

L. HUNTOON.
Compound Steam-Engines.

No. 135,223.

Patented Jan. 28, 1873.

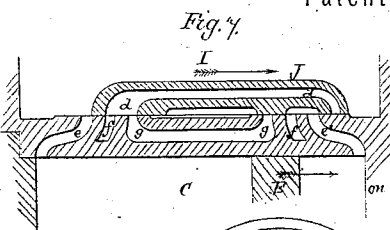
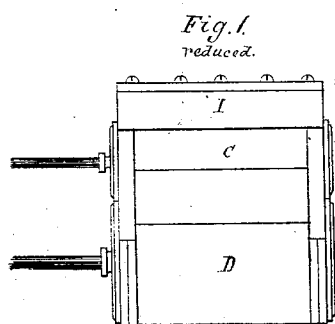


Fig. 2.
on line c.d. of Fig. 4.

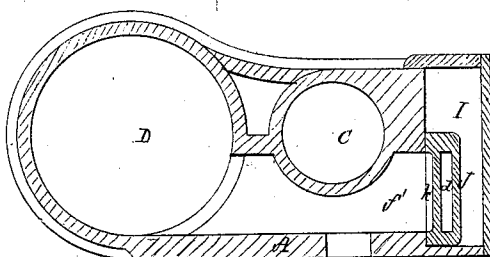


Fig. 3.
on line a.b. of Fig. 4.

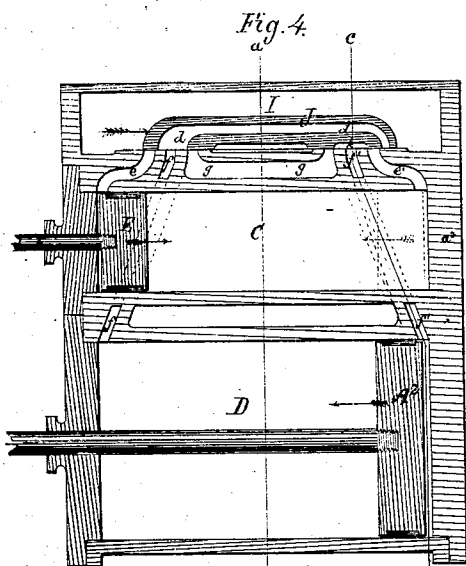
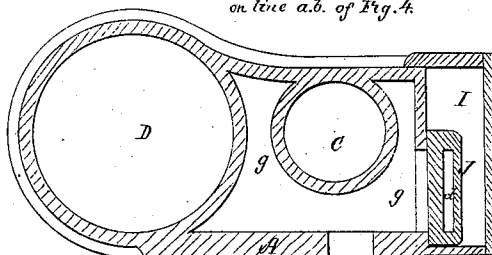


Fig. 5.

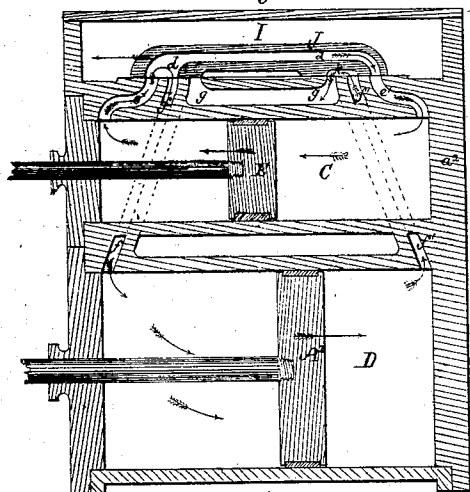
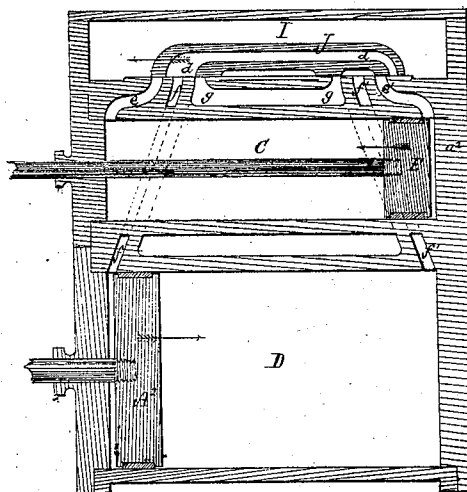


Fig. 6.



Witnesses.
W. Geo. Alden.
W. E. Boardman.

Lafayette Huntoon.
J. Curtis. Atty.

UNITED STATES PATENT OFFICE.

LAFAYETTE HUNTOON, OF NATICK, MASSACHUSETTS, ASSIGNOR TO HIMSELF AND ELWIN C. HUNTOON, OF SAME PLACE.

IMPROVEMENT IN COMPOUND STEAM-ENGINES.

Specification forming part of Letters Patent No. 135,223, dated January 28, 1873.

To all whom it may concern:

Be it known that I, LAFAYETTE HUNTOON, of Natick, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain Improvements in Double-Cylinder Steam-Engines, of which the following is a specification:

My present invention is an improvement in double-cylinder steam-engines of the class in which the exhaust steam from the primary cylinder is conducted into a second and larger cylinder and compelled to drive the piston of the latter.

Several patents have formerly been granted to me in the United States on this class of engines—for instance, numbers 54,731 and 63,638. In the engines shown in these patents—and, in fact, in all heretofore devised of this class—the exhaust steam from the first cylinder exerts its force in two directions—that is to say, backward upon the primary and small piston and forward upon the auxiliary and larger piston, the gain being that due to the diameter of the larger cylinder in excess of that of the smaller, less the increased friction which the second cylinder and its adjuncts entailed.

The purpose of my present invention is to remove this back pressure upon the first or primary piston and direct the full power of the exhaust from the primary cylinder upon the piston of the auxiliary cylinder; and to this end this invention consists in a peculiar construction of the valve of the engine, wherein a long passage is created throughout its length, of such extent, and so calculated with respect to the various ports of the steam-chest and two cylinders, that when the exhaust steam is passing from the primary cylinder to the auxiliary cylinder by means of the said passage, such exhaust also passes by means of this passage to the opposite end of the primary piston, and thus equalizes the pressure upon the latter, and removes the back pressure otherwise directed upon it, the full force of the exhaust, as a consequence, being imparted to the larger piston. In order to accomplish the above result I entirely shut out from one end port of the primary cylinder the direct steam from the steam-chest, and take this steam at one end only of the primary piston and cylinder, the engine

being driven, during the return traverse of said primary piston, by the power of the exhaust steam from the first cylinder upon the larger piston of the second or auxiliary cylinder.

The drawing accompanying this specification represents in—

Figure 1 a plan, in Figs. 2 and 3 vertical sections, and in Figs. 4, 5, and 6 horizontal sections of parts of an engine embodying my present improvements.

In the drawing, the bed of the engine is shown at A as supporting two horizontal cylinders, of which C is the lesser and primary cylinder, and D the larger or auxiliary expansion-cylinder, the two being of equal length, but the diameter of the latter being double that of the former, or substantially so, as this difference has been found to give the best results, the two cylinders being placed side by side, and preferably cast in one piece of metal. E is the piston of the primary cylinder C, and A² the piston of the auxiliary cylinder D. These pistons are to be connected, by suitable connecting-rods, to cranks which are situated at right angles to each; consequently the pistons travel in directions opposite to one another. The valve-chest, valve, and seat are not placed over the small cylinder, as now customary, but are placed upon one side of said cylinder, and so low down that the water resulting from condensation of steam, or held in suspension by the steam, and precipitated within the cylinders, will not stand therein, but will escape with the exhaust steam through the various ports. By this means I find a relief from the annoyance and objection found to exist heretofore in these engines. The valve-chamber is represented in the drawing at I, and the valve at J. The cylinder C is formed with two end ports, *e e'*, which communicate directly with the steam-chest and with a main exhaust-passage, *g*, which opens into the atmosphere, this main exhaust passing partially about both cylinders, and being common to both end ports *e e'*. *f f'* represent two ports or passages, one at each end of the cylinder, and leading from the face of the valve-seat and communicating with the interior of the auxiliary cylinder D at each end thereof. The valve of this engine is shown at J, as before stated, and is of pecul-

iar construction—that is to say, it is provided or formed with a passage or chamber, *d*, extending longitudinally through it, this passage being enlarged at the steam-inlet end of the cylinder to such an extent as to be equal to the combined area of the mouths of the passage *f* and exhaust port or passage *g*, for purposes hereinafter stated, while at the opposite end of the valve I create, in its lower face, and below and inside of the passage *d*, a shallow pocket or chamber, *k*, the longitudinal extent of this chamber being equal to that of the enlarged and opposite end of the valve-passage *d*.

I have not, in the accompanying drawing, represented the ordinary adjuncts of a steam-engine, such as main shaft, crank, connecting-rods, fly-wheel, piston-rods, &c., for the reason that my present improvements are in nowise peculiarly connected with such details.

The operation of the herein-described engine is as follows: Supposing, as a starting-point, that the valve and pistons are in the respective positions shown in Fig. 4 of the drawing—that is, with the pistons at extreme opposite ends of the cylinders, and with the valve closing the direct inlet-steam port *e* of the primary cylinder, and also the opposite port *e'*, it being understood that the last-named port is never open to direct steam from the steam-chest, but that the engine takes direct steam at one end only of the primary cylinder—the valve moves in the direction of its arrow in said Fig. 4 until the port *e* is full open, and steam from steam-chest or valve-chamber I, at one hundred pounds, or thereabout, enters the primary cylinder C through such port, and drives the piston E in the direction of its arrow in said figure until the piston has traveled half the distance of the cylinder, at which point the valve begins to retrace its movement and travels until it closes port *e* and cuts off entrance of direct steam from the valve-chamber, the piston, at this point of “cutting off,” having traversed five-eighths the length of the cylinder or of its stroke. The port *e* remains closed while the piston completes its stroke by the expansive force of the steam within the cylinder C, the steam being reduced from one hundred to about sixty pounds per square inch, the port *e'* being at the same time closed by the valve. The piston E, by the momentum of the engine and the power of the exhaust upon the large piston, and not by admission of steam at this end of the cylinder, begins its return stroke in the direction of the arrow in Fig. 6, and the valve travels in a direction opposite to that first taken by it, or in the direction shown by the arrows in Figs. 5 and 6 of the drawing, until port *e* begins to open and exhaust steam from small cylinder C passes through port *e* into passage *d* of the valve; thence into auxiliary cylinder D, through passage *f*, and behind the piston A² of the said auxiliary cylinder, such piston being at this time at the extreme end of the cylinder opposite that of the primary cylinder, or, as shown in Fig. 6—the exhaust steam per-

forming its office in this auxiliary cylinder to drive its piston forward in the direction of the arrow in said Fig. 6, in the same manner as in ordinary steam-engines—and exhausting and returning through the said passage *f* into the chamber or passage *d* of the valve, and thence through the main exhaust-passage *g*, which discharges into the atmosphere in the usual manner, this exhaust-passage being situated below the bottom of the two cylinders, as hereinbefore stated.

As shown in my former patents, before alluded to, the exhaust steam from the first cylinder acts upon the pistons of both cylinders unequally, to drive the larger piston forward and the smaller backward; consequently all the gain found in these patented engines is, as before stated, that due to the increased area of the larger over that of the smaller.

In my present engine, however, it will be seen that as the port *e* opens and allows exhaust steam from cylinder C to enter the passage *f*, and thence to and against the piston A² of the large cylinder, the port or passage *d* of the valve is also in open communication with the port *e'* at the opposite end of the cylinder and of the piston E, as shown in Fig. 5 of the drawing; consequently the pressure is equal upon both ends of said piston E, and I obtain the full force of the exhaust steam upon the entire area of the larger piston to drive the engine, in lieu of direct steam against the smaller piston.

The pistons E and A² continue to travel in the directions last stated, or as indicated in Fig. 6, until they each traverse five-eighths of their stroke, or thereabout, as shown in Fig. 5. The two pistons continue to travel in the direction last stated until they reach their extreme positions, the valve, in the interim, reversing its movement and traveling in the direction of the arrow in Fig. 4 until, as each piston reaches the end of its cylinder, the valve has closed the port *e*, and we are brought to our starting-point. As the port *e* is opened and direct steam is driving the primary piston forward in the direction of the arrow in Fig. 4, the passage *f* is opening communication with the exhaust-passage *g*, and the large cylinder is thus permitted to discharge any steam or water which remains in it through these passages into the atmosphere, the opposite end of the valve-passage *d* being at the time closed by the valve-seat. As the piston of the primary cylinder is being advanced by direct steam from the steam-chest through port *e*, the exhaust steam remaining in said cylinder and upon the opposite side of the piston, or between it and the head *a*² of the cylinder, (which exhaust steam was admitted to the cylinder through port *d* of the valve in the act of effecting an equilibrium of pressure upon the piston, at the same time it was entering the opposite end of the large cylinder and driving its piston,) is passing through passages *e'* *f'* into the large cylinder and against its piston, to drive the latter in the direction of the arrow in Fig. 4, as the movement of the valve in opening

port *e* brings the pocket *k* into communication with the said passages *e'* and *f'*. The position of the valve and ports under this last condition is shown in Fig. 7 of the accompanying drawing, which is a section of the parts. This gain, however, is small, for the reason that the steam within the cylinder at this time has been reduced to a low pressure, and the primary piston as it advances meets this steam as an abutment, to retard it slightly, the actual gain being that due to the increased diameter of the large piston as the steam acts upon both.

It will thus be seen that the engine is driven by direct steam upon the small piston in one direction, and by the full power of the exhaust of this steam upon the large piston in the opposite direction, and that the passage *d* of the valve becomes alternately a means of establishing communication between both ends of the piston of the small cylinder to effect an equilibrium of pressure thereupon, while the exhaust from such cylinder is driving the larger piston, and a means of opening communication between the ports *f'* and *g* to allow the large cylinder to exhaust at this end.

Claims.

What I claim, and desire to secure by Letters Patent, is as follows:

1. In a double-cylinder steam-engine operating with a single valve, substantially as specified, the mode herein described of equilibrating the pressure upon the piston of the small or primary cylinder, while the exhaust steam from said cylinder is driving the piston of the larger or second cylinder by bringing at that time that part of the first cylinder in rear of its piston in communication with that part of the said cylinder in front of said piston, and from which the exhaust steam is passing, substantially in the manner and by the means shown and set forth.

2. The valve *J* provided with a passage, *d*, and a chamber, *k*, substantially as described, in combination with the two cylinders and the ports *e*, *e'*, *f*, *f'*, and *g*, substantially as and for the purposes set forth.

LAFAYETTE HUNTOON.

Witnesses:

F. CURTIS,
W. E. BOARDMAN.