W. MOORE.
Steam-Engines.

No. 219,496. Patented Sept. 9, 1879.

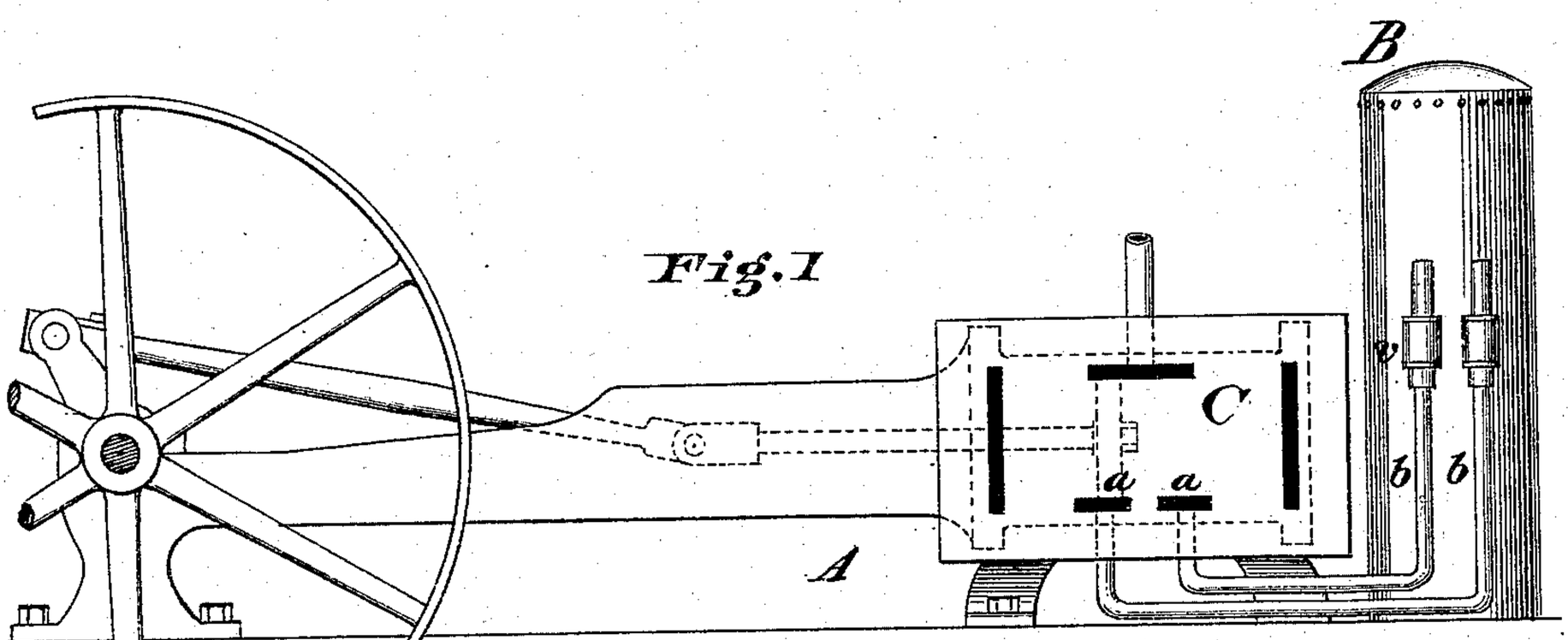
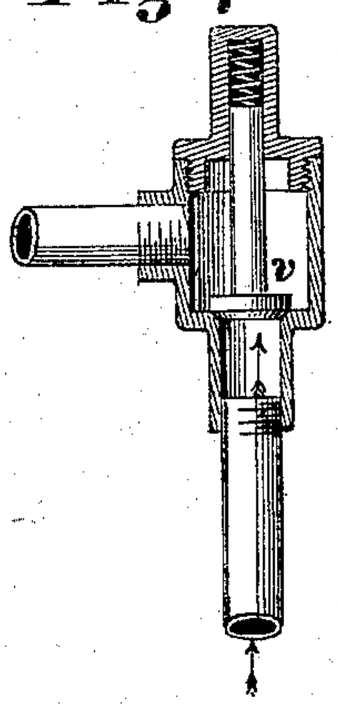


Fig. 1

Fig. 7



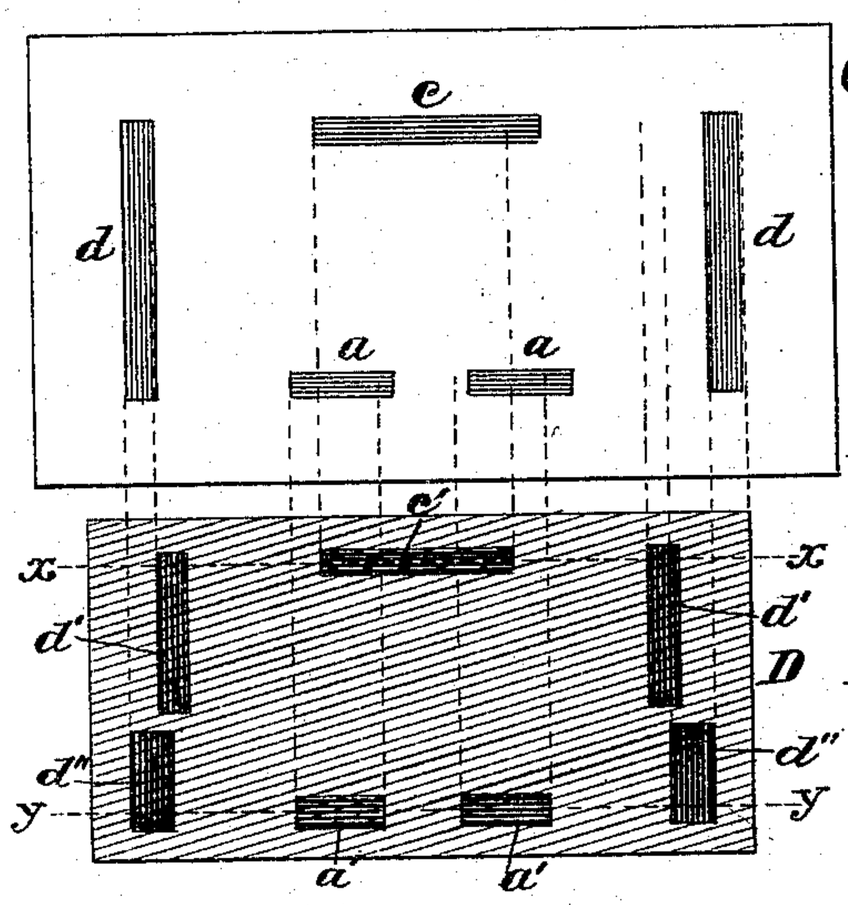


Fig. 2

Fig. 5

Fig. 3

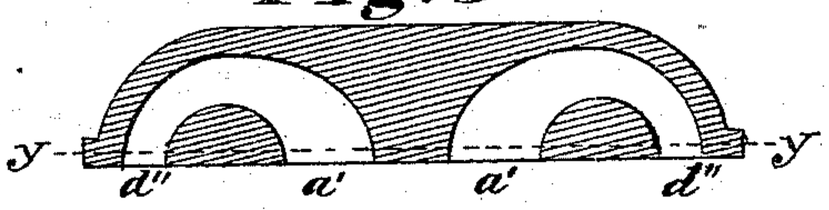


Fig. 4

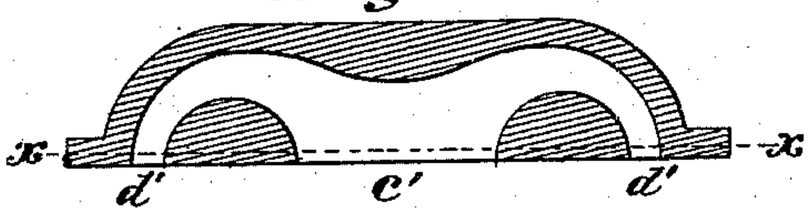
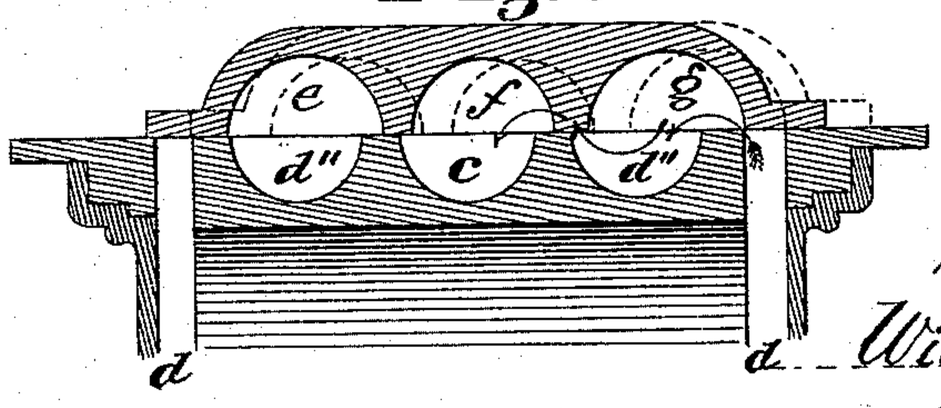


Fig. 6



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UNITED STATES PATENT OFFICE.

WILLIAM MOORE, OF KOKOMO, INDIANA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **219,496,** dated September 9, 1879; application filed July 7, 1879.

To all whom it may concern:

Be it known that I, WILLIAM MOORE, of Kokomo, Howard county, Indiana, have invented a new and useful Improvement in Steam-Engines, of which the following is a specification.

My invention relates more especially to high-pressure engines operated by the expansive force of steam, in which such expansive force is not entirely expended in driving the piston; and consists in the method and means by which the steam, after driving the piston, is further utilized for other useful purposes.

As illustrating the principle of my invention, I have shown, and specify herein, a reservoir, which may be a feed-water heater connected with an ordinary slide-valve engine, in which class of devices a higher degree of heat is desirable, and may be attained by exhausting the steam from the engine into the heater under pressure, as hereinafter more fully set forth.

In the drawings, Figure 1 is a side elevation of the engine and reservoir combined. Fig. 2 is a plan view of the valve-seat, with a corresponding plan view of the bottom surface of the valve. Fig. 3 is a side sectional view of the valve at the line *y y*, Fig. 2. Fig. 4 is a cross-sectional view of the valve at the line *x x*. Fig. 5 is a plan of the face of the slide-valve, and Fig. 6 shows a modified form of valve and seat in side section; and Fig. 7, the check-valve used in connection with the heater.

In the drawings, A is the engine, and B the reservoir, which, in the present case, we may consider a feed-water heater, or a "lime-extractor," in which a high degree of heat is very desirable and essential to its perfect operation. Pipes *b b* lead from the exhaust-ports of the engine to the heater, and are provided with check-valves *v*, by which the return of the steam is prevented. The valve-seat C of the engine has two rectangular end ports, *d d*, communicating with the cylinder in the usual manner. The exhaust-ports are three in number, *a a c*, of which the two former communicate with the heater, as before described, while the latter is open to the atmosphere by means of the ordinary escape-pipe.

The slide-valve D is constructed with a longitudinal partition, dividing the recesses or channels *d' d' c'* from those indicated at *d'' d'' a' a'*, as shown more fully in the plan view, Fig. 5, and in the sections of the valve, Figs. 3 and 4, taken on the lines *x x* and *y y* of Fig. 2, respectively. The corresponding recesses of the valve communicate by channels, as shown in Figs. 3 and 4.

It will be observed that the exhaust-cavities *d''* of the valve are situated in advance of the cavities *d'*.

Supposing, now, the valve upon its seat, and traveling from right to left, or in the contrary direction, it will be readily seen that the exhaust of steam from the cylinder through the port *d* of the valve-seat will pass first into and through the recess *d''* of the valve, and through the channel connecting it with port *a'*, and thence into the heater. This may be termed the "preliminary exhaust," and the dimensions of the valve and the relative position of the ports and its operating mechanism are so arranged that the preliminary exhaust begins after steam is cut off for expansive working, but before the stroke of the piston is fully completed. As the valve continues its travel, and when the piston has about completed its stroke, the main exhaust-port *d'* of the valve opens, and allows the remaining steam to escape into the outer air, thus preventing any back-pressure on the piston. The preliminary exhaust is therefore under pressure according to the pressure of steam in the cylinder, and the capacity of the heater being insufficient to allow a full expansion of the steam, it receives the benefit of the increased pressure, and consequent higher degree of heat of the steam exhausted into it. For example: Suppose the pressure of steam in the cylinder, when the preliminary exhaust takes place, to be one hundred pounds per square inch, its temperature will be about 337° Fahrenheit. Now, being allowed to flow into a larger containing-space formed by the heater, its pressure will be correspondingly reduced—say to fifty pounds per square inch—and its temperature to 300° Fahrenheit. This pressure being practically maintained by the recurring exhaust from the working cylinder, and the check-valves preventing a return flow, there is a corresponding gain in the heat above what would exist were the steam allowed to

expand in the heater to its normal state at 212° Fahrenheit.

The check-valve *v* in each connecting-pipe is held to its seat by a spring, as shown in Fig. 6. By the use of these a substantially continuous pressure is maintained in the heater or other vessel into which the steam is exhausted.

Another form of the valve and seat by which a similar result is attained is shown in Fig. 6. The valve has three cavities and the valve-seat five ports, all in the same line. Supposing the valve in the position shown in the figure and moving to the right, the cylinder-port *d* is about opening into the valve-cavity *g*. The steam from the cylinder will pass through the cavity *g*, and thence by the port *d''* to the heater, and as the valve continues to move the cavity *f* will open into *d''*, when the remaining steam will pass over through *f* into the port *c* and escape into the atmosphere. The operation in the other direction is precisely similar.

The principle of my invention may be carried into operation by using two or more valves instead of one, or by using lifting or rotating valves operated by cams or otherwise. It may be applied to any of the purposes to which the heat or pressure of the exhaust-steam is applicable, such as heating buildings, boiling or evaporating liquids, driving supplemental engines, &c., by means of a reservoir or pipes, into which the preliminary exhaust may take place.

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

1. The method of utilizing exhaust-steam of a high-pressure steam-engine for heating and other purposes and preventing back-pressure upon the piston, the same consisting in directing the preliminary or first part of the exhaust into a suitable reservoir, and diverting the following or main portion of the exhaust to the open air, substantially as described.

2. In combination with the suitably and correspondingly formed valve-seat of a high-pressure engine, a valve or valves adapted to direct the preliminary or first part of the exhaust from the cylinder of said engine to a closed reservoir, and to direct the following or main portion of said exhaust to the open air, substantially as described.

3. In combination with a valve-seat provided with ordinary receiving steam-ports and two sets of exhaust-ports, a slide-valve divided by a longitudinal partition, having recesses upon one side suitably arranged to allow a preliminary and partial exhaust into one set of said exhaust-ports, and upon the other to allow a main exhaust into the air, substantially as and for the purpose specified.

4. The valve-seat C, provided with receiving-ports *d d* and exhaust-ports *a a c*, in combination with the valve D, provided with recesses *d' d'' a' c'*, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my hand this 19th day of June, 1879.

WILLIAM MOORE.

Witnesses:

EDGAR J. GROSS,

L. M. HOSEA.