to cylinder-bracket a, and the centre one to the frame J, and of the three female v's, the two outside are connected to the frame J, and the centre one to the cylinder-bracket.

When linked together, they will resist upward and downward pressure, and will permit the oscillation of the cylinder under the greatest pressures, with but little if any friction, and, as far as my present experiments extend, without perceptible wear. But it is to allow for possible wear that the male v's are arranged to point in one direction, for if they were to point in opposite directions, and become rounded at the edge, they would "jamb" in oscillation. To take up lost motion in the joint, and to preserve the pivots on an equal bearing, and always in line, it is only necessary to use two adjusting-screws, M N, one in the centre of the frame, and the other in the centre of the cylinder-bracket, a. One great advantage arising from the absence of friction at the centre of oscillation, is, that the side wear on the piston-rod and stuffing-box, and the side scrubbing of the cylinder, are principally obviated. In the operation of oscillating engines, in which the steam is taken through the trunnions, there is an immense amount of friction, (by reason of the size of and pressure on the trunnions,) opposed to the action of the piston-rod and piston in pulling the cylinder over, and the consequence is that the stuffing-box is worn to an oval form, and the cylinder is worn unequally. This is urged as a great objection to oscillating engines. In the engine herein described, this objection is almost entirely obviated, there being so nearly a total absence of friction, that the cylinder will swing over, pendulum-like, by its own gravity, or with but slight aid from the piston-rod.

The ports of the engine are governed by the oscillation of the cylinder under the valve almost entirely, and it is only in order that I may use a "lap-valve," and give a "lead" to the engine that I connect to the valve-stem an independent valve-motion, which is coincident with the motion of the piston, both terminating their strokes at the same time. This motion gives a reciprocating motion to the valve O, to an extent exactly equal to the "lap" and lead only, and it consists of a bell-crank, P, pivoted to the frame at p, link Q, and rod R, the latter being connected to an eccentric-wrist, S, on the disk T.

The rod R is made adjustable in the long arm of the bell-crank P, as shown, in order that the amount of "lead" can be increased or diminished at will.

By the combined action of the cylinder and valve-motion, as described, a better control of the ports of the engine is obtained than is usual in other known devices for operating a single valve. A great width of opening for steam is obtained at a very early part of the stroke; the opening is maintained wide until it is time to cut off, when it is closed rapidly to get the full benefit of expansion.

I have operated this engine successfully in the pendulous position, as shown, and also reversed, horizontal, and inclined. For an oscillating engine with lap and lead, it has been practically proved to be adapted for very cheap manufacture.

I claim herein as new, and of my invention—

1. The combination and arrangement of the frame J, cylinder A, and v-shaped joint or hinge, substantially as shown and described.

2. The arrangement of the pivots K and L, by which the wear between the parts thereof may at any time be taken up, substantially as shown and described.

3. The arrangement of the adjusting-screws M N, with reference to the v-shaped pieces K and L, for the purpose of taking up lost motion and preserving the pivots in line.

4. The oscillating side-pipes E G, and flexible tubes I, for the purpose specified.

5. The arrangement of the independent valve-motion P Q R S, or its mechanical equivalent, for the purpose of reciprocating the valve the short distance equal only to the "lap" of the valve, and the slight additional distance necessary to give a proper "lead" to the engine, substantially as described.

In testimony of which invention, I hereunto set my hand.

FRANK MILLWARD.

Witnesses:

JAMES H. LAYMAN,
JOHN H. MCCARREN.