(No Model.)

3 Sheets—Sheet 1.

J. THOM.

VALVE FOR ENGINES.

No. 344,881. Patented July 6, 1886.

FIG 5.

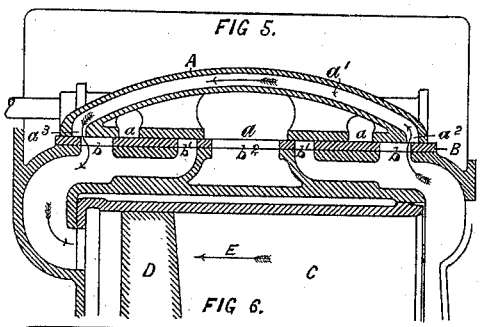


FIG 6.

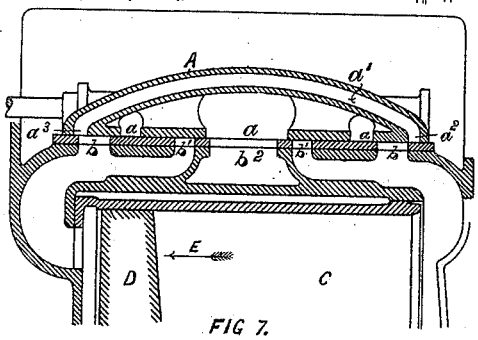


FIG 7.

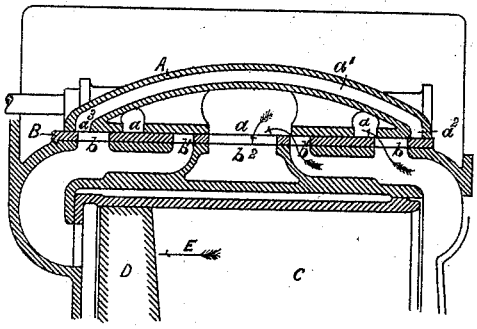


FIG 8.

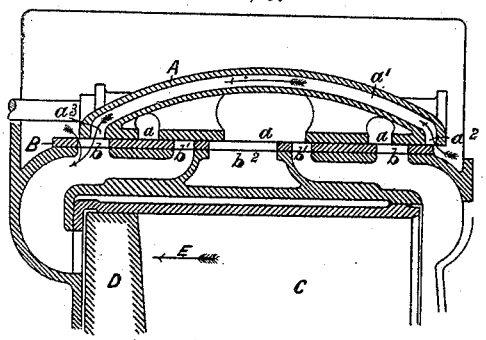


FIG 1.

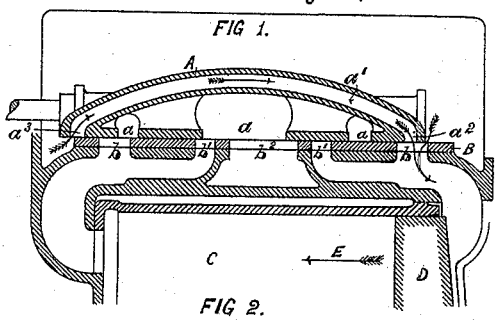


FIG 2.

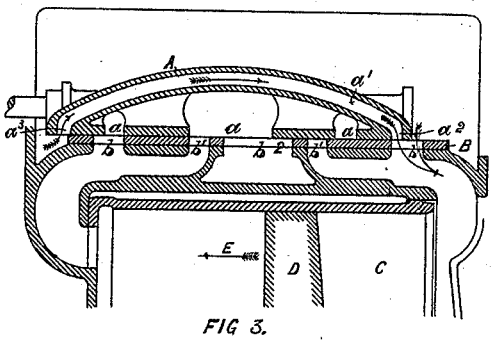


FIG 3.

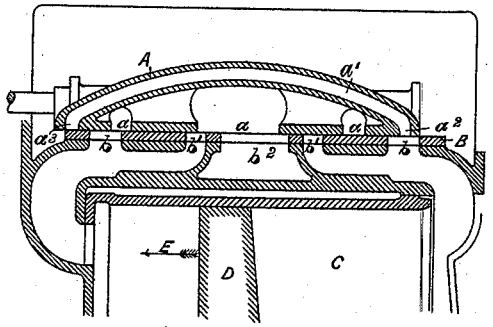
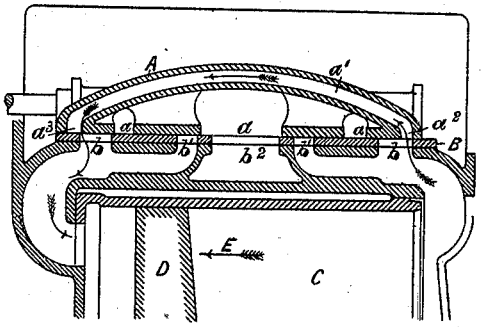


FIG 4.



WITNESSES

Frederick John Cheesbrough

John Hamilton Redmond

INVENTOR

John Thom

(No Model.)

3 Sheets—Sheet 2.

J. THOM.

VALVE FOR ENGINES.

No. 344,881. Patented July 6, 1886.

FIG 9.

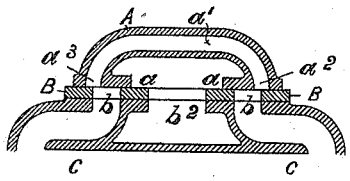


FIG 10.

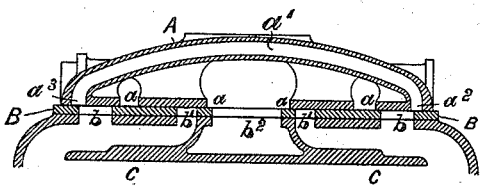
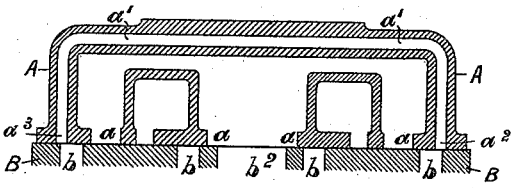


FIG 11.



WITNESSES

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(No Model.)

3 Sheets—Sheet 3.

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VALVE FOR ENGINES.

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FIG 12.

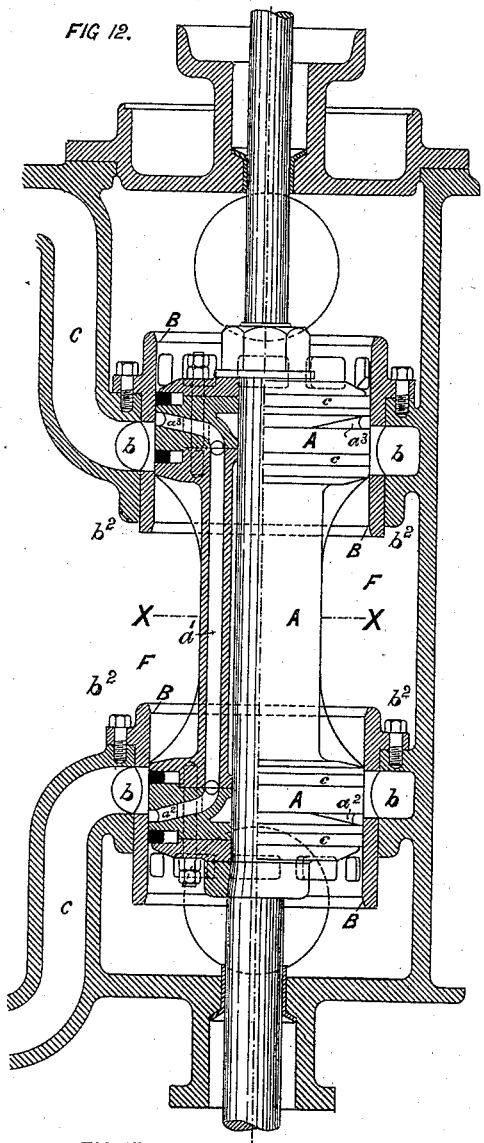


FIG 13.

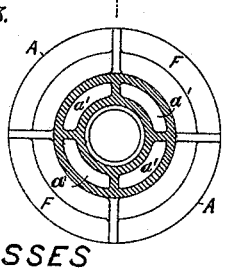


FIG 14.

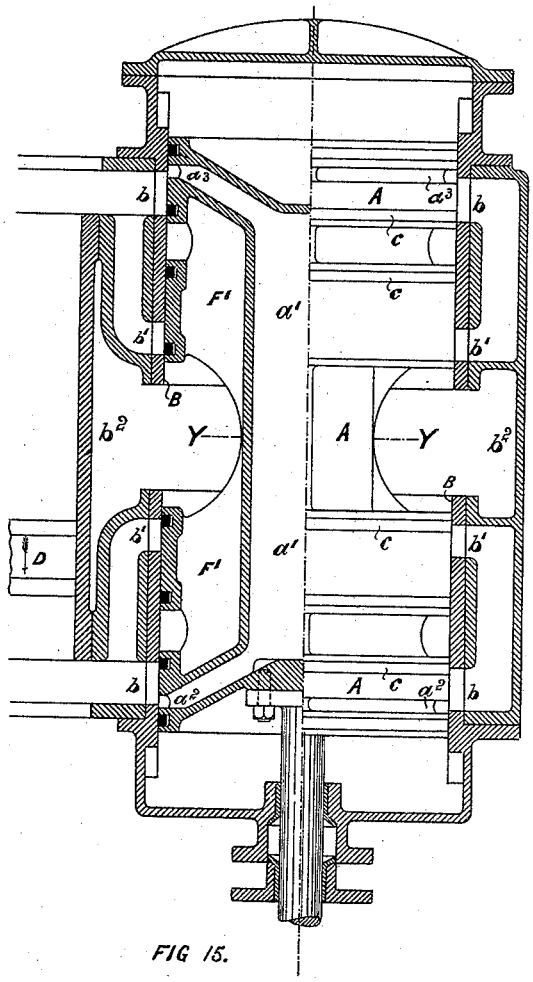
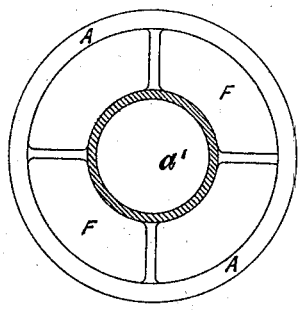


FIG 15.



WITNESSES

Frederick John Cheesbrough

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INVENTOR

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UNITED STATES PATENT OFFICE.

JOHN THOM, OF BARROW-IN-FURNESS, COUNTY OF LANCASTER, ENGLAND.

VALVE FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 344,881, dated July 6, 1886.

Application filed September 1, 1885. Serial No. 175,879. (No model.) Patented in England August 23, 1883, No. 4,087, and in France November 21, 1883, No. 158,703.

To all whom it may concern:

Be it known that I, JOHN THOM, a subject of the Queen of Great Britain, and a resident of the town of Barrow-in-Furness, in the county of Lancaster, in that part of the United Kingdom of Great Britain and Ireland called England, engineer, have invented certain new and useful Improvements in Valves for Steam-Engines, (and that the same has not been patented to me or to others with my knowledge or consent, except in the following countries, to wit: in Great Britain by Letters Patent No. 4,087, dated August 23, 1883, and in France No. 158,703, dated November 21, 1883;) and I do hereby declare that the following is a full, clear, and exact description of my invention, sufficient to enable others skilled in the art to which it appertains, or with which it is most nearly connected, to make, use, and put the same into practice, reference being had to the sheets of drawings, making a part of this specification, and to the letters and figures of reference marked thereon, which correspond with those used in the specification, like letters and figures being used to denote the same or corresponding parts throughout the various views and figures.

My invention has for its object, among other things, to so construct valves for steam-engines that I obtain a large opening for the exhaust with a short travel of valve and to provide a means for utilizing a portion of the steam from one side of the piston at the end of the stroke for use at the other side of the piston, the features of novelty being designated in the claims concluding this specification.

In the drawings, Figure 1 is a sectional elevation of a single-ported steam and double-ported exhaust slide-valve, and valve-face, showing the valve at the "top lead," and showing the means which I employ for conveying and utilizing the steam from one side of the piston to the other. Fig. 2 is a section elevation showing the valve with the greatest steam-opening. Fig. 3 is a sectional elevation showing the valve with the steam cut-off. Fig. 4 is a sectional elevation showing the valve at the point at which communication opens between the ends of the cylinder. Fig. 5 is a sectional elevation showing the valve with communication full open between the ends of the cylinder. Fig. 6 is a sectional elevation showing the valve at the commencement of compression of the steam. Fig. 7 is a sectional elevation of the valve, showing the point at which the exhaust opens. Fig. 8 is a sectional elevation showing the valve at the "bottom lead." Fig. 9 is a sectional elevation of a slide-valve according to my invention of a single-ported cylinder. Fig. 10 is a sectional elevation of a slide-valve according to my invention of a double-ported cylinder. Fig. 11 is a sectional elevation of a slide-valve according to my invention, being an ordinary double-ported slide-valve, with my invention applied thereto. Fig. 12 is a sectional elevation of a slide-valve of the piston type according to my invention. Fig. 13 is a section through X X, Fig. 12. Fig. 14 is a sectional elevation of a slide-valve of the piston type according to my invention provided with double-ported exhaust. Fig. 15 is a section through Y Y, Fig. 14.

In practicing my invention I form a longitudinal passage through the back of the valve, the said passage being so arranged as to form a communication between the ends of the cylinder, so that a portion of the steam from one side of the piston at terminal pressure is transferred from one end of the cylinder to the other and used over again on the return-stroke. For example, this valve may partake of the nature of what is known as a "trick-valve;" but I so form the passage that a communication is opened through the passage of the valve from one end of the cylinder to the other, so that the steam flows through the passage just before communication to the condenser is opened to one end of the cylinder and before new steam is admitted to the other end of the cylinder.

In the drawings, Figs. 1, 2, 3, 4, 5, 6, 7, and 8 are sectional elevations of a single-ported steam and double-ported exhaust slide-valve and valve-face, showing the means which I employ for conveying and utilizing the steam from one side of the piston to the other. These figures show the position of the slide-valve in relation to the piston. Upon reference to these figures, A is the slide-valve; B, the cylinder valve-face; C, a portion of the cylinder; D, a portion of the piston. The arrow E shows the direction of the piston's travel. *a*, are the

exhaust-ports of the valve A, separated from the steam-inlets at the back of the valve A—that is to say, the steam enters only from outside of the valve A, while the inside is entirely devoted to the exhaust. a' is a passage through the back of the valve similar to the passage in what is known as the "trick-valve;" but the ports a^2 a^3 of the passage a' are so arranged in reference to the ports of the cylinder valve-face that the passage a' serves to supply steam to the cylinder in similar manner to a trick-valve, and also to form a communication between the opposite ends of the cylinder C, so that a portion of the steam from one side of the piston at terminal pressure is transferred from one end of the cylinder to the other and used over again on the return-stroke. b b' b^2 are the ports in the cylinder valve-face, the ports b serving for both steam and exhaust, and the ports b' b^2 serving for exhaust only, the port b^2 being the main exhaust.

The working of the valve will be understood upon reference to Figs. 1 to 8, inclusive, in which Fig. 1 shows the valve at the top lead steam being supplied in the direction shown by the arrows from the outside of the valve A and through the passage a', similar to a trick valve. Fig. 2 shows the valve with greatest steam-opening. Fig. 3 shows the steam cut-off. Fig. 4 shows the point at which communication opens between the ends of the cylinder C, so that the steam passes through the port a^2 and passage a' and port a^3 to the other end of the cylinder. Fig. 5 shows the communication full open between the ends of the cylinder C. Fig. 6 shows the commencement of compression of the steam which has passed from one end of the cylinder to the other end of the cylinder. Fig. 7 shows the point at which the exhaust opens. Fig. 8 shows the valve at the bottom lead.

Fig. 9 shows a slide-valve for a single-ported cylinder with trick arrangement, and having negative lap on inside edge of the passage, forming communication between the ends of the cylinder.

Fig. 10 shows a slide-valve for a double-ported cylinder with trick arrangement, and having negative lap on the inside edge of the passage a', forming communication between the ends of the cylinder C.

Fig. 11 shows my invention as applied to an ordinary double-ported slide-valve with the trick-passage a' so arranged as to have negative lap on the inside edges of the ports a^2 a^3. The outside edges of the exhaust-ports a are made with a little larger positive lap, so as to prevent the steam from passing from the ports a^2 or a^3 direct to the exhaust a.

Fig. 12 shows a piston-valve and valve-face constructed with my improvements applied thereto.

Fig. 13 is a section through X X, Fig. 12.

Fig. 14 shows a similar construction of valve and valve-face to that in Fig. 12, but provided with double-ported exhaust.

Fig. 15 is a section through Y Y, Fig. 14.

With reference to the drawings, A is the valve. B is the valve-face. C are the cylinder-ports. D is a portion of the piston. a' is a passage through the valve having ports a^2 a^3. The passage a' is in some respects similar to the passage in what is known as a "trick valve;" but the ports a^2 a^3 of the passage a' are so arranged in reference to the ports of the valve-face, hereinafter described, that the passage a' serves to supply steam to the cylinder in a similar manner to a trick-valve, and also to form a communication between the opposite ends of the cylinder, so that a portion of the steam from one side of the piston at terminal pressure is transferred from one end of the cylinder to the other and used over again on the return-stroke.

The annular chamber F round the valve A in Fig. 12 forms the exhaust-space. In Fig. 14 the annular chamber F forms the exhaust-space also; but in this case the exhaust-steam enters the chamber F by the circumferential passage F'.

b b' are the ports in the valve-face, the ports b serving for both steam and exhaust, and the ports b' serve for exhaust only.

The annular passage b^2 serves for the main exhaust for both ends of the cylinder.

In operation the working of the valve will be as follows: Upon reference to Fig. 12, the valve is shown at the point at which communication is opened between the ends of the cylinder, so that the steam passes through the port a^2, passage a', and port a^3 to the opposite end of the cylinder. The valve, traveling along in the direction of the arrow, closes the port a^3, and compression of the steam, which has passed from one end of the cylinder to the other, takes place. Soon after the passage a^3 is closed, the exhaust is opened to the opposite side of the piston. When the piston has arrived at the end of the stroke, steam is admitted from the outside of the valve, and also through the trick-passage a', and the return-stroke is made. The valve-face of the piston-valve is kept tight by packing-rings C, kept up with springs.

On reference to the foregoing description, it will be seen that a valve according to my invention contains the trick arrangement applied to a valve having positive exhaust-lap at the top and bottom of the cylinder on the port-edges in connection with the condenser, and negative exhaust-lap between the top and bottom of cylinder on the passage through the valve, contained in one valve, thereby forming a communication between the ends of the cylinder, just before exhausting, to the condenser, so that steam at terminal pressure is transferred from one side of the piston to the other, then compressed nearly up to the initial pressure, and used over again on the return-stroke. It can be arranged as a slide-valve or a piston-valve, and to suit single, double, and treble ported cylinders.

A valve constructed according to my invention saves in each revolution of the crank an

amount of steam at terminal pressure equivalent to the capacity of the ports and clearance between the ends of the cylinder and piston, which in many cases is fully fifteen per cent. of the total capacity of the cylinder. As there is little steam left to compress in the low-pressure cylinder with the ordinary slide-valve, if the vacuum is good and the ports large enough the work stored in the piston and other parts moving vertically is thrown away against the steam admitted by the lead; but by my invention the steam is taken from the other end of the cylinder after performing its ordinary work, and is compressed nearly or quite up to initial pressure, using the work stored in the piston and other moving parts for this purpose, so that there is no loss of power from changing the direction of the motion of the piston, and a greater number of revolutions can be got out of the engines with the same indicated horse-power.

The change of pressure from the one side of the piston to the other side being divided into four stages—(*a*) release by communication-opening; (*b*) compressing steam transferred; (*c*) exhaust opens to condenser; (*d*) initial steam enters—causes the engines to turn the centers without shock, even though the brasses are slack. The friction of the valve is reduced to a great extent through one part being always exposed to the pressure of the cylinder, thus tending to reduce the pressure on the valve-face.

Having now described the nature, object, and purposes of my invention and shown how the same may be carried into practical effect, while I do not claim anything that is contained in the patent granted to John W. Vermillion August 24, 1875, what I do claim is—

1. In combination with the valve-seat of a steam-cylinder, a valve having a steam-passage communicating with the steam-ports at both ends of the cylinder at the same time, and a throat embracing the exhaust-nozzle of the cylinder by which the valve in its motion upon its seat alternately permits the steam to pass from one end of the cylinder to the other, and then permits the engine to exhaust at the same time that a steam-port takes steam at two separate points in the same port, one leading through and the other around said valve, substantially as described.

2. A valve having a steam-passage which alternately establishes communication between the opposite ends of the piston-cylinder and then between the steam-chest and one side of said piston-cylinder, while at the same time direct communication between the steam-chest and the same side of said piston-cylinder is established outside of said valve, substantially as described.

3. The combination of a steam-chest, piston-cylinder, suitable ports, and a valve with means for operating the same, said valve being provided with a steam-passage which alternately establishes communication between the opposite ends of said piston-cylinder, and then between the steam-chest and one side of said piston-cylinder, while at the same time said valve admits steam to said piston-cylinder directly from the steam-chest outside of the valve, substantially as described.

JOHN THOM.

Witnesses:
FREDERICK JOHN CHEESBROUGH,
JOHN HAMILTON REDMOND,
Both of 15 *Water Street, Liverpool, England.*