

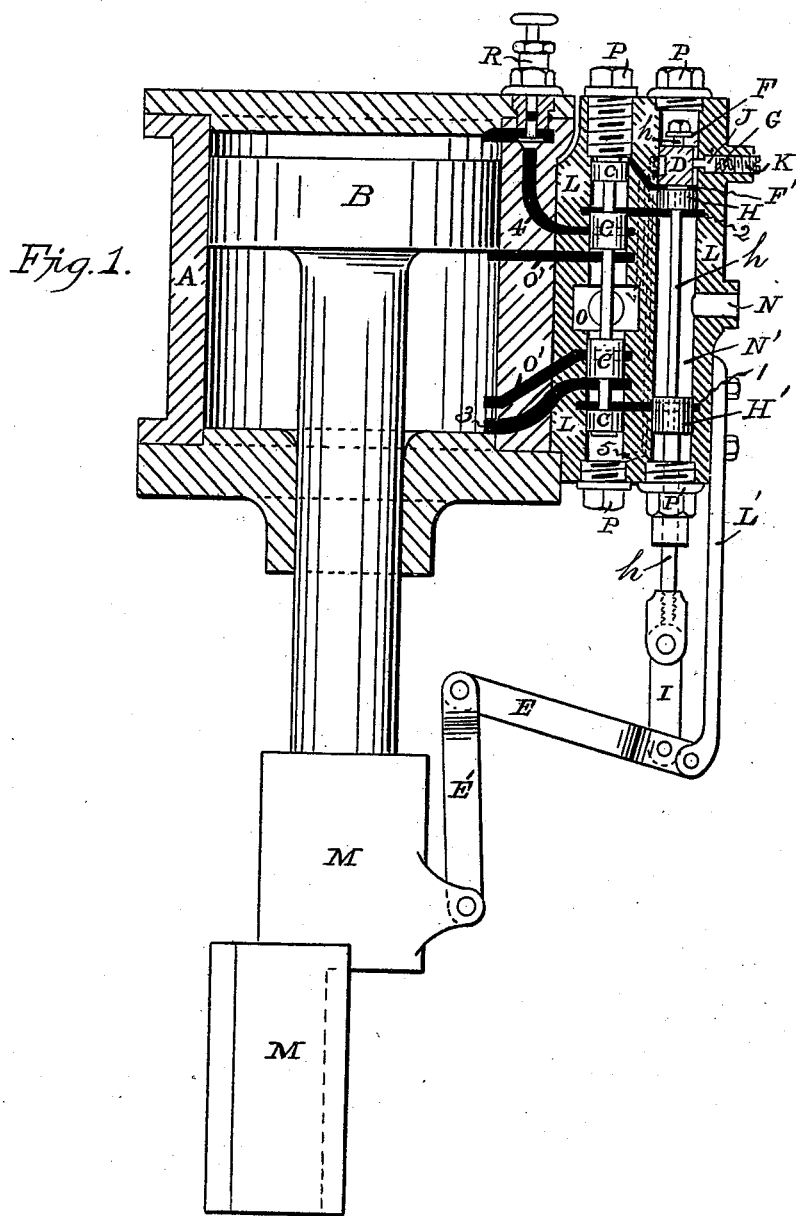
(No Model.)

4 Sheets—Sheet 1.

A. BALL.
STEAM ACTUATED VALVE.

No. 421,890.

Patented Feb. 25, 1890.



WITNESSES

Edward Caspary
Laura W. Helderby

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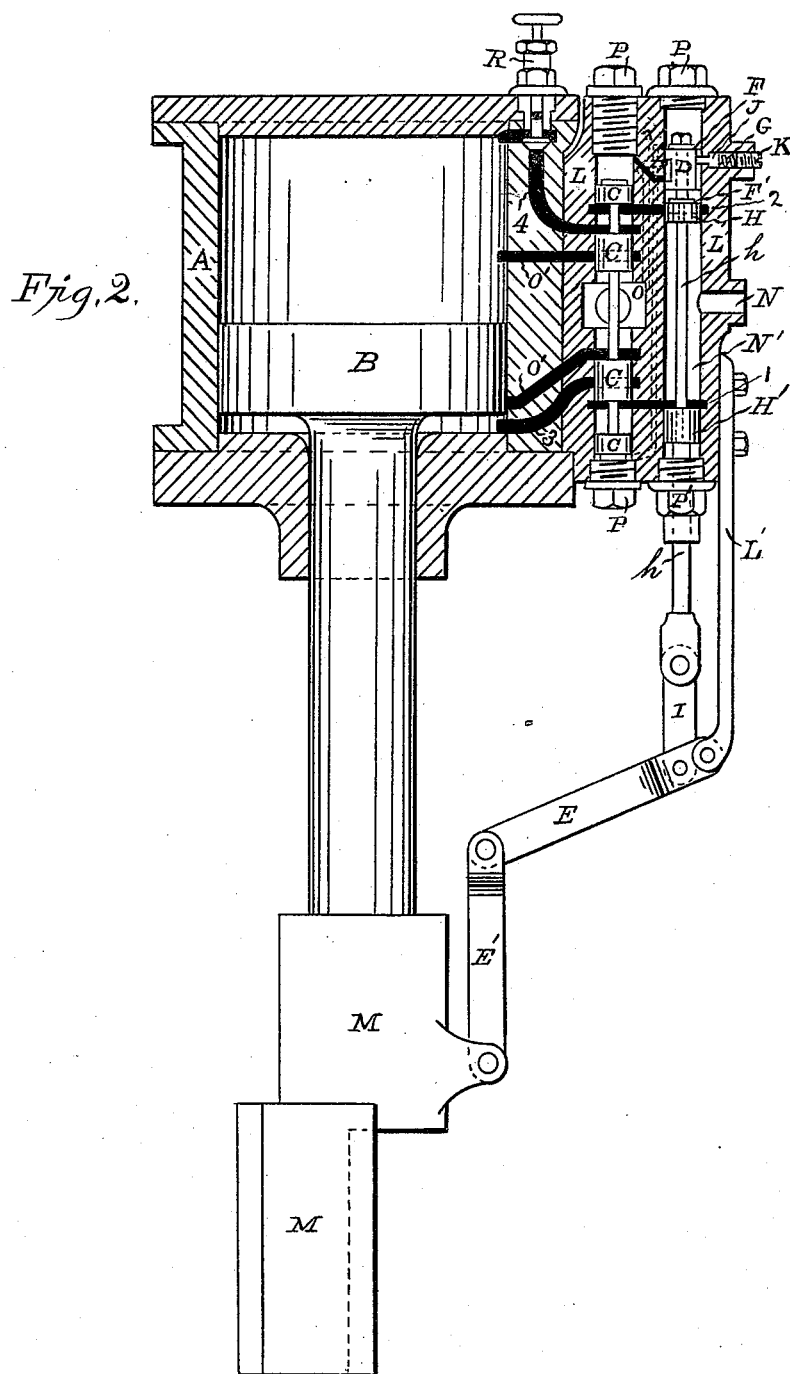
(No Model.)

4 Sheets—Sheet 2.

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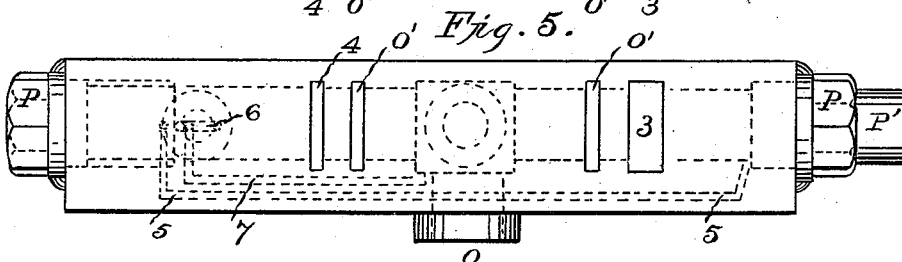
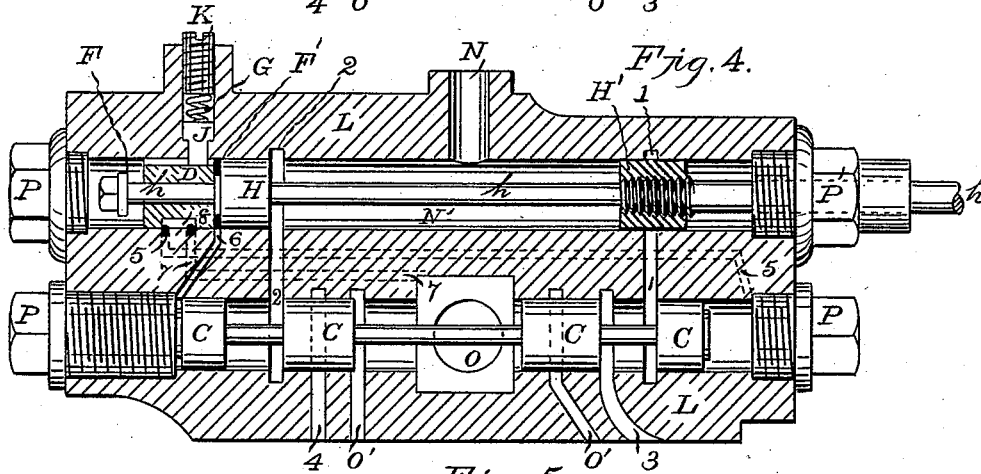
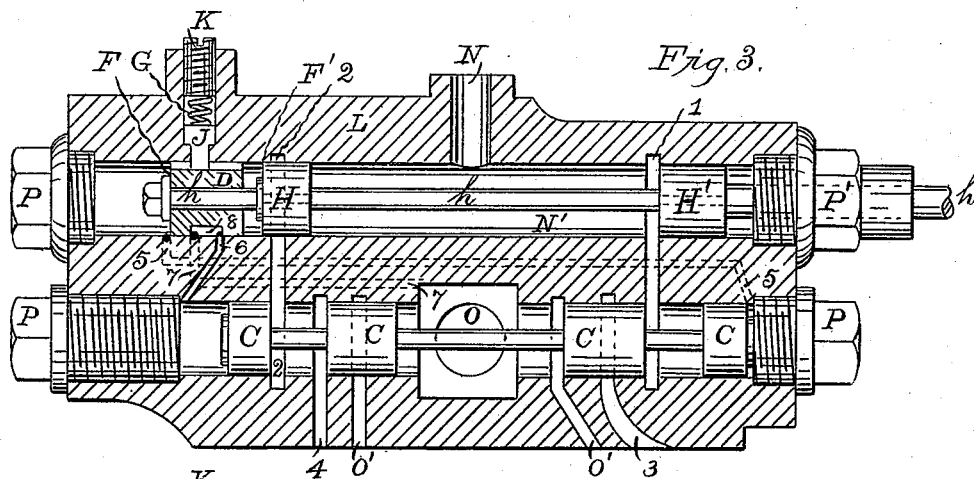


Fig. 6.



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Fig. 7.

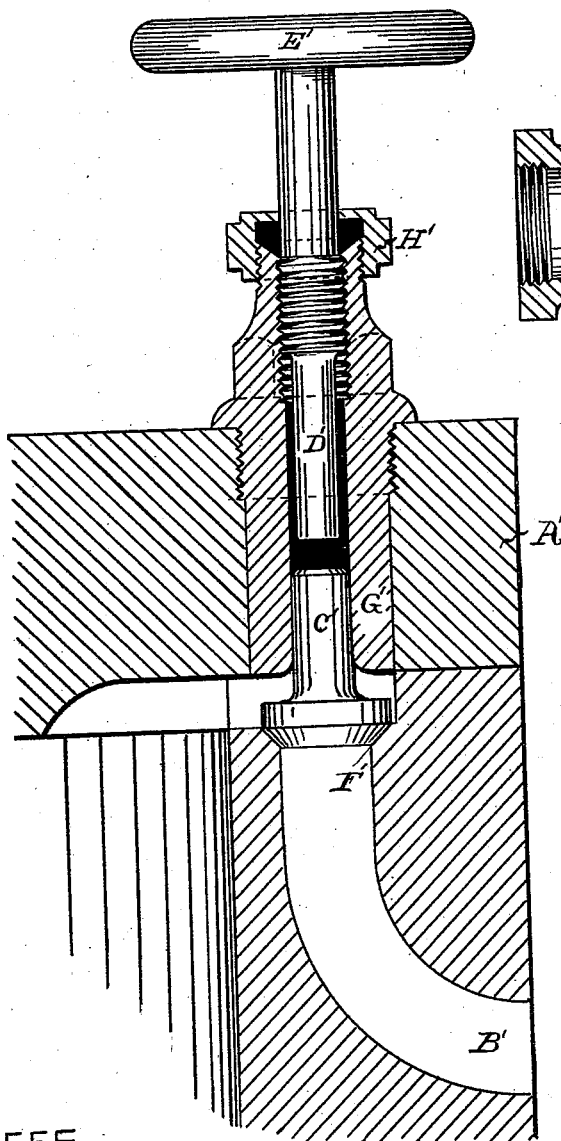
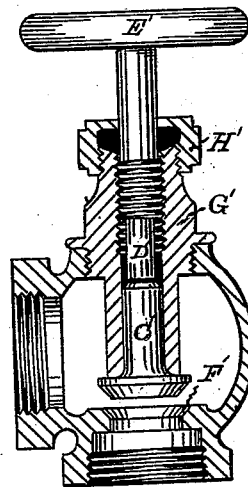


Fig. 8.



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UNITED STATES PATENT OFFICE.

ALBERT BALL, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO THE
SULLIVAN MACHINE COMPANY, OF SAME PLACE.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 421,890, dated February 25, 1890.

Application filed June 1, 1889. Serial No. 312,845. (No model.)

To all whom it may concern:

Be it known that I, ALBERT BALL, a citizen of the United States, residing at Claremont, in the county of Sullivan and State of New Hampshire, have invented certain new and useful Improvements in Steam - Actuated Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to provide efficient means for controlling, limiting, and utilizing steam or other fluid employed to drive engines, and it is particularly adapted to engines for drilling stone, though not confined thereto.

Among the particular objects attained are the easy regulation of the amount of steam according to the requirements of the work to be done, avoidance of the rebound or hammering of the main steam-valve, the instantaneous reversing of the valve that controls the steam which operates the main valve when the piston is arrested by a dead-stroke, whereby the piston is immediately raised or returned for another stroke, and the positive operation of subsidiary cut-off valves by connection with the piston-rod.

The invention relates to a combination of a reversing-valve, main or distributing valves, and subsidiary cut-off valves; and it consists in certain novel devices and combinations, hereinafter described and pointed out.

In the accompanying drawings, Figure 1 is a side elevation showing the piston up, the cylinder and chest being represented in section. Fig. 2 is a similar view showing the piston down. Fig. 3 is a view of the steam-chest in section, the valve being shown in position to drive the piston down. Fig. 4 is a similar view showing the valve in position to drive the piston up. Fig. 5 is a view of the steam-chest from the plane of contact with the steam-cylinder. Fig. 6 is an end view of the reversing-valve, and Figs. 7 and 8 are sectional views of a check-valve provided with means for regulating its action.

A and B, Figs. 1 and 2, indicate, respectively, the cylinder and piston.

C C C C are main or distributing valves, and D is the reversing-valve.

H and H' are cut-off valves. These valves are balanced by longitudinal conduits for the free passage of steam therethrough.

h is the cut-off-valve rod. It has a screw-thread connection with the cut-off valves, whereby they can be adjusted to vary the quantity of steam admitted to the main-valve chamber.

I, Figs. 1 and 2, is the cut-off-valve connection.

E and E', Figs. 1 and 2, are respectively the cut-off lever and the cut-off-lever connection.

F and F' are shoulders on the cut-off-valve rod which move the reversing-valve D.

J is an adjusting-pin; G, an adjusting-spring, and K an adjusting-screw; and J', Fig. 6, a slot for the pin J, all designed to regulate by more or less frictional contact the movement of the valve D.

L is the steam-chest.

L', Figs. 1 and 2, is a bracket or arm attached to the steam-chest, to the lower end of which is pivoted the lever E.

M, Figs. 1 and 2, is the cross-head; N, a steam-inlet; N', a steam-inlet chamber; O, a steam-exhaust; and O' O' are exhaust-ports.

P P P are screw-plugs closing the steam-inlet and valve-chambers.

P' is a stuffing-box through which passes the valve-rod into a steam-chest.

In Figs. 7 and 8, A' is a section of a steam-cylinder; B', a steam-inlet port; C', the check-valve; D', a regulating or adjusting screw, and E' the handle to turn the screw; G', a cap holding the valve and regulating-screw, and H' a stuffing-box.

To cut off the flow of steam, screw D' can be turned in until it holds C' against its valve-seat F', so that the pressure of steam will not raise it. If a slight flow of steam is desired, the screw D' can be raised to allow the valve to be lifted from its seat the desired distance by steam-pressure.

1 and 2 indicate steam-ports leading from the cut-off-valve chamber to the distributing-valve chamber.

3 and 4 are inlet-ports leading from the distributing-valve chamber to the steam-cylinder.

5 is a port leading from the reversing-valve chamber to raise or throw up the distributing or main valve C.

6 is a port leading from the reversing-valve chamber to lower or throw down the distributing-valve.

7 is the exhaust-port leading from the reversing-valve chamber to the exhaust-cavity of the steam-chest.

8, Figs. 3, 4, and 6, is the exhaust-cavity in the reversing-valve.

The operation of the engine is as follows:
 10 The engine, as shown in Fig. 2 with the piston and all the valves down, (see also Fig. 3,) is ready to start. The friction upon valve D is, however, first suitably adjusted by means of the regulating-screw K and the spring and friction block or pin J. Steam being turned on, fills the chamber N', passes through the holes bored longitudinally through the valve H and by the side of the valve D, and down through the passage 5 into the valve-chamber under the valve C. The valve C is thereupon instantly thrown upward (the other valves remaining as before) into the position shown in Figs. 1 and 4, and opens the steam-inlet port 3, thereby admitting steam under the piston B. The piston is raised thereby, carrying up (by means of the connection E' and the lever E, and the connection I and the rod h) the cut-off valves H' and H, and reversing valve D until the point is reached where the live steam is to be cut off. This point is determined by the position of H' relative to the inlet-port, and it can be adjusted by a screw on the rod h, which screw passes through the valve, as shown in Fig. 4. The valve H', when it covers the port I, cuts off the live steam, and the remainder of the upward stroke is caused by expansion. When the piston passes the exhaust-port O', the pressure is removed and the piston and valves are ready to reverse. (See Figs. 1 and 2.) This reversing is effected as follows: The steam passes from the reversing-valve chamber through the port 6 above the valve C, which is instantly thrown down, as shown in Figs. 2 and 3, opening the steam-port 4. This carries the piston down and with it the cut-off valve (by means of E', E, I, and h.) When the cut-off valve H covers the port 2, the flow of live steam is thereby cut off and the rest of the travel is by expansion of the steam until the blow is struck or the exhaust O opened. In case the blow is delivered at part-stroke, the impetus of rod h, having a projection or shoulder F, throws down the reversing-valve D against shoulder F', thereby instantly reversing the valve C and throwing the piston up. The steam-ports 5 and 6 are uncovered when the valve D is at the extreme limit of its downward and upward movements, respectively. At such times the direction of the movement of the rod is changed and it slips through the valve, closing the space between it and the shoulder F or F' most distant from the open port, the valve remaining at rest until engaged by said shoulder.

The reversal by a blow at part-stroke above referred to is effected by the impact of the

shoulder F upon the valve D, which latter is held at rest by the friction of the adjustable spring and pin or block or like means until struck, as stated. It is obvious that the length of piston-stroke required to throw the valve D will depend upon the relative distance which the rod h is moved, which latter will depend upon the proportion of the arms of the levers between the piston and the valve-rod, provided the space between the valve D and shoulder F is fixed. If this distance be varied, other parts remaining unchanged, then the piston-stroke necessary to throw the valve will be correspondingly varied. It will be understood that the above-described throw only occurs upon a partial descent of the piston and that whenever there is a full downward stroke of the same the valve is pulled the whole length of its path by the shoulder F. The construction is such that if a dead-stroke be made—that is, if the piston be arrested before traversing the cylinder by a blow, as of a drill—it is instantaneously raised by suitable admission of steam and put in readiness for another stroke.

Although the up-and-down movement of the piston and valves has been above described, the invention is not confined to such movement, nor is it limited to use in any particular machine, and, further, it is manifest that details may be varied by mechanical skill. It is not of the gist of the invention, for example, that valve D be located, as in the present instance, in the steam-inlet chamber N', or that it be connected through the medium of the rod of the cut-off valves with the piston-rod, nor that the particular connections and levers nor special form of friction devices be employed, as these may be varied without departing from the invention.

When working up and down, and especially when carrying a heavy gang of steel drills, comparatively a small supply of steam is required, and, accordingly, to regulate this, as well as to economize steam, the combination check and adjustable valve R is used. By regulating this to close to any desired degree the port 4 between the distributing-valve and the cylinders the blow can be made very powerful or light in an instant without otherwise changing the machine, and this adjustment, together with the adjustment of the subsidiary cut-off valves H H', affords means of regulating the expenditure of steam with great nicety.

Having thus described my invention, what I desire to claim by Letters Patent is as follows:

1. In combination with the cylinder and the main steam-actuated valve and ports to admit steam to directly operate the same, the reversing-valve loose and movable on its support, but normally held at rest and arranged in the path of shoulders or projections on a rod or other part connected to the piston-rod of the cylinder, substantially as described, whereby the reversing-valve may

be thrown by concussion at a part-stroke to reverse the main valve.

2. In combination with the cylinder and the main steam-actuated valve and ports to admit steam to directly operate the same, the reversing-valve loose and movable on its support, but normally held at rest and arranged in the path of shoulders or projections on a rod or other part connected to the piston-rod of the cylinder, the length of the valve being less than the distance between the shoulders, whereby the reversing-valve may be thrown by concussion at a part-stroke to reverse the main valve, substantially as described.

3. The combination of the cylinder of the main valve C and spring-held valve D, placed loosely on its rod *h*, and said rod connected to the cylinder-piston and provided with shoulders F and F', arranged to move valve D by contact therewith and adapted to throw it by concussion at a part-stroke to instantly reverse the main valve and piston, all located in chambers provided with suitable ports, substantially as set forth.

4. The combination of the cylinder with the main valve, the subsidiary cut-off valves connected to the cylinder-piston, and a reversing-valve also connected to said piston, the valves being arranged in chambers provided with suitable ports, substantially as described.

5. The combination of the cylinder with the main valve, a check-valve, the subsidiary cut-off valves connected to the cylinder-piston, and a reversing-valve also connected to said piston, the valves being arranged in chambers provided with suitable ports, substantially as described.

6. The combination of the steam-actuated distributing-valve and its casing and ports with the rod *h* and valves H H', with their

casing and ports, and the lever and the connecting-rod and piston, substantially as described, whereby in a valve directly actuated by steam the cut-off valve H H' is actuated by the piston.

7. In combination with the main and reversing valves, the subsidiary cut-off valves, all located in chambers provided with suitable ports, the cut-off valves being bored to pass steam to balance the valves and to supply steam to the reversing-valve chamber, substantially as described.

8. The combination of a cylinder and adjustable cut-off valves with the adjustable check-valve free to move uniformly under the same pressure in every adjustment, and with a device for varying the extent of the automatic action of said check-valve without varying the pressure required to automatically move it, whereby the amount of steam admitted to the cylinder may be regulated, substantially as described.

9. In combination with the main and reversing valves, the subsidiary cut-off valves, all located in chambers provided with suitable ports, the cut-off valves being bored to pass steam to balance the valves and to supply steam to the reversing-valve chamber, substantially as described.

10. The combination of a cylinder and adjustable cut-off valves with the check-valve and with a device for varying the extent of the automatic action of said check-valve, whereby the amount of steam admitted to the cylinder may be regulated, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT BALL.

Witnesses:

FRANK A. BALL,
W. O. SMITH.