T. L. Jones,

Compound Engine.

No. 94,891. Patented Sept. 14. 1869.

Fig. 1.

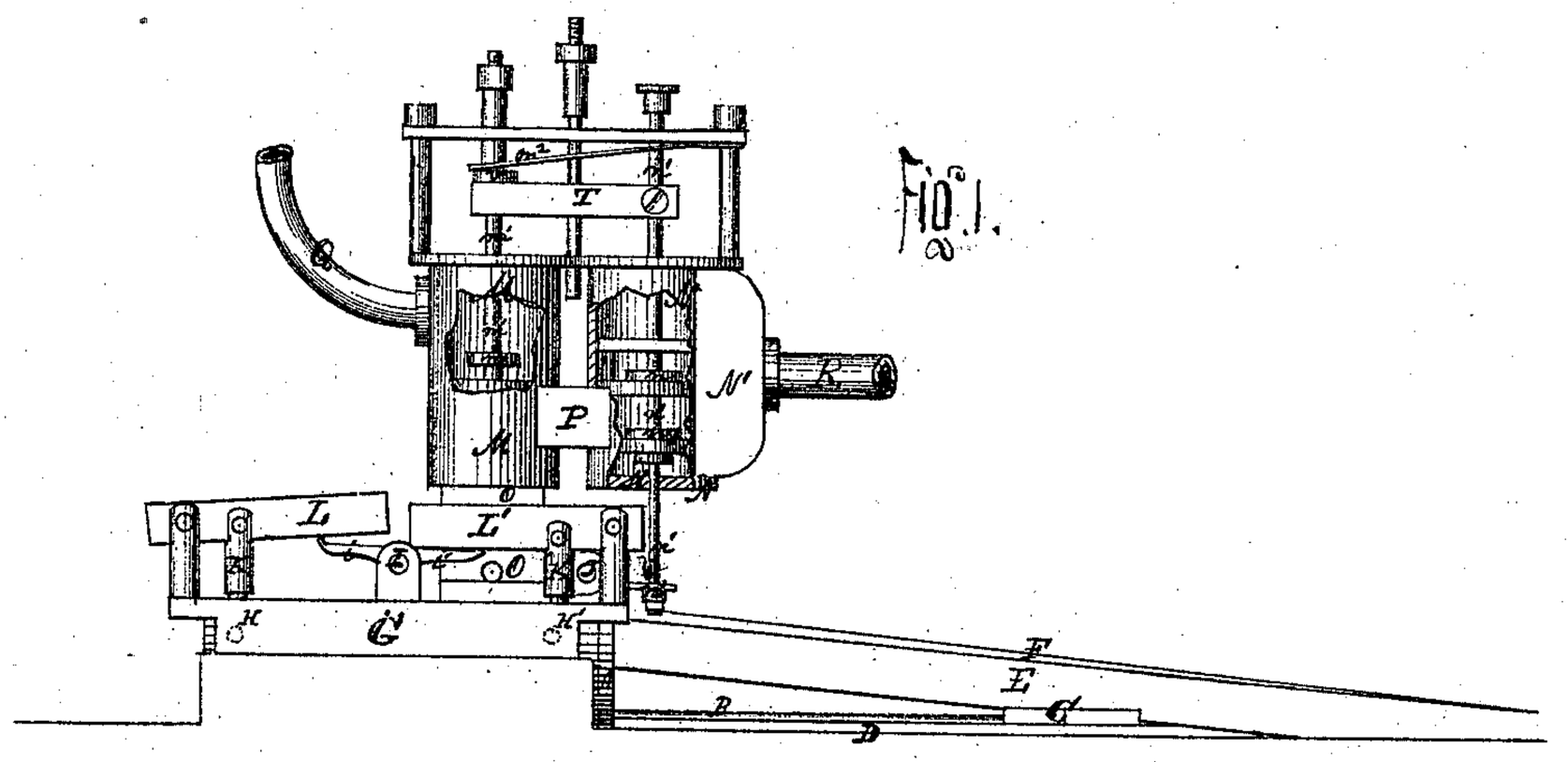


Fig. 2.

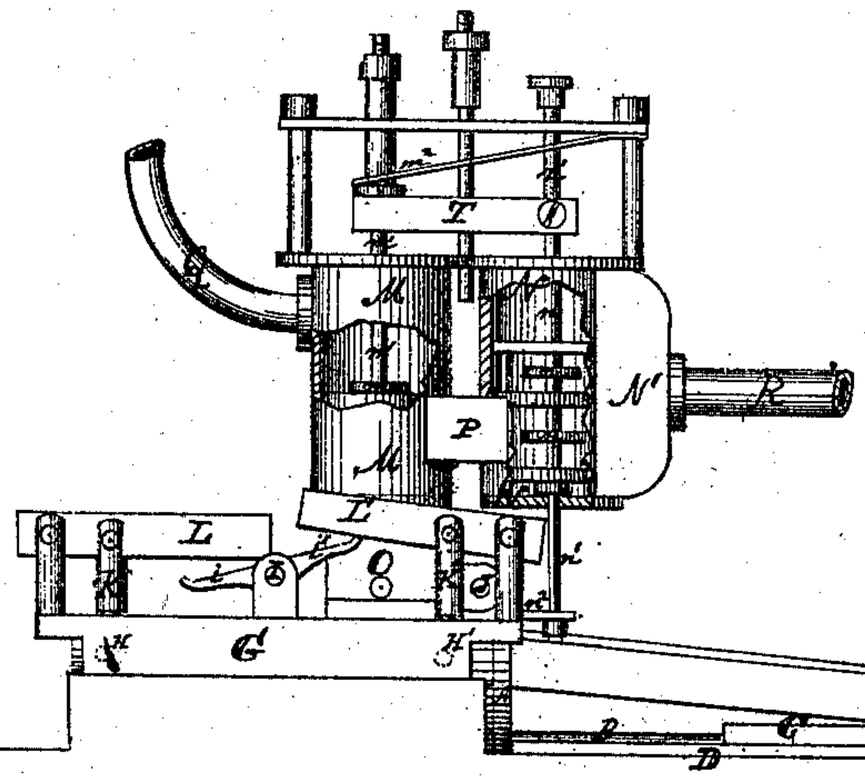
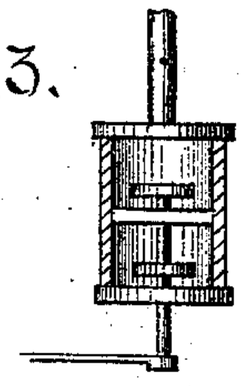


Fig. 3.



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THOMAS L. JONES, OF NATCHEZ, MISSISSIPPI.

Letters Patent No. 94,891, *dated September* 14, 1869.

IMPROVEMENT IN COMBINED HIGH AND LOW-PRESSURE 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, THOMAS L. JONES, of Natchez, in the county of Adams, and State of Mississippi, have invented a new and improved Combined High and Low-Pressure Engine; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figures 1 and 2 are side views, showing the valves in different positions, a portion of the walls of the valve-chests being broken away, to reveal the operation of the parts enclosed therein.

Figure 3 is a detached view of valve *n n'*.

This invention is an adaptation of my combined high and low-pressure steam-engine, patented April 14, 1868, No. 76,776, and consists in a new arrangement of parts, whereby I am enabled to use my atmospheric valve (a portion of my patent) in connection with that form of engines now in use on our western rivers, enabling them, with slight addition of machinery and cost, to retain their present high-pressure steamboat-engines, and, with my improvement, giving them the advantage of a vacuum, increasing the speed of their forty-foot paddle-wheels three or four revolutions per minute, without additional pressure of steam.

This improvement I have practically tested, on a large scale, at Louisville, Kentucky, on one of our river steamboats, and it has proved to work to perfection in all its particulars.

In the drawings—

A is the cylinder-head;

B, the piston-rod;

C, the cross-head;

D, the slide-bars;

E F, two reciprocating rods, which work the valves, themselves operated, by a cam and yoke, from the main shaft;

G, a "side pipe," arranged alongside of the cylinder, on the opposite side to that occupied by the steam-chest, the latter not being shown in the drawings;

I and J, two rock-shafts, the former worked by the rod E, and the latter by the rod F;

i i', a rocking or lifting-lever, affixed to shaft I.

L L', two levers, operated, alternately, by the toes *i i'*.

H H', pipes, leading from the ends of the main cylinder into the side pipe G, at each end of the latter, and shown here in dotted lines;

K K', rods, connecting the levers L L' to valves that open and close pipes H H', respectively, and thus alternately opening a passage for the steam in each end of the main cylinder, to exhaust into the "side pipe" G;

O, a pipe, leading from side pipe G to an upright "atmospheric" valve-chest M;

N, another upright valve-chest, which I denominate the "condenser valve-chest," it being of about the same dimensions as the former, and standing beside it;

P, a steam-passage, connecting the two chests M and N a little below their centre;

Q, a pipe, entering the side of chest M a little above its centre, through which steam exhausts from the valve-chest to the open air;

N', a side pipe, attached to the side of valve-chest N; and

R, a pipe, leading from the centre of side pipe N' to the condenser.

The operation of these several parts is briefly as follows:

When the steam exhausts from the left-hand end of the main cylinder, it passes, through pipe H, into side pipe G, the toe *i* being lifted, so as to open pipe H, and the toe *i'* being depressed, so as to close pipe H' at that moment, as shown in fig. 1

When the steam exhausts from the right-hand end of the main cylinder, it also passes into side pipe G, but through pipe H', lever L' being up, and lever L down, as shown in fig. 2.

From side pipe G, in either case, the steam, under considerable pressure, passes directly into valve-chest M, where it forces up an atmospheric valve, $m\ m^1$, and blows off, through pipe Q, down to an equilibrium with the atmosphere, or fifteen pounds to the square inch.

The valve $m\ m^1$ then falls by its own weight, (assisted, if necessary, by the action of a spring, m^2,) and, at that instant, two balanced valves, connected on one stem, $n\ n^1$, in chest N, open and establish a direct communication from side pipe G to the condenser, through the parts O M P N N' R, and instantly, by the action of the condenser, the remaining fifteen pounds of steam are condensed, and a vacuum produced in the exhaust-end of the main cylinder.

The live steam is being admitted to the opposite end of the main cylinder meanwhile, so that the piston that operates rod B has a vacuum on one side, and a full head of steam on the other side, at the same instant, and thus acts with the combined force of a high-pressure and a low-pressure engine.

The valves $m\ m^1$ and $n\ n^1$ are operated by means of a lifting-foot on shaft J, similar to that shown at *i i'*.

The two valve-stems $m^1\ n^1$ are connected to a cross-

head, T, which is alternately raised and depressed by the action of the rocking-foot, a bent rod connecting the cross-head with the flat block or shoe that rests on the rocking-foot, so that the latter supports the weight of the cross-head, valve-stems, and valves.

The cross-head is fastened rigidly to the valve-stem n^1 by means of a set-screw, but the valve-stem m^1 slides through the cross-head a short distance, which distance is adjusted by means of a stop, v, in order that the steam-pressure, when above fifteen pounds to the inch, may raise valve m, and allow the steam to exhaust to the open air, whatever may be the position of the cross-head and the other valves.

This arrangement not only insures the raising and lowering of valve $m\,m^1$ at the proper instant, but prevents all danger should anything connected with steam-chest N, its valves, or the condenser, get out of order, or refuse to act, since, in such case, the steam would simply blow off without going to the condenser, just as in a simple high-pressure engine. Indeed, it can be made to act as a high-pressure engine alone, by raising the cross-head, and fastening it up, in which position the two balanced condenser-valves $n\,n^1$ will be securely seated, and the valve $m\,m^1$ open.

In my large engines, I provide a sleeve and lever over rock-shaft J, for the special purpose of thus raising the cross-head, and fastening it.

Among other advantages of this arrangement, it enables the engineer to ascertain, at any time, just what gain results from the employment of the condenser-exhaust in addition to the open-air exhaust. He has only to shut off the former, and run the engine awhile, noting the number of revolutions per minute, and then open it, and run the engine an equal time, noting the revolutions, when a comparison of the revolutions made under each condition will show which is most advantageous.

In the large river-boats on which this improvement has been most fully and satisfactorily tested and demonstrated, a gain of three to four revolutions per minute over the high-pressure engine has been noted whenever the combination was employed.

In order to assist in securely shutting the valves n n^1, a spring, n^2, may be provided under the valve-chest.

The valve-rod n^1 will require but little packing, since the chest N is so connected with the condenser that the outward pressure is nearly always neutralized. Indeed, the pressure is generally inward on this chest, so that the steam has no tendency whatever to escape from it, except to the condenser.

The throw of the valves $m\,m^1\,n\,n^1$ may be adjusted by changing their position on their stems, or by adjusting the cross-head or the lifting-foot, or moving the cam employed at the main shaft to work the rod F. It is, therefore, perfectly easy to regulate the working of any part of the apparatus, and it will be especially observed that the engine with my improvement works as well backward as forward.

In fig. 1, the piston is at the right-hand end of the main cylinder, and the exhaust H is opening. Just at this instant, the cross-head raises valve $m\,m^1$, making a free passage from the exhaust-end of the cylinder to the open air, and allowing all but fifteen pounds of steam to blow off. At the same instant, the valve $n\,n^1$ has seated, cutting off the communication with the condenser. As it takes but an instant to blow off all the steam above fifteen pounds, the cross-head now comes down quickly, allowing valve $m\,m^1$ to close, and opening valve $n\,n^1$, so that the remaining fifteen pounds may go to the condenser. The passage to the condenser continues open during the remainder of the stroke, and is only closed when, on the return-stroke, the toe i' opens the exhaust H', at the opposite end of the cylinder. At that instant, it closes momentarily, to allow the newly-exhausted steam to blow off to fifteen pounds, when it again unseats, as shown in fig. 2, and keeps the way to the condenser open to the end of the return-stroke, and so on, as long as the engine is in operation.

The valves $n\,n^1$ are balanced, consisting of a frame, e, two annular rings, $a\,a$, attached to the frame, and working steam-tight in the chest, two circular plates, $n\,n$, opening and closing the central orifice of the annular plates, the frame and annular plates being attached to that part of rod n^1 which is fastened to the cross-head, and the plates $n\,n$ being attached to that part of said rod which extends down through the bottom of the valve-chest, and is connected to the spring.

It will be seen that the rod n^1 is thus in two parts, connected only by the sliding parts $e\,a\,n$, as described.

The construction of this valve is clearly exhibited in fig. 3.

It will be observed that the open-air exhaust Q communicates with the side of the valve-chest M, so that the valve m can rise above it—an arrangement which allows the steam to blow off before the valve reaches the end of its upward throw.

The upper end of the valve-chest, above the orifice Q, thus forms an air-chamber, which cushions the valve, and prevents all jar and shock.

In practice, the valve is found to work as smoothly and silently under full head of steam as if operated by hand.

If necessary, the valve might be made to rise into the mouth of a downward-projecting tube, closed steam and air-tight at its upper end, in which case a perfect air-cushion would be provided for the valve.

I do not wish to confine myself to the particular form of valve shown in fig. 3, but may use any other construction which, adopted in place of that, would answer the purpose as well.

When I employ the form of valve described, as shown, the simplicity and beauty of the operation of the parts are particularly noticeable, the simple vertical movement of the cross-head performing three functions, viz, operating the valve $m\,m^1$, raising and lowering the frame e and annular plates $a\,a$, and moving, at the proper moment, the valve-plates n. It would be difficult to effect such complex movements with simpler mechanism.

Having thus described my invention,

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination of pipe O, valve-chest M, valve n, and pipe Q, when the latter is arranged at the side of the valve-chest, with an air-chamber above it, substantially as set forth.

2. The cross-head T, in combination with the valve-stem n^1, fixed to it by a set-screw, the valve-stem m^1 sliding loosely through it, and the stop v, to regulate the distance which the rod m^1 slides through the cross-head, substantially as and for the purposes set forth.

3. The combination and arrangement of the valve-chests M N, valves $m\,m^1\,n\,n^1$, passage P, pipes Q R, cross-head T, and springs $m^2\,n^2$, substantially as described.

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