E. S. WINCHESTER.

Rock-Drills.

No. 208,449. Patented Sept. 24, 1878.

Fig. 1.

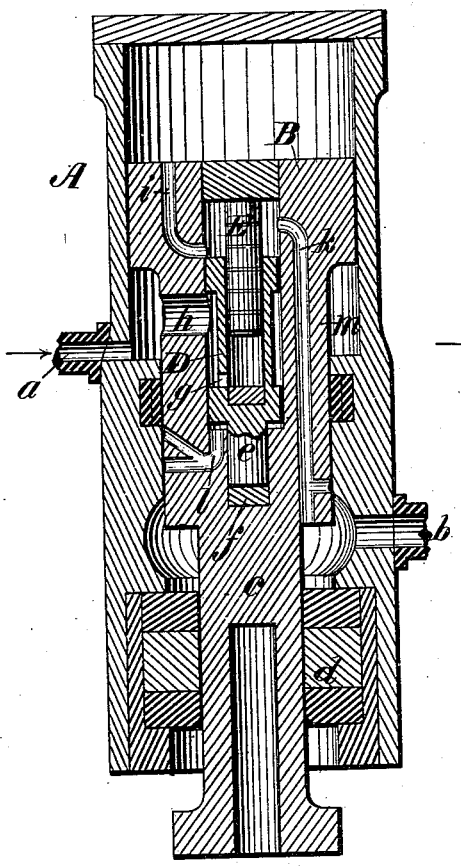
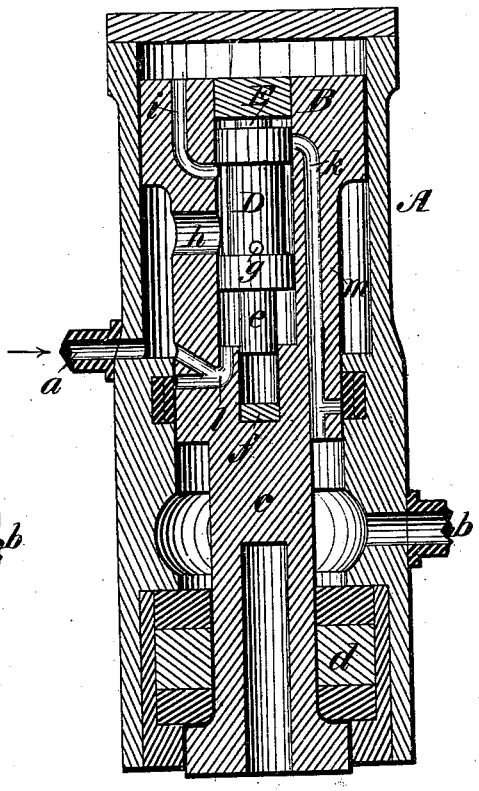


Fig. 2.



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IMPROVEMENT IN ROCK-DRILLS.

Specification forming part of Letters Patent No. **208,449**, dated September 24, 1878; application filed June 21, 1878.

To all whom it may concern:

Be it known that I, EDWARD S. WINCHESTER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Steam-Valves, of which the following is a specification:

This invention relates that class of valves which are mounted in the pistons of rock-drills, pumps, and engines for the purpose of controlling the admission and discharge of the steam by which the piston is actuated, as represented, for example, in the patent hitherto granted to me on the 22d day of August, 1876, No. 181,386; the object of the present invention being to secure a positive movement of the valve in both directions, and to prevent the rebound of the valve after reaching the limit of its stroke, and at the same time to simplify and cheapen the construction of the parts.

With this end in view the invention consists in providing the reciprocating piston-valve with a small or secondary piston in one end, and with a port by which the steam is admitted constantly behind the small piston to force the same outward, in order that it may force the valve backward when the latter is relieved from steam-pressure, on its opposite end, as hereinafter more fully described.

Referring to the accompanying drawings, Figure 1 represents a central longitudinal section of a rock-drill provided with my improved valve, the parts being shown in the positions which they occupy during the movement of the main piston or piston proper; Fig. 2, a similar view, showing the position of the parts during the downward movement of the piston.

A represents the main cylinder, provided with an induction-port, *a*, and with an eduction-port, *b*, located at a lower point, the bore of the cylinder being reduced below the induction-port, as shown. B represents the piston, having at its upper end a head of suitable diameter to fit the large upper end of the piston, and having below said head a large neck or body adapted to fit closely within the reduced lower end of the cylinder in the manner shown, so as to prevent direct communication between the induction and eduction ports.

At its lower end the piston is provided with a stem or neck, *c*, of less diameter than the interior of the cylinder, and which extends outward through a stuffing-box or gland, *d*, in the lower end of the cylinder, as shown.

In the upper end of the piston B, I form a longitudinal central chamber or bore, in which is mounted a reciprocating piston-valve, D, having its ends adapted to fit closely within the bore, but having its central portion or waist reduced to leave an annular steam-space around it, into which space steam is constantly supplied through a port or opening, *h*, in the piston, which port is always in communication with the steam-induction port *a*. At its lower end the valve is provided with an elongation or neck, *e*, of small diameter, which extends downward into a hole or opening, which contains a wooden or other elastic buffer, *f*, against which the neck strikes as the valve finishes its downward movement, and by which the movement of the valve is arrested easily and without shock.

In the upper end of the valve I mount a longitudinal piston, E, one end of which protrudes beyond the valve, and through the side of the valve I form a port, *g*, through which steam is constantly admitted below the small piston, so that the latter is always urged outward or upward against the top of the bore in which the valve works, so that it tends always to push the valve downward. For the purpose of permitting the passage of steam into and out of the upper end of the cylinder above the piston, I provide a port, *i*, extending downward through the upper end of the piston into the bore or seat in which the main valve D works, the inner end of said port being so located that the upper head of the valve is carried first above and then below it as the valve moves to and fro. For the purpose of permitting the escape of the exhaust-steam which is delivered from the upper end of the cylinder through the port *i* into the space above the valve, I provide a port, *k*, extending from the upper end of the valve-space downward through the lower end of the piston,

where it is forked, and emerges both through the side and the end, as represented.

For the purpose of securing the passage of steam into and out of the valve-space below or under the lower end of the valve, I provide the piston with a port, *l*, leading from the lower end of the valve-space outward through the sides of the piston at two different points, one above the other, as shown in the drawings. The lower end of the valve, which is subjected to the pressure of steam entering through the port *l*, has an area greater than the sectional area of the small piston E in the upper end of the valve, so that when both the piston and the lower end of the valve are subjected to the pressure of steam the pressure against the lower end of the valve will overcome the downward pressure exerted by the small piston and force the valve upward, the valve being retained in its elevated position by the pressure of the steam until the latter is cut off, whereupon the valve will be driven downward again by the upward pressure of the small piston E.

The operation is as follows: The parts being in the position represented in Fig. 1, the valve is held down by the pressure of steam acting on the piston E. Steam entering the port *a* in the annular space around the neck *m* of the piston acts under the head of the latter and forces it upward, the steam previously admitted to the upper end of the cylinder above the piston escaping in the meantime through the port *i* into the space above the valve, and thence through the port *k* into the annular space in the lower end of the cylinder around the piston-rod *c*, whence it escapes through the port *b*. As the piston reaches the upper limit of its movement the port *l* is carried into position to communicate with the induction-port *a*, whereupon live steam passing through the port *l* into the space below the valve forces the valve upward against the counter-pressure of the small piston, the parts assuming the position shown in Fig. 2, whereupon the live steam passes through the port *h* into the space around the waist or body of the valve, and thence upward through the port *i* into the upper end of the cylinder, where it serves to force the piston downward, the downward movement being due to the fact that the area of the upper side of the piston is much greater than that of the lower side, which is constantly subjected to the pressure of the live steam. The valve is maintained in its elevated position during the downward movement of the piston by the pressure of the steam confined below it. As the piston completes its downward movement the port *l* is brought into communication with the exhaust-port, allowing the steam below the valve to escape, whereupon the valve is immediately forced downward by the action of the small piston.

The essential feature of my invention is the application to the sliding piston-valve of the small or secondary piston, forced outward by the action of the steam; and it is obvious that the details of construction may be modified as desired without departing from the limits of my invention, provided the small piston is caused to operate in substantially the manner described.

By the application of the small piston to the valve and the arrangement of parts in the manner described, I secure a positive action of the valve in both directions, and prevent the difficulty hitherto experienced from the rebound or reaction of the valve when the movement of the main piston is suddenly arrested.

In momentum-valves, as heretofore constructed, the rebound of the valve at the end of the stroke was frequently so great as to cut off or reverse the admission of steam, in consequence of which the proper action of the piston was not only rendered uncertain and irregular, but oftentimes entirely stopped—an action which cannot under any circumstances occur with the valve represented in the drawings.

Another advantage arising from my construction of parts is, that the valve is always compelled to move its entire operating distance, and that whenever the action ceases the valve is left in such position as to secure the starting of the piston when steam is admitted without requiring the parts to be adjusted or started by hand under any circumstances.

While the valve is represented in connection with the piston of a rock-drill, it is manifest that it may be applied to the pistons of pumps and steam-engines.

Having thus described my invention, what I claim is—

1. A sliding valve mounted in a piston, provided with a small piston or plunger at one end, and with a port for admitting steam constantly under said small piston, substantially as shown.

2. In combination with the main piston B, having the sliding valve D therein, the secondary piston E, mounted in the valve, and the port *a*, to admit steam behind said secondary piston.

3. In combination with the main piston and ports, substantially as shown, a piston-valve mounted in said main piston, and subjected at one end to an intermittent pressure of steam, and at the opposite end provided with a small piston, urged outward by a constant pressure of steam.

4. A direct-acting steam-valve provided in one end with a small piston, urged outward by a constant pressure of steam, and subjected at the opposite end to an intermittent and greater pressure of steam, substantially as shown, whereby the valve is caused to move in one direction by the direct press-

ure of the steam, and in the opposite direction by the pressure upon or against the secondary piston.

5. A reciprocating steam-valve mounted in the piston of a drill or engine, and provided at one end with a small area, subjected to a constant pressure of steam to cause a movement in one direction, and at the other end with a greater area, subjected to an intermittent pressure of steam to cause the movement in the opposite direction.

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