R. Gornall,

Steam Slide Valve.

No 82,936. Patented Oct. 13, 1868.

Fig: 1.

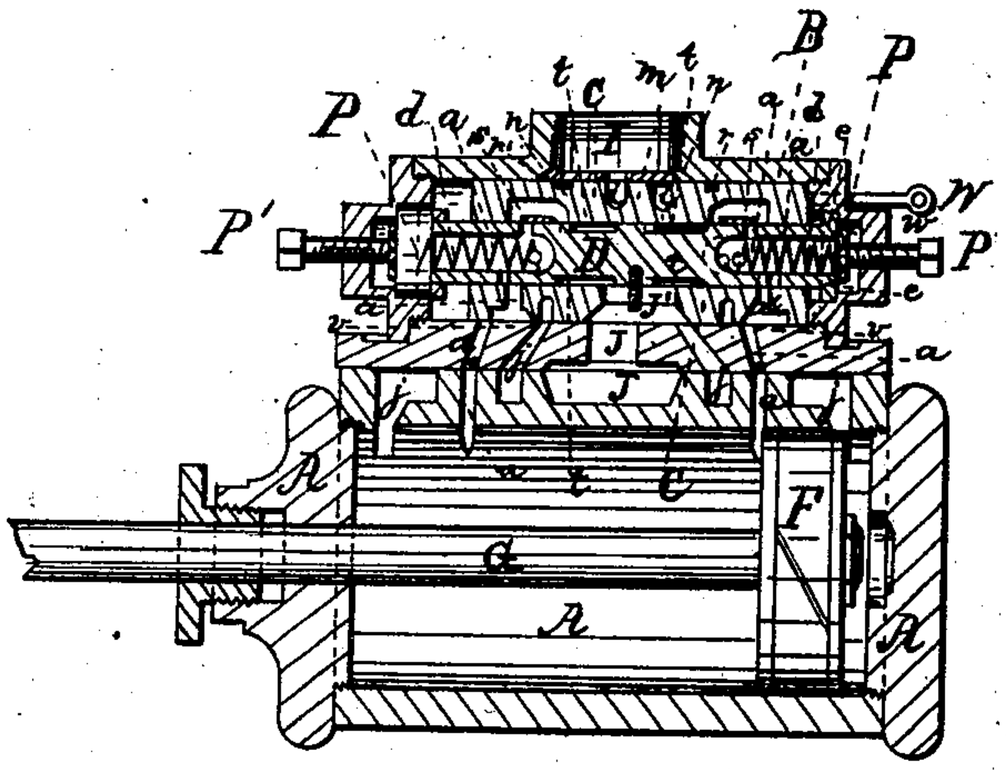
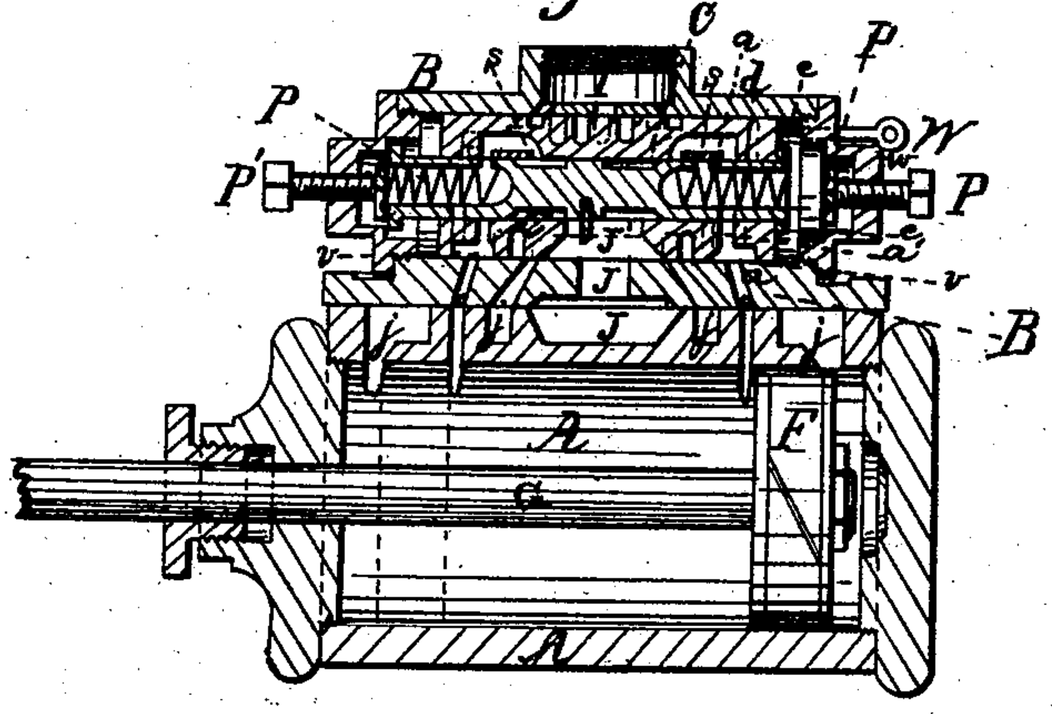


Fig: 2.



Witnesses:
Solon C. Kemon
Chas A. Pettit

Inventor:
Richard Gornall
By Munn & Co
Attorneys

United States Patent Office.

RICHARD GORNALL, OF BALTIMORE, MARYLAND.

Letters Patent No. 82,936, *dated October* 13, 1868.

IMPROVEMENT IN STEAM-ENGINE-PISTON VALVES.

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, RICHARD GORNALL, of the city and county of Baltimore, and State of Maryland, have invented a new and improved Water and Steam-Valve and Cylinder; and I do hereby declare the following to be a full, clear, and exact description of the same, sufficient to enable those skilled in the art to which my invention appertains to make use of it, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a longitudinal section through the centre of the cylinder and steam-chest, showing the operation of the valves at one part of the stroke, and

Figure 2 is a similar section, showing the position of the valves at another part of the stroke.

In this invention, the cylinder-valves are worked by the direct action of the live steam, without the intervention of tappets, eccentrics, cams, or any other device outside of the steam-chest and cylinder.

In the drawings, A is the cylinder; B, the steam-chest; C, the main slide-valve; D, a slide-valve extending longitudinally through the main valve; F is the piston; G is the piston-rod; I is the induction-pipe; and J the exhaust.

At the beginning of the stroke, the valves being in the position shown in fig. 1, the steam enters from the cylinder through the passage $a\ a^1$ to an aperture, a^2, with which the passage a^1 is then in communication, and fills a chamber, d, in the end of the valve D, where it expands against the end of the steam-chest and forces the valve D back from the end of the steam-chest until its terminal flanges, $e\ e$, rest against the end of the main valve, as seen in fig. 2, the position of the main valve being yet unchanged.

This movement of the valve D cuts off the communication from the passage a^1 to the aperture a^2, and opens a free communication from the cylinder to the chamber d, through the passages $a\ a^1$ and c.

The steam entering the chamber d, then, with great force, acts against the end of the steam-chest, as before, and against the end of the valve D and the main valve C, and drives them both together toward the other end of the steam-chest.

$j\ j$ is a port or passage running in behind the passage a, which sometimes connects the right-hand end of the cylinder with the induction-pipe, and sometimes with the exhaust, according to the position of the main valve; and $j'\ j'$ is a corresponding port or passage connecting the left-hand end of the cylinder with the exhaust and induction in the same way.

When the main valve is in the position shown in fig. 1, the steam from the induction-pipe I passes into the port i, then around behind the main valve, and through the port j', into the cylinder at its left-hand or upper end, driving the piston down, or to the right, and bringing it to the position shown in fig. 1.

While the piston is passing from the upper to the lower end of the cylinder, before it passes the port a, the latter is in communication with the exhaust but not with the live steam. The moment the piston passes the port a, however, the latter is brought into communication with the live steam, which passes through it and acts upon the valve D, and then upon the main valve C, in the manner above described.

While the piston is at the upper end of the cylinder, and until it has passed to the lower or right-hand end, the steam exhausts from the lower end, through the passage $j\ j$ and the recess J′ in the side of the main valve, to the pipe J, which leads to the condenser or to the open air.

The action of the steam in this manner will, as before remarked, change the position of the valves with great rapidity from the lower to the upper end of the steam-chest, where they will assume the same relative position that they occupied before they commenced to move from the lower end, as shown in fig. 1. This reversing of the position of the valves reverses the whole action of the steam and the motion of the piston.

The recess J′ is brought over the port j', and the passage i' is disconnected from the induction, cutting off the live steam from the upper end of the cylinder, and opening the way from that end to the exhaust, while the recess J′ is disconnected from the port $j\ j$, and the live steam from the induction is let into the latter through a passage, i, similar in formation and operation to that designated as i', and which has already been described. The steam now entering below or to the right of the piston, forces the latter back to the upper end of the cylinder, where the same action will take place to drive the valves back that took place in the first instance to drive them from the position shown in fig. 1, and this alternating and reciprocating action of the valves and the piston will continue as long as there is steam enough to work the parts.

There is a point in the stroke where for a moment the induction steam would be entirely shut off were not some provision made to prevent it, and the action of the mechanism might be interfered with to some extent thereby. That point is at the moment when the valves are midway between the ends of the steam-chest, so that the solid metal of the main valve at m, between the passages i and i', covers and closes the induction-port. This difficulty is, however, entirely remedied by the employment of auxiliary ports, $n\ n'$, connecting with two passages, $r\ r'$, leading from the induction-pipes at each side of the port, and passing around behind the main valve, entering the chambers $d\ d'$ at $o\ o'$.

When the main valve is at either end of its stroke, or in such a position that the live steam can pass to the cylinder, the passages $r\ r'$ are disconnected from the ports $n\ n'$; but whenever the main valve gets into such a position that the induction steam is cut off by the part m, then the passages $r\ r'$ and ports $n\ n'$ will

be in communication with each other, and the live steam will freely enter the passages *r r'* and pass toward the chambers *d d'*, one of which it will enter, and the other it will not. It must, of course, be made to enter that end of the steam-chest in which the steam is acting upon the valves, and from which the latter are receding, and it must not be allowed to enter the opposite or exhaust end of the steam-chest. This is effected by means of the interior sliding valve D. When the flange *e* of this valve lies against the end of the main valve, a communication is open between the chamber *d* or *d'* in that end of the valve D and the passage *r* or *r'* leading toward it, and when the flange does not lie against the end of the main valve, such communication is closed.

The flange being caused to seat upon the end of the main valve only by the action of the live steam in the end of the steam-chest from which the valves are receding, it follows that, at the proper moment, when the valves are passing from right to left, the induction steam will be let into the chamber *d*, and when they are passing in the opposite direction, it will be let into the chamber *d'*, acting, into whichever chamber it is let, to push the main valve past that portion of its stroke where the induction steam was cut off by the part *m*, as above described.

The position of the valves, with the main induction cut off and the auxiliary valve-inductions open, is shown clearly in fig. 2.

While the steam is passing to the chamber *d* or *d'*, to assist in moving the valve past the "dead-point," as above described, it will not do to have that chamber communicate with the main exhaust or the interior of the cylinder. Accordingly, at this point of the stroke a small plate, *v*, in an enlargement of the passage *a'*, at the edge of the main valve, shuts over the end of the passage *a*, and severs the communication for the time between the two passages. By the time when the main induction is open again, the plate *v* has passed over the end of the passage *a*, and the communication from the cylinder to the valve-chamber is restored.

s s' is the valve-exhaust, communicating with the main exhaust through a passage, *t t'*, which runs round behind the valve D.

P P are springs, and P' P' tempering-screws to regulate them, which serve as cushions to the valves.

W is a rod, having an eye, *w*, on its outer extremity, and extending from the main valve, C, through the end wall of the steam-chest, in order to afford means for reversing the engine at any part of the stroke. It may be operated by a lever or any other suitable device.

Besides the function above described, the rod W serves as a guide to the valve, to prevent it from turning, and also serves as a means by which the valve may be worked loose in case it becomes stiff with rust or obstructed with sediment.

In order to reverse the engine with this rod, it will only be necessary to shut off the induction steam, and by means of the rod force the main valve back to the end of the steam-chest opposite to that at which it is standing at the time.

The operation of this engine is exceedingly regular, uniform, rapid, and powerful. It has been thoroughly tried, and found to work admirably.

By dispensing with valve-rods operating outside of the steam-chest, the cylinder may be brought within four or five inches of a pump-barrel or other instrument, which the engine is intended to work, and the expensive cylinder packing hitherto required when the engine is applied to such purposes, may be entirely dispensed with. In place of such packing, a simple split bushing may be used, packed in any suitable manner, and confined in position by any suitable means. Besides the saving of this expense, the space saved by the use of my form of engine will often be of no inconsiderable importance.

It is evident that the principle of construction embraced in my invention may be employed in connection with engines working with any kind of motive-power that operates a piston in a cylinder by means of an arrangement of valves.

Having thus described my invention,

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

1. The combination of the main valve C with the interior sliding valve D, having the flanges *e e*, substantially as and for the purposes specified.

2. In combination with the valve C and the interior sliding valve D, I claim the auxiliary steam-ports *n n'*, substantially as and for the purpose specified.

RICHARD GORNALL.

Witnesses:

EDWARD JOHN BAKER,

WILLIAM ELIAS SWAIN.