(No Model.) 4 Sheets—Sheet 1.

M. R. MOORE.

STEAM ENGINE.

No. 534,753. Patented Feb. 26, 1895.

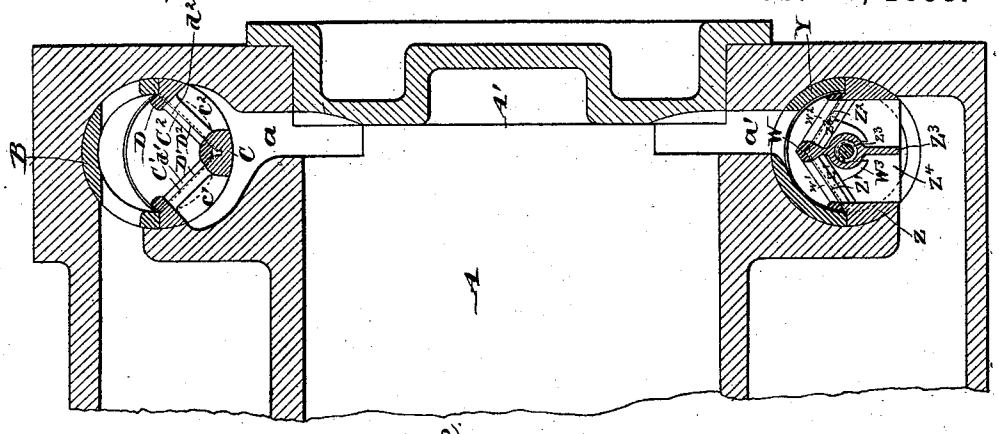

Fig. 2.

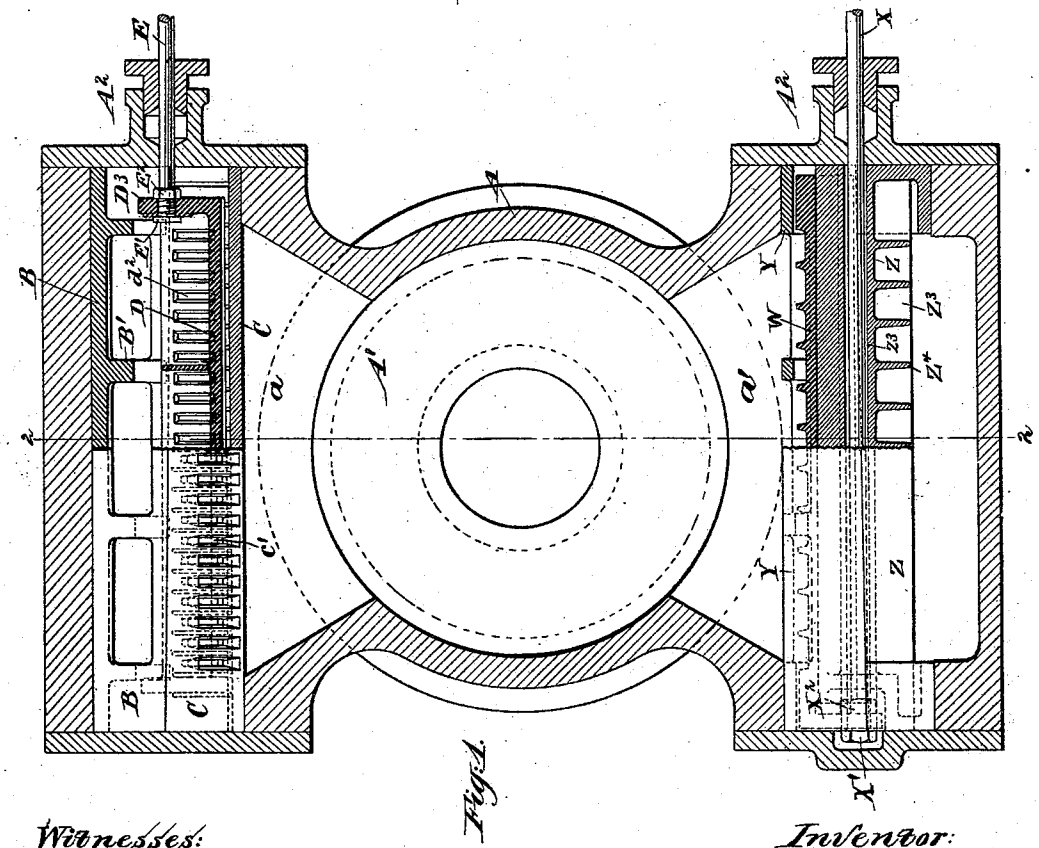

Fig. 1.

Witnesses:
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M. F. Boyle.

Inventor:
Matthew R. Moore
by his attorney
Thomas Drew Stetson

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M. R. MOORE.

STEAM ENGINE.

No. 534,753. Patented Feb. 26, 1895.

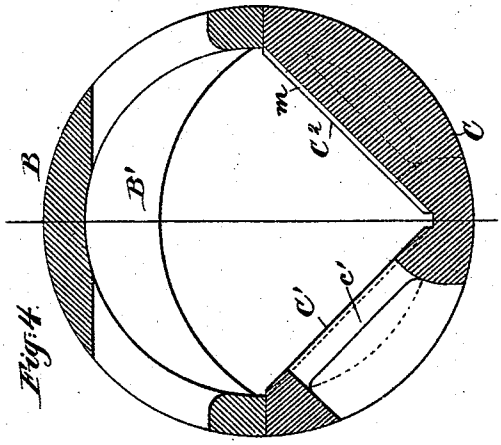


Fig. 4.

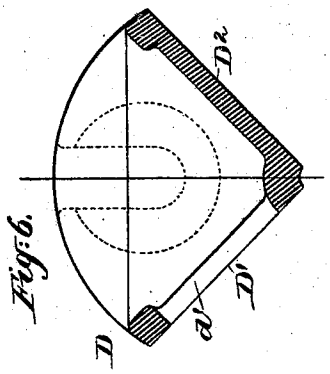
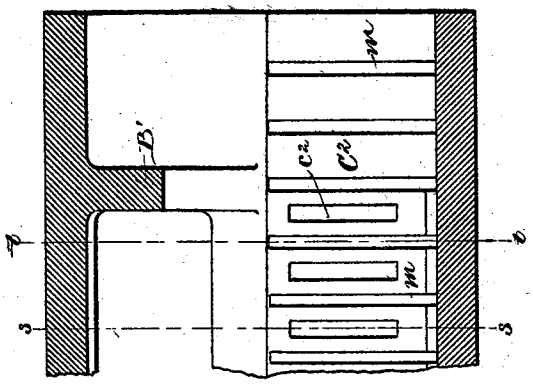


Fig. 6.



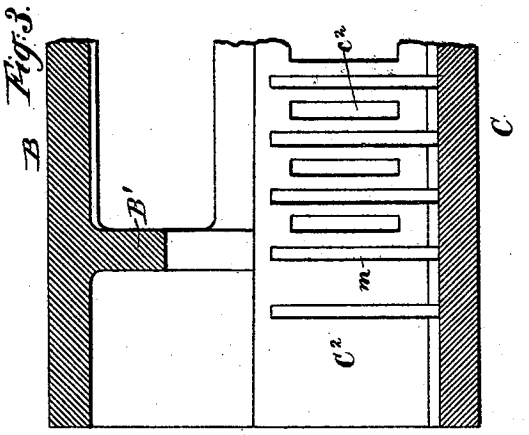


Fig. 3.

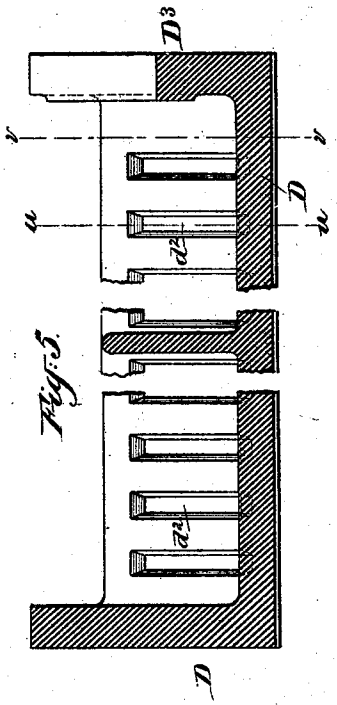


Fig. 5.

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M. R. MOORE.

STEAM ENGINE.

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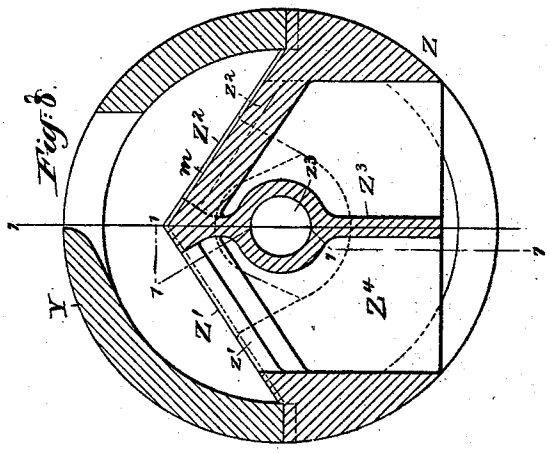

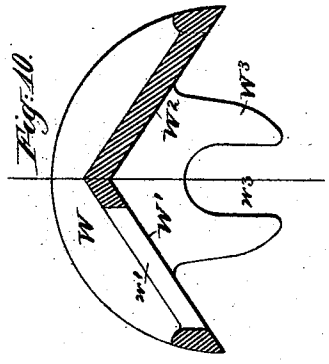

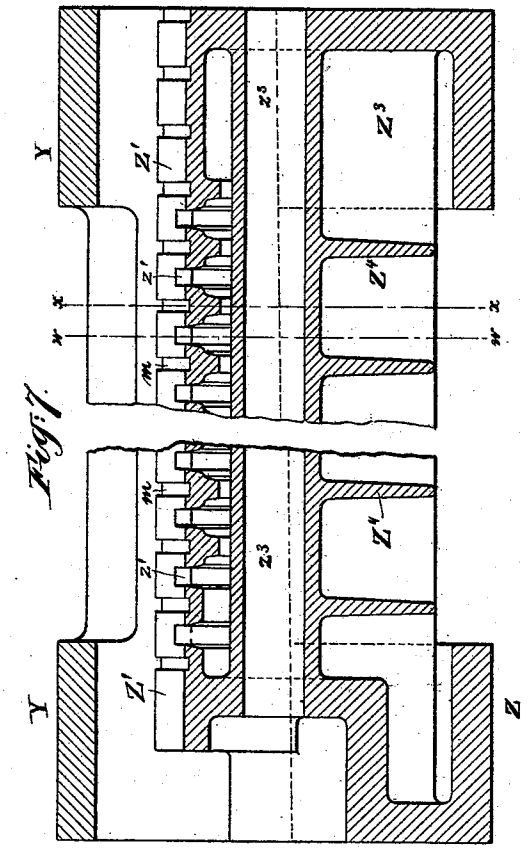

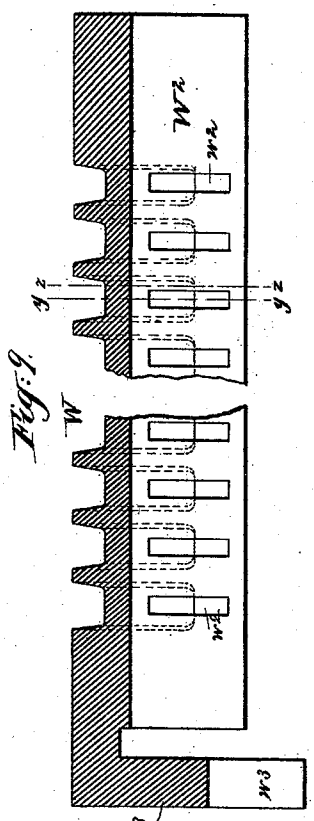

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M. R. MOORE.

STEAM ENGINE.

No. 534,753. Patented Feb. 26, 1895.

Fig. 1.

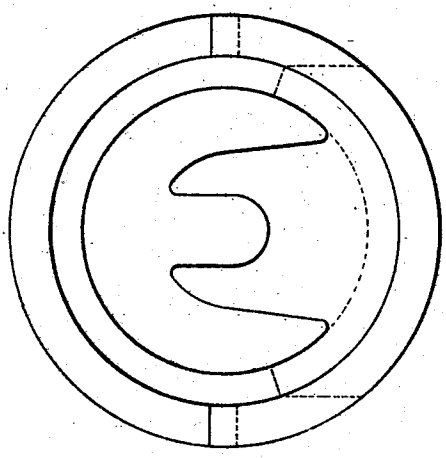
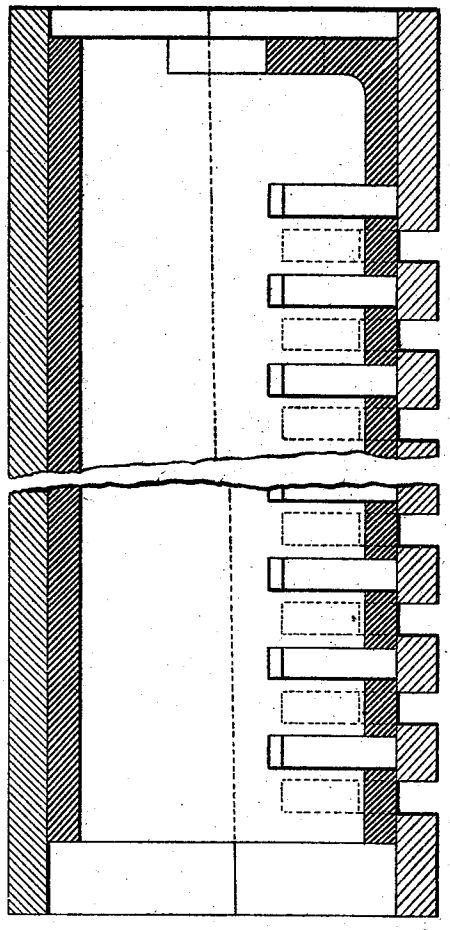


Fig. 2.



Witnesses:
Charles R. Searle.
M. F. Boyle.

Inventor:
M. R. Moore
By
Thomas Drew Stetson
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MATTHEW ROBERT MOORE, OF INDIANAPOLIS, INDIANA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 534,753, dated February 26, 1895.

Application filed May 2, 1894. Serial No. 509,756. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW ROBERT MOORE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a certain new and useful Improvement in Steam-Engines, of which the following is a specification.

The improvement applies to the construction and mode of connection of the valves and adjacent parts.

I will describe the invention as applied to the type of engine known as "Corliss." I will assume that the valves are operated in the manner of a Corliss engine, by moving them by a positive motion in the opening, opening to various extents, and allowing them to close and be arrested automatically;—but the valves may be operated positively in both directions by any suitable mechanism, if preferred.

I bore a separate chamber for each valve in planes at right angles to the axis of the main cylinder, and fit bushings or shells therein, which serve as seats for the valves. Each shell is divided in two nearly or exactly equal parts, the joining line being slightly oblique so that each part is tapered. One part being set in position, the other part on being forced in acts wedge-wise and secures the parts tightly and reliably.

Instead of one or more ports extending longitudinally of the valve and seat, and operated by a partially revolving or oscillating motion, I provide a great number of ports, each extending transversely of the valve-seat, and operate the valve by reciprocating it endwise.

The seat is cast integral with the lower portion of the shell, and extends across, presenting a double inclined surface. The seat for each steam-valve is arranged V-wise,—the angle downward. The seat for each exhaust valve is arranged A-wise,—the angle upward. The valve in each case is made to correspond. The angular form of the valve gives great strength with little weight, which is an important consideration with quick-working engines.

Each valve-rod may reciprocate in the axis of the shell. It may be convenient to extend each rod the whole length of the valve and make the connection where it can be easily accessible by removing the bonnet through which the valve is inserted and removed. I will show the exhaust valves only as thus connected.

I have devised a construction by which each exhaust valve-rod extends through a tubular passage provided below the seat, and is connected to its valve and operates it without involving any opening through which steam can pass from the cylinder to the exhaust passage.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention. They represent the novel parts with so much of the ordinary parts as is necessary to indicate their relation thereto.

Figure 1 is a central vertical section through one end of a cylinder, with a cross-section of the steam and exhaust valve at that end. Fig. 2 is a vertical section on the line 2—2 in Fig. 1. The remaining figures are on a larger scale. Fig. 3 is a central vertical longitudinal section through the steam valve shell. It shows each end with the mid-length portion broken away. Fig. 4 is a transverse section of the same. The left side of this figure is on the line *s*—*s* in Fig. 3, and the right side of this figure is on the line *t*—*t* in said figure. Fig. 5 is a central vertical longitudinal section of the steam valve with certain portions broken away. Fig. 6 is a vertical cross-section, the left side on the line *u*—*u* in Fig. 5, and the right side on the line *v*—*v* in said figure. Fig. 7 is a longitudinal section through the exhaust valve shell on the irregular line 7—7 in Fig. 8. It will be observed that the extreme upper portion of this figure is a central vertical section,—next, an approximately quarter depth above the center is at the angle indicated by the angular line in Fig. 8, while the lower portion of the figure is mainly on a line a little one side of the central web. Fig. 8 is a transverse vertical section through the same exhaust shell. The left side is on the line *w*—*w* in Fig. 7, and the right side on the line *x*—*x* in said figure. Fig. 9 is a central longitudinal vertical section of the exhaust valve with the mid-length portion broken away, and Fig. 10 is a corresponding transverse section, the left side on the line *y*—*y* in Fig. 9, and the right side on the line *z*—*z* in

said figure. Fig. 11 is an end view, and Fig. 12 a longitudinal section showing a modification.

Similar letters of reference indicate like parts in all the figures where they appear.

A is the cylinder; A′, the head; *a*, the steam port, and *a′* the exhaust port.

B and C are the two parts of each steam-valve shell, fitted tightly in a steam-valve chest bored in the ordinary manner of the Corliss engine, in a plane at right angles to the axis of the main cylinder. Each part B and C forms approximately half of the shell, but the line of junction is slightly oblique. The obliquity may be an eighth of an inch to the foot. Certain portions of each part of the shell are designated, when necessary, by super-numerals.

The upper part B is formed with liberal apertures to admit the steam, and with webs B′ which stiffen it. The function of this portion is to hold the lower portion C down firmly and tightly.

The lower part C is formed with two oppositely inclined nicely finished faces C′, C², which serve as valve-seats. In these faces are cut a series of transverse ports *c′*, *c²*. I have shown twenty-two (22) pairs.

D is a steam-valve, formed with two faces D′, D², carefully finished to match the correspondingly inclined faces C′, C², of the seat. In each face of the valve are cut ports *d′*, *d²*, corresponding to the ports *c′*, *c²*. In each both valve and valve-seat the bridges between the ports are twice the width of the ports so that the valve may have a lap of half a port width.

At one end of the V-section valve D is a sufficiently strong web D³ with its faces nicely finished. The steam valve-rod E matches in an open slot *d³* in this web D³, and takes hold of this web by means of an offset and washer E′ and nut E², or by other firm and reliable connection. The union is effected before the valve and rod are put in place. In the working of this valve the steam from the boiler at full pressure entering through the liberal ports *b*, which may be in the upper part B of the shell, fills the upper portion of each steam valve chamber, and when the corresponding steam valve D is by its endwise reciprocating motion transverse to the axis of the cylinder moved to such an extent as to cause these parts to coincide with the several corresponding ports *c′*, *c²*, the valve is open and the steams flows freely through the valve and seat and thence through the liberal apertures in the lower part C of the shell and flows to the cylinder to actuate the piston, not shown.

For the exhaust valve the upper part of the shell is provided with liberal apertures *b* which receive steam from the exhaust port *a′* of the cylinder. As in the other, the steam-valve, the function of this portion of the shell, which I will mark Y, is mainly useful to hold the lower portion Z which carries the valve-seat firmly and tightly down, but it is also important in occupying space and thus reducing the loss in filling valve spaces. This lower portion is formed with two inclined faces Z′, Z², in each of which are cut a series of ports *z′*, *z²*, extending transverse to the motion of the valve. The exhaust valve W is formed with correspondingly inclined faces W′, W², having corresponding ports *w′*, *w²*. The valve is furthermore provided at the outer end with a sufficiently deep web W³, formed with a slot *w³*, which receives the operating rod X equipped like the steam-valve rod with nuts X′ and X². These parts are arranged at the outer end of the valve-chamber, the end farthest from the valve operating mechanism and are easily accessible on simply removing the bonnet. The valve can be conveniently connected and disconnected.

I arrange to have each valve-rod reciprocate in the axial line of the shell. The cross-section of the steam valve and its seat is like the letter V. I will term it V-wise. The cross section of the exhaust valve and its seat is like an inverted V. I will term it A-wise. This arrangement reduces the clearance spaces. Besides having one the reverse of the other I use a different angle for the steam valve and its seats from the exhaust valve and its seats. The angle which the two faces of the steam valve make with each other is about ninety degrees, the center line being lowest. The angle which the two faces of the exhaust valve make with each other is about one hundred and twelve degrees, the center line being highest. This allows for the space required for the stem and its inclosing tubular casing, which will now be described.

Each lower half of the exhaust shell is formed with a sufficiently stout central web Z³, braced by transverse webs Z⁴, all cast integral. At the proper height in this central web Z³ coinciding with the axis of the shell is a tubular passage extending the whole length, as indicated by *z³*. This passage is sufficiently large to allow the valve-operating rod X to extend loosely through. The engine operates with the space in the lower portion of the shell except the interior of that tube Z³ in constant communication with the exhaust passage, which coincides with the liberal port *c* in the lower half of the shell and consequently subject to the low pressure therein, while the limited space above the valve W and also the space at the end of the shell where the connection to the valve-rod is formed, and the small space around the valve-rod within the tubular passage *z³* are subject to the fluctuating conditions which obtain within the main cylinder. The point of exit of the valve-rod being guarded by an efficient stuffing-box, A² and the casting for the lower portion of the shell being sound and steam-tight, the valve is worked above its seat by a rod beneath its seat without involving any opening through which steam can pass, or the necessity for any further steam-tight joint.

To admit steam and lubricant under each

valve and to prevent the formation of ridges on the seats and valves by unequal wearing, a narrow groove *m* is planed across each seat at the middle of each bridge.

The triangular shape of the valves allows them to be made very light without sacrificing the necessary stiffness and strength. Thus the inertia of the valves, which in high-speed engines is a permanent source of trouble, is reduced to a very small amount.

I do not in this patent claim the construction of the shell in two parts with the joining edges oblique, such being made a part of the subject of a separate patent to me of even date herewith.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. I can vary the inclination of the faces. I can vary the number of the ports, always having the same number of ports in the valve as in the seat to which it is matched, and all equally spaced. I can vary the amount of lap. It is important, in working the steam-valves Corliss-wise, allowing them to shut automatically and be arrested gradually by a dash-pot, or an air or steam cushion, that there be sufficient lap to allow each valve to have some movement in the closed position and to come to rest with some variation of position and still hold the port tightly closed.

Instead of the angle shown for the seats and valves I can give them various other angles, or can make them curved. I can have the valve a portion of a cylinder and have it reciprocate on a corresponding cylindrical seat. Figs. 11 and 12 show such a form. I prefer the forms first shown.

I claim as my invention—

1. In a steam engine of the Corliss type, a shell in two tapering parts one part having a valve seat formed thereon, both held in place by their mutual wedging action, substantially as herein specified.

2. In a steam engine, having reciprocating valves the valve-seats with faces Z′, Z^2, inclined relatively to each other, and transverse ports z', z^2, having also a tubular passage z^3, under the seat, inclosed steam-tight as shown, with free space around it for the passage of the steam, in combination with a valve W, having correspondingly inclined faces W′, W^2, and corresponding transverse ports w', w^2, and the reciprocating valve-rod X, extending through said passage z^3, with means as the nuts X′, X^2 for engaging the parts together, and attaching and detaching the rod and the valve, all arranged for joint operation substantially as herein specified.

3. In a steam engine of the Corliss type, having valve-chambers extending transverse to the axis of the cylinder, and having steam-receiving ports and steam-delivering ports, the angular steam valve seats arranged **V**-wise and the angular exhaust-valve seats arranged **A**-wise, each seat provided with a series of transversely arranged ports and carrying a valve correspondingly **V**-formed or **A**-formed, and correspondingly provided with a series of transverse ports and properly reciprocated, all combined and arranged for joint operation substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

MATTHEW ROBERT MOORE.

Witnesses:

ROLLIN DEFREES,

E. K. MARQUIS.