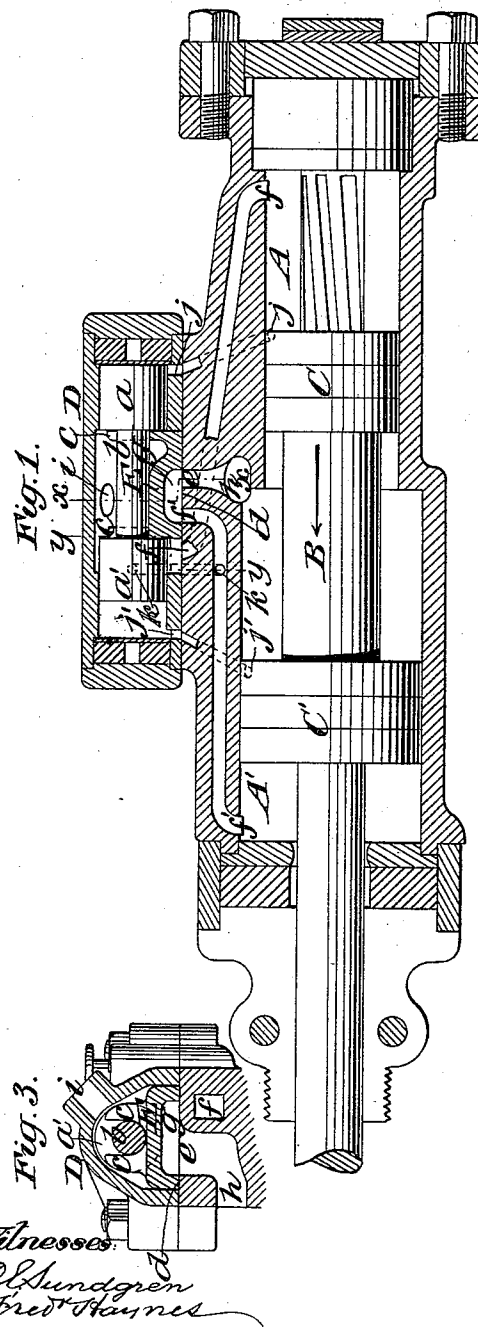
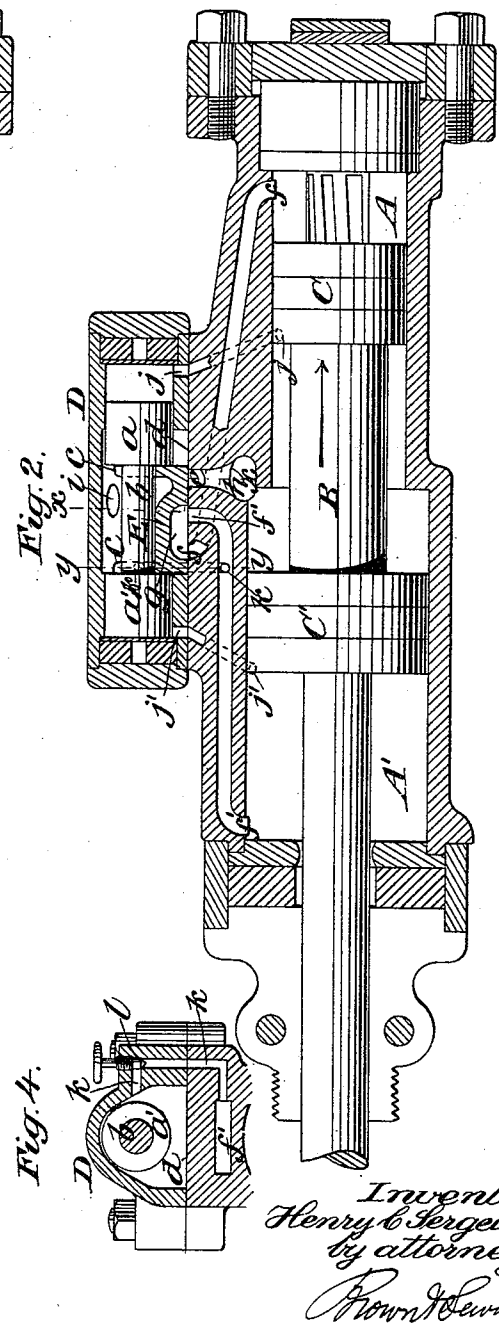
(No Model.)

H. C. SERGEANT.

STEAM ACTUATED VALVE FOR COMPOUND DIRECT ACTING ENGINES.

No. 525,801. Patented Sept. 11, 1894.





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UNITED STATES PATENT OFFICE.

HENRY C. SERGEANT, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO THE INGERSOLL-SERGEANT DRILL COMPANY, OF NEW YORK, N. Y.

STEAM-ACTUATED VALVE FOR COMPOUND DIRECT-ACTING ENGINES.

SPECIFICATION forming part of Letters Patent No. 525,801, dated September 11, 1894.

Application filed November 28, 1893. Serial No. 492,215. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. SERGEANT, of Westfield, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Steam-Actuated Valves for Compound Direct-Action Engines, of which the following is a specification.

This invention relates to compound direct-action engines in which the two cylinders are in line with each other and the two pistons are attached to the same rod, such engines being especially applicable to rock-drills.

I will first describe the construction and operation of my invention with reference to the accompanying drawings and afterward point out its novelty in claims.

Figures 1 and 2 represent a central longitudinal section of a rock-drill engine embodying my invention, the said figures representing the pistons and the valves in different positions. Fig. 3 represents a transverse section of the valve-chest and part of the engine cylinder in the line *x x* of Figs. 1 and 2, and Fig. 4 a transverse section of the same in the line *y y* of Figs. 1 and 2.

Similar letters of reference designate corresponding parts in all the figures.

A A′ designate a cylinder having a bore A of smaller diameter through one half of its length constituting the high pressure cylinder and a bore A′ of larger diameter through the other half of its length constituting the low pressure cylinders, which cylinders are in line with each other.

B is the piston-rod or drill-bar on which are the high and low pressure pistons C C′ working respectively in the cylinder bores A A′ of smaller and larger diameter.

D is the valve-chest containing the valve E serving for induction and eduction and the two attached pistons *a a′* for operating it. The said pistons being practically embodied with and constituting parts of the valve might obviously be made in one piece with it, but for convenience of fitting up they are represented as made separate, the pistons being on a rod *b* and receiving the valve snugly between them and the valve having at its ends lugs *c c* which are slotted to receive the said rod. The valve is represented as having a flat face and working on a flat seat *d* on the engine cylinder. The valve-chest is bored cylindrically at its ends to receive the pistons *a a′* and is enlarged in the middle portion of its length to give steam room above and at the ends of the valve, the steam inlet *i* being in the so enlarged middle portion. The said chest is represented as having cushions in its ends but these have nothing to do with my invention.

In the valve seat *d* there are three ports *e f f′*. The said port *e* is the main exhaust port and is always open to the atmosphere through a side passage *h* which also keeps the space between the pistons C C′ open to the atmosphere. The ports *f f′* communicate respectively with the outer ends of the cylinder bores A, A′.

The cove *g* in the face of the valve E, is long enough to cover and bring into communication the two ports *f f′*, as shown in Fig. 2, or the two ports *f′ e* as shown in Fig. 1, and the movement permitted to the valve is sufficient to take it from one of said positions to the other, its faces being of such length on opposite sides of the cove *g* that when the ports *e f′* are brought into communication through the cove *g* as shown in Fig. 1, the port *f* and high pressure cylinder bore A are open to the steam in the valve-chest D and that when the ports *f f′* are brought into communication as shown in Fig. 2, the main exhaust port *e* is closed.

In the chest D close to one end thereof, there is a small port *j* which communicates with the high pressure cylinder bore A, at a suitable point in the length thereof, and there is also close to the other end of the said chest a small port *j′* which communicates with the low pressure cylinder bore A′ at a suitable point in the length thereof, and the pistons C C′ are respectively of such length or thickness that they will at proper times during their stroke, cover and uncover those ends of the said ports within the cylinder A A′ for the purposes of admitting steam from each cylinder bore in turn to its respective end of the valve-chest to act on the piston *a* or *a′* and of opening the other end of the valve-chest to the exhaust space between the engine pistons C C′ and of thereby producing the necessary movement of the valves for the changing of the stroke of the engine pistons.

Having now fully described its construc-

tion I will now describe the operation of my invention, first supposing the pistons C C′ to be moving to the left as shown in Fig. 1. The valve is now at the right hand end of its stroke, the port *f* being open to admit steam to the bore A, and the port *f′* being open to the main exhaust port *e*. The inner ends of the ports *j j′* are covered and closed by the engine pistons but when the latter have moved a little farther to the left they will uncover and open the said ports and steam will be allowed to pass from the cylinder through the port *j* to the corresponding end of the valve-chest to act on the valve piston *a* and the opposite end of the valve-chest will be opened through the port *j′* to the exhaust space in the cylinder A A′ between the pistons. The valve will then be quickly moved to the left and will assume the position shown in Fig. 2, opening the high pressure bore A to the low pressure bore A′ through the port *f*, valve cove *g* and port *f′*. The pressure on the outer faces of the two pistons now being in equilibrio and their inner faces open to the exhaust, they will move to the right by reason of the greater area of C′. In this movement the pistons will again cover and close the ports *j j′* and keep them closed until they have moved far enough to again uncover and open the said ports when steam will pass through the port *j′* to the left hand end of the valve-chest to act on the valve piston *a′*, and the right hand end of the valve-chest will be open to the exhaust space between the pistons C C′. The valve will then move to the right and assume the position first described with reference to Fig. 1 and the pistons will again make their stroke to the left.

In order to provide for starting the engine whenever it has been used in an upright or nearly upright position, the pistons should have arrived in their lowest position as, owing to the weight of the drill, they almost invariably would, I provide as shown in the transverse sectional view Fig. 4 and partly shown in Figs. 1 and 2, a branch passage *k* between the steam space of the valve-chest and the port *f′*. This passage will, when the engine is in operation, be closed by a screw valve *l* arranged to be manipulated by hand. By opening this valve steam is admitted through the said passage *k* and port *f′* to the cylinder bore A and when the engine is thereby started, the said valve *l* is closed and the engine proceeds with its work under the control of the valve E.

One important feature of this valve is that there are at both ends of the valve-chest in the cylindrical bores provided for the valve pistons, ports each of which provides both for the supply of the steam from the cylinder to its respective end of the valve-chest and for the exhaust of the steam from its respective end of the valve-chest, making the action of the valve very positive and prompt.

I have herein referred to the motive fluid to be employed in the engine as "steam" and to the valve as "steam-actuated" but of course the invention might be applied to engines in which air or other fluid might be used as the motive agent.

What I claim as my invention is—

1. In a direct action compound engine having its high and low pressure cylinders and corresponding connected pistons in line with each other, the combination with an induction and eduction valve common to both cylinders, of a valve-chest which contains said valve and in which there is at one end a direct communication with the high pressure cylinder and at the other end a direct communication with the low pressure cylinder at such points in said cylinders as to be passed by and opened and closed by their respective pistons in their movements in both directions, whereby communication is opened and closed between each end of each of said cylinders and the corresponding end of the valve-chest for admitting steam to said valve-chest from said cylinders and exhausting it from said valve-chest into said cylinders, substantially as herein set forth.

2. In a direct-action compound engine having the two ends of its cylinder bored of smaller and larger diameter, and connected pistons having corresponding smaller and larger diameters, the combination of a valve for controlling the supply and exhaust of steam to and from the ends of said cylinder, a valve-chest containing said valve and provided with a steam inlet and cylindrically bored at its ends, two pistons connected with the valve and working in the said cylindrically bored ends, the said cylindrically bored ends each containing a port communicating with the corresponding end of the cylinder and the said ports each constituting both a supply port to the valve-chest from its respective end of the cylinder and an exhaust port from the valve chest to its respective end of the cylinder, substantially as and for the purpose herein set forth.

3. The combination with the high and low pressure cylinders A A′ and their contained pistons C C′ all in line the said cylinders having a valve-seat from which two ports *f f′* lead one to the outer end of each cylinder and a third port *e* communicates with both cylinders and with an exhaust opening *h* between the said pistons, of the valve-chest D and its contained valve E having a cove *g* in its face and having pistons *a a′* at its ends, the said valve-chest having at its end ports *j j′* communicating directly with the said cylinders A A′ respectively for controlling the movement of the valve by the movement of the pistons C C′, substantially as herein described.

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