

(No Model.)

J. SMITH.
ENGINE.

No. 487,132.

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Fig: 1.

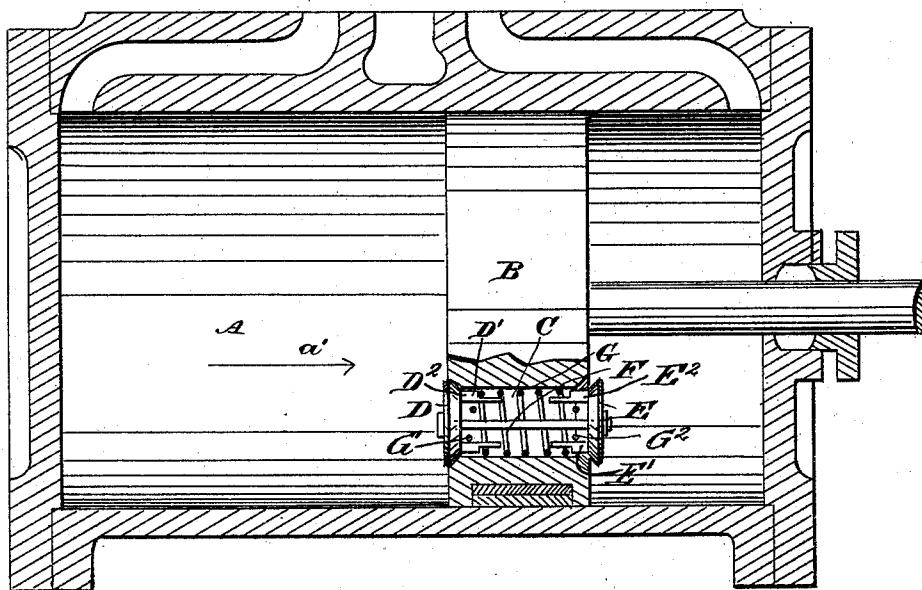


Fig: 2.

Fig: 3.

WITNESSES:

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ENGINE.

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To all whom it may concern:

Be it known that I, JAMES SMITH, of Dresden, in the county of Yates and State of New York, have invented new and useful Improvements in Engines, of which the following is a full, clear, and exact description.

The object of the invention is to provide certain new and useful improvements in engines, whereby the motive agent is utilized to the fullest advantage, its pressure never falling much below exhaust-pressure after expansion has taken place.

The invention consists in certain parts and details and combinations of the same, as will be fully described hereinafter, and then pointed out in the claim.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is an indicator-diagram of an ordinary engine, and Fig. 3 is an indicator-diagram of my improved engine.

The improvement consists principally in a device, preferably a valve, for connecting the two ends of a cylinder with each other at a time when the pressure of the live motive agent on the driving side of the piston is about equal to the exhaust or reservoir pressure on the other side of the piston, the pressure of the exhaust being the active force to actuate the device (to open the valve) to establish communication between the two ends of the cylinder, so as to permit the exhaust to pass to the driving side of the piston to mingle with and to reinforce the live motive agent, so that its tension is equal to the exhaust-pressure up to the end of the stroke of the piston.

As shown in the accompanying drawings, the device is applied to the cylinder of an ordinary single steam-engine; but it is evident that the improvement can be readily adapted to all kinds of engines.

As shown in Fig. 1, the cylinder A contains the piston B, in which is formed a longitudinal passage C, adapted to connect the two ends of the cylinder A with each other. At the ends of this passage C, on the face of the piston B, are formed valve-seats adapted to receive the valves D and E, attached to a

common valve-stem F, extending through the passage C. In the passage C is arranged a coiled spring G, normally resting with its ends 55 on the forked cross-rods G' and G², extending transversely through the passage-way, as is plainly shown in the drawings. The ends of the spring G are adapted to be engaged by shoulders D' and E', formed on the auxiliary 60 valve-stems D² and E², respectively, of the valves D and E, respectively. When no excess of pressure is on either side of the piston the valves D and E are held off their seats by the spring G, which opens outward at both 65 ends up to the cross-rods G' and G², and by engaging the shoulders D' and E' of the auxiliary valve-stems D² and E² hold the valves D and E off their seats. The spring G is of sufficient strength to hold both valves off 70 their seats, as described, during the passage of vibrating currents and until compression or live steam seats them—that is, when a preponderance of pressure is on either side of piston, then the respective valve on that side 75 is seated on the seat at the respective end of the passage C, while the other valve is correspondingly moved farther off its seat, as will be readily understood by reference to the drawings, which show the valve in this position. 80 When the valves are both unseated, they then permit the remaining portion of the exhaust agent on the exhaust side of piston to pass into the pressure side. Now when the motive agent passes into the left end of the 85 cylinder A to drive the piston B in the direction of the arrow a', then the motive agent seats the valve D, and communication between the two ends of the cylinder A is cut off. When the slide valve has cut off the supply 90 of the motive agent, the latter expands until the pressure of the motive agent reaches a pressure corresponding to the exhaust on the opposite side of the piston B and the right-hand end of the cylinder A. When the two 95 pressures on the opposite sides of the piston B are about equal, then the valve D is opened by the force of the exhaust, so that the latter can pass through the now open passage C into the left-hand end of the cylinder A to mingle 100 with the motive agent contained therein. The motive agent on the driving side is thus reinforced and prevented from falling below back or exhaust reservoir pressure up to the

end of the stroke of the piston B. On the return stroke of the piston the live motive agent passing into the right-hand end of the cylinder A forces the valve E to its seat on the passage C, so that communication between the two ends of the cylinder is cut off. The motive agent acts with supply-pressure on the piston B until the supply is finally cut off and the motive agent expands until its pressure becomes finally equal to the pressure of the exhaust on the left-hand side of the piston B, when the valve E is again opened by the force of the exhaust pressing on the said valve E from the inside of the passage C. The exhaust now mingles with the motive agent in the right-hand end of the cylinder A, and thus reinforces the same to prevent its pressure from falling much below exhaust or back pressure. By reference to Fig. 2 it will be seen that the pressure in the cylinder falls below back-pressure before the piston is at the end of the stroke causing the usual back-pressure. As will be seen by my indicator-diagram shown in Fig. 3, the pressure does not fall below back-pressure during any time of the stroke.

It will be seen from the foregoing that the device is actuated only at a certain time—that is, according to the pressures at both ends of the cylinders.

I am aware that devices have been con-

structed to establish a communication between the two ends of the cylinder at the time the piston reaches a predetermined position, so that the device is always actuated at the same point in the travel of the piston. My device is actuated only when the live motive agent and the exhaust are in the condition above described. Thus the device is actuated at different times in the travel of the piston when the pressures of the motive agent or the load vary.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

In an engine, a cylinder, a piston operating therein and provided with a passage-way and bars near the ends of the said passage-way, a spring held in the said passage-way between the bars, and two valves held on the ends of the said passage-way and connected with each other by a valve-stem, the valve being adapted to be closed by compression and the live motive agent, and are arranged to be held off their seats by the said spring at the time the pressures on the two sides of the piston are about equal, substantially as described.

JAMES SMITH.

Witnesses:

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JAMES F. REYNOLDS.