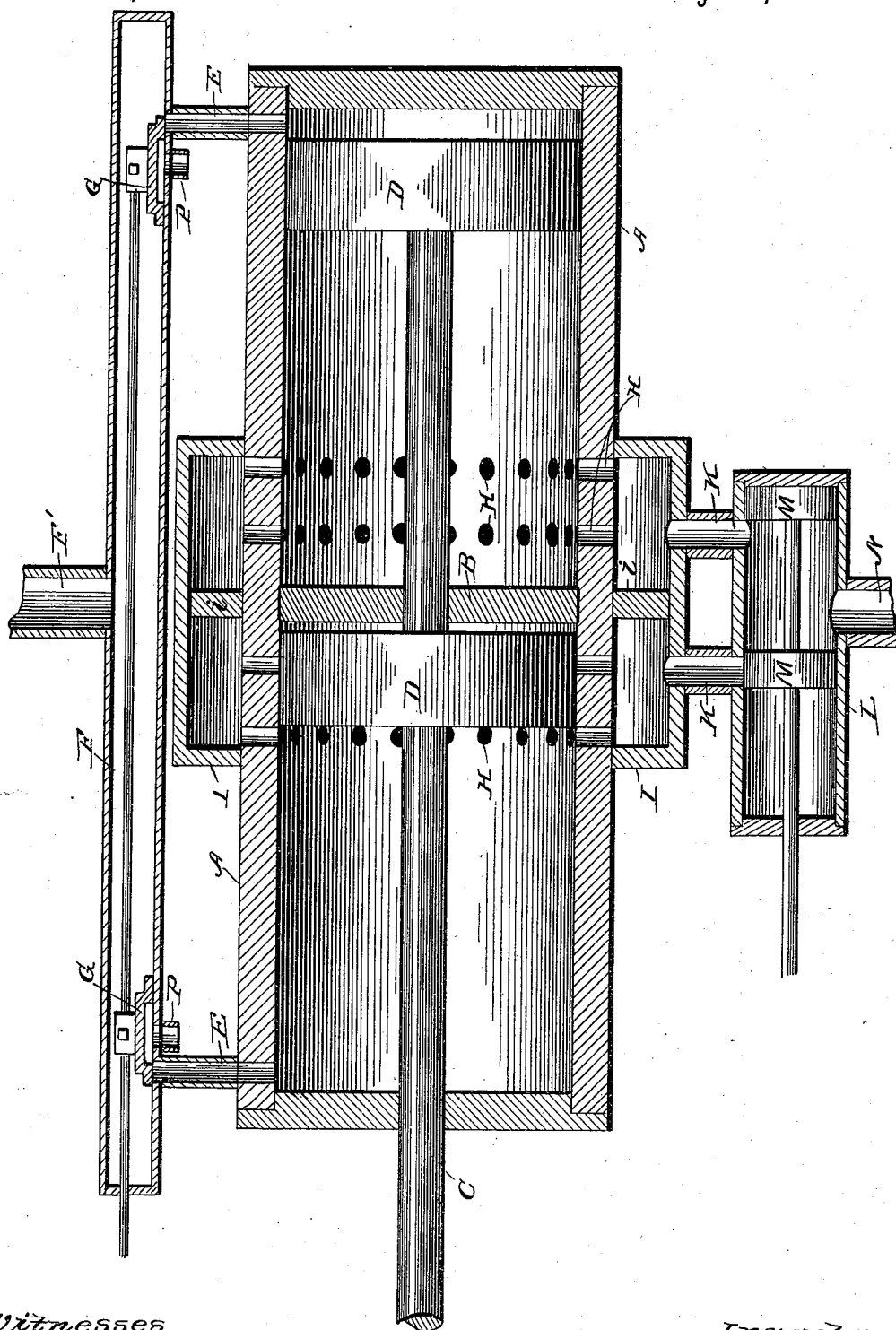


(No Model.)

G. SMITH.
STEAM ENGINE.

No. 501,581.

Patented July 18, 1893.



Witnesses

J. M. Fowler
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UNITED STATES PATENT OFFICE.

GEORGE SMITH, OF LITTLE ROCK, ARKANSAS, ASSIGNOR OF THREE-
FOURTHS TO JOHN McCLURE, W. K. ELLIOTT, AND LOGAN H. ROOTS,
OF SAME PLACE.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 501,581, dated July 18, 1893.

Application filed March 8, 1893. Serial No. 465,091. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SMITH, of Little Rock, in the county of Pulaski and State of Arkansas, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in steam engines and has for its object to increase the efficiency of the same by utilizing a second expansion of the steam, and is adapted for any class of engine, locomotive, stationary or marine.

The invention consists in certain novel details of construction and combinations and arrangements of parts all as will be now described and pointed out particularly in the appended claims.

The accompanying drawing represents a longitudinal vertical section of an engine embodying my present invention.

If reference be had to a patent granted to me on the 7th day of February, 1893, No. 491,141, it will be seen that I have in that patent, described and claimed an engine having admission ports at each end of the single cylinder, with centrally arranged exhaust ports which are opened by the movement of the piston, so as to give an instantaneous exhaust at the moment when the piston reaches the end of its stroke, and in which construction, it was found necessary to employ a double headed or very long piston in order to secure the return stroke by pressure on the opposite piston face. Now in the present instance, while I still employ what may be called an exhaust jacket or chamber, I do not allow the steam exhausted into the same from the high pressure side of the piston, to pass away and be lost, but propose to utilize it expansively to facilitate the return stroke of the piston, and instead of locating the exhaust ports at the center of each cylinder, I propose to locate them at one end, and to use a single short piston in each cylinder.

In the preferred form of engine, and as illus-

trated in the drawing, it will be seen that I have provided a cylinder lettered A, having a central partition B dividing it into two separate cylinders, the only communication between which, is through the aperture left for the passage of the piston rod C. This piston rod carries two pistons D one located in each of the cylinders so as to operate after the manner of the well known tandem engines. At the outer ends of each of the cylinders I arrange an induction or admission port E, similar to those in an ordinary engine, and communicating with a valve or live steam chest F to which steam is supplied by a supply pipe F' leading from any suitable source of supply. Valves G control the induction ports, and they are preferably of the cavity type for a purpose which will presently appear.

At the inner ends of each of the cylinders, is arranged a double series of exhaust ports H located a distance apart approximately equal to the thickness of the piston, that is to say, at one point in its stroke, the piston will exactly cover and close such ports, keeping one closed and opening the other, when moving either way, until both are opened on the same side, thus while traveling through a very small space at the end of its stroke, it first opens the exhaust to the high pressure side of the piston while keeping the other ports closed. Then as the piston reverses and advances or moves forward, it closes the ports to the high pressure side of the piston and opens those on the opposite side of the same and finally opens both series or sets of ports into the cylinder in rear of the piston.

An exhaust jacket surrounds the exhaust ports of each cylinder; in the preferred construction, a single jacket I having a central partition i serves as the exhaust jacket for both cylinders, such casing being clamped or secured in place as in said former patent or in any other preferred manner. These exhaust jackets have exhaust ports or passages K, preferably leading to a valve chest L, where they are controlled by valves M and thence to a common exhaust opening or passage N. The valves M are mounted on the

same rod and are adapted to alternately open and close the ports K or place them in communication with the exhaust N.

In addition to the exhaust N, I provide in the present engine, an additional or secondary exhaust for each cylinder located in proximity to the induction port and controlled by the valve G, such exhaust passages being lettered P in the drawing.

The valves G controlling the induction ports, and as I shall term them, the secondary exhaust ports, are operated as in an ordinary engine and are given a proper lap and lead to secure the best results, and the valves M or those controlling the main exhaust are operated to cut off or close the ports K at the moment when the piston has reached a point where the ports H leading from the high pressure side of the piston are opened into the exhaust chamber, and to open such ports K when the piston starts inward after having reached the outer extreme of its stroke, thus allowing steam to escape from the rear side of the piston through the exhaust chamber freely while the live steam is forcing it inward.

In operation, now, the steam enters through the induction ports, forces the piston inward until the ports H are uncovered, when the exhaust takes place into the exhaust chamber which is now closed by the valve M. Then as the piston starts on its outward movement, the ports H in rear of the piston are opened from the exhaust chamber, and simultaneously the secondary exhaust ports P are opened by the movement of the valve H, the result of which is, that we have pressure from the exhaust chamber in rear of the piston and no pressure in front of it, and hence the second expansion of the steam may be utilized to great advantage. At the moment when the piston reaches the outer extreme of its movement the valve G is moved to open the induction port, and the valve M is moved to open the exhaust port from the exhaust chamber, when we have live steam pressure in front of the piston and no pressure in rear of it.

To utilize the principle to the greatest advantage the cylinders are arranged reversely and operate oppositely. Hence we have at all times the live steam pressure, or the first expansion thereof, on one piston plus the low pressure steam from the exhaust chamber on the other piston, both acting in the same direction, which arrangement it will be observed is extremely simple, utilizes to a high degree the expansion of the steam and hence gives a very high efficiency.

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

1. In a steam engine, the combination with the cylinder having the steam admission port at one end and a set of exhaust ports at the opposite end, of the exhaust chamber into which said exhaust ports open, an exhaust port for said exhaust chamber, a valve con-

trolling said last mentioned exhaust port, and a piston working in the cylinder and adapted to uncover the exhaust ports therein during its inward movement; substantially as described.

2. In a steam engine, the combination with the cylinder having the admission port at one end, a set of exhaust ports at the opposite end and a valve controlling the admission port, of an exhaust chamber surrounding the exhaust ports, an exhaust port leading from said exhaust chamber and a valve controlling said port, and a piston working in the cylinder and adapted to open the exhaust ports therein during its inward movement; substantially as described.

3. In a steam engine, the combination with the cylinder having the admission port at one end, a set of exhaust ports at the opposite end, a secondary exhaust port in proximity to the admission port and a valve controlling said admission and secondary exhaust ports, of an exhaust chamber surrounding the exhaust ports, an exhaust port for said exhaust chamber, a valve controlling said last mentioned exhaust port and a piston working in the cylinder and adapted to open the exhaust ports to the outer end of the cylinder during its inward movement; substantially as described.

4. In a steam engine, the combination with the cylinder having the admission port at one end and the two sets of exhaust ports at the opposite end, of the exhaust chamber surrounding said exhaust ports and having itself a valve controlled exhaust, and a piston working in the cylinder and adapted when at the inner extreme of its movement to open one set of exhaust ports to the outer end of the cylinder, and to open the other set in rear of the piston when it has moved sufficiently far forward to close the first mentioned set; substantially as described.

5. In a steam engine, the combination with the cylinder having the admission port at one end, two sets of exhaust ports at the opposite end, a secondary exhaust port in proximity to the admission port and a valve controlling said admission and secondary exhaust ports, of an exhaust chamber surrounding said exhaust ports and having itself a valve controlled exhaust, and a piston working in the cylinder and adapted when at the inner extreme of its movement to open one set of exhaust ports to the outer end of the cylinder and to open the other set in rear of the piston when it has moved sufficiently far forward to close the first mentioned set; substantially as described.

6. In a steam engine, the combination with the cylinder divided centrally into two oppositely arranged cylinders, each having an induction or admission port at the outer end and each having at the inner end a set of exhaust ports, of exhaust chambers surrounding said exhaust ports and having themselves valve controlled exhaust ports, and

pistons working in said cylinders and adapted when at the inner extremes of their movement to open the cylinder exhaust ports to the outer ends of the cylinder; substantially
5 as described.

7. In a steam engine, the combination with the two oppositely arranged cylinders each having an admission port at the outer end, and each having at the inner end a set of
10 exhaust ports, secondary exhaust ports located in proximity to the admission ports and valves controlling said admission and secondary exhaust ports, of exhaust chambers

surrounding the exhaust ports at the inner ends of the cylinders with valves controlling
15 the exhaust from said chambers, and pistons mounted on the same piston rod, working in said cylinders and so proportioned as that they open the sets of exhaust ports to the
20 outer ends of the cylinders, when at the inner extremes of their movement; substantially as described.

GEORGE SMITH.

Witnesses:

THOMAS DURANT,
ALEX. S. STEWART.