

No. 655,737.

Patented Aug. 14, 1900.

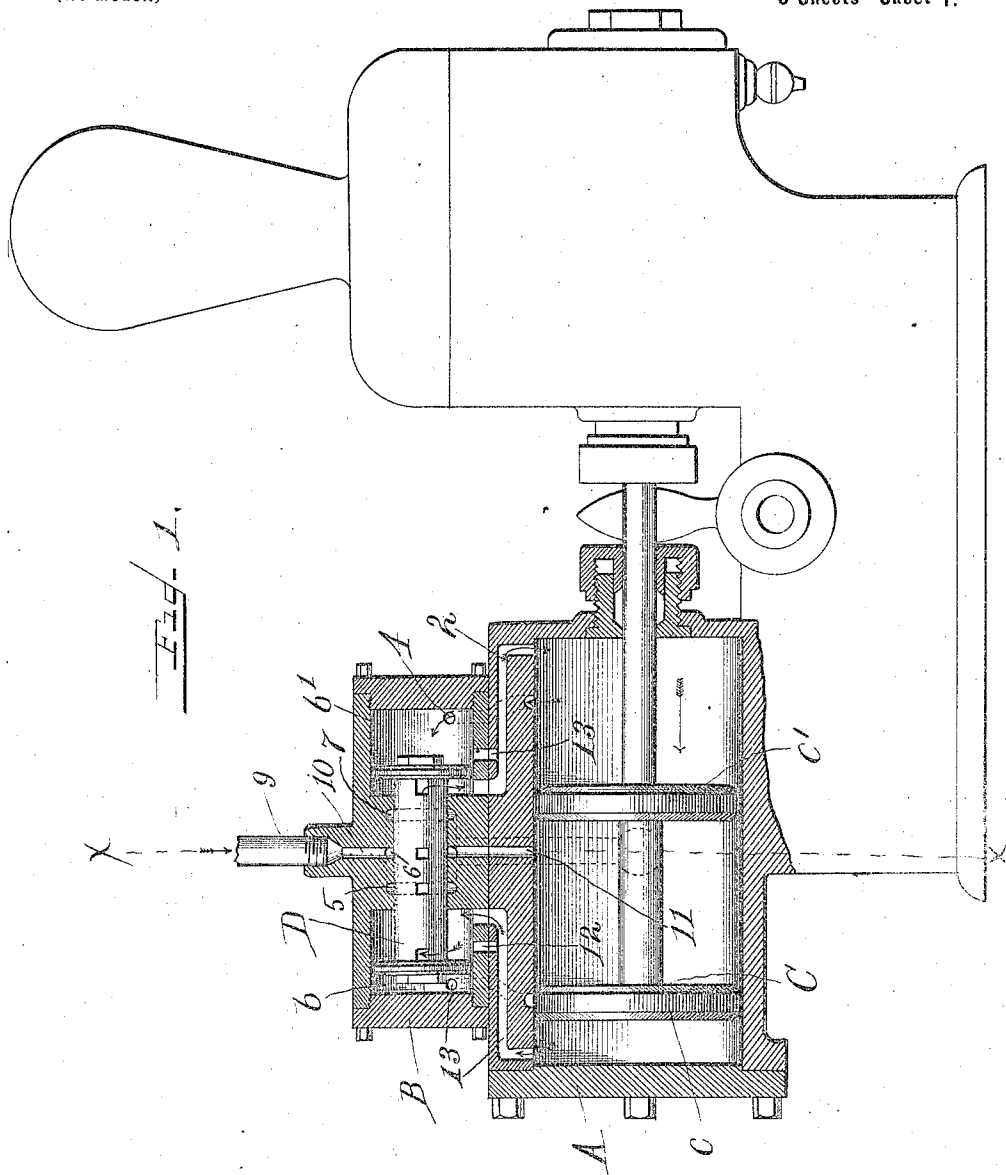
J. B. RHODES.

FLUID ACTUATED VALVE.

(Application filed Nov. 17, 1899.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses—

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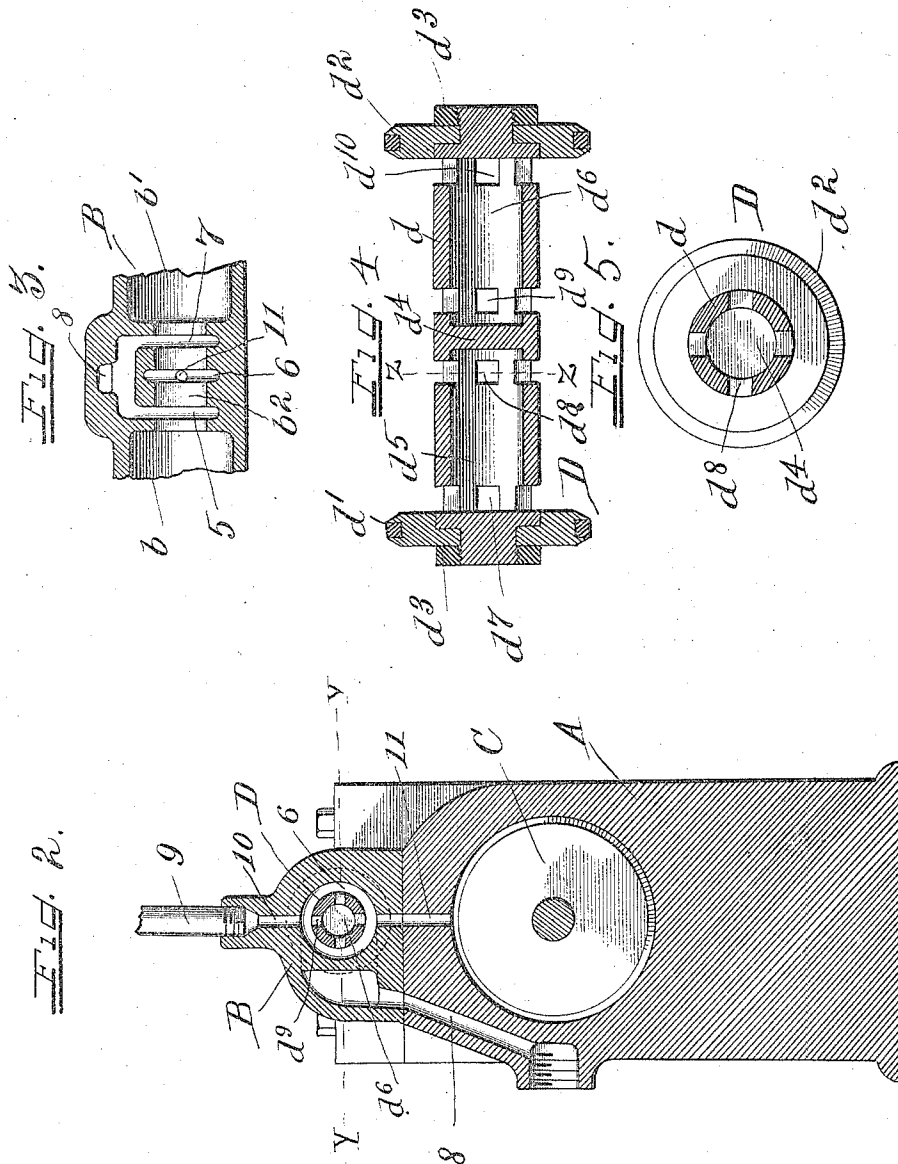
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Witnesses.

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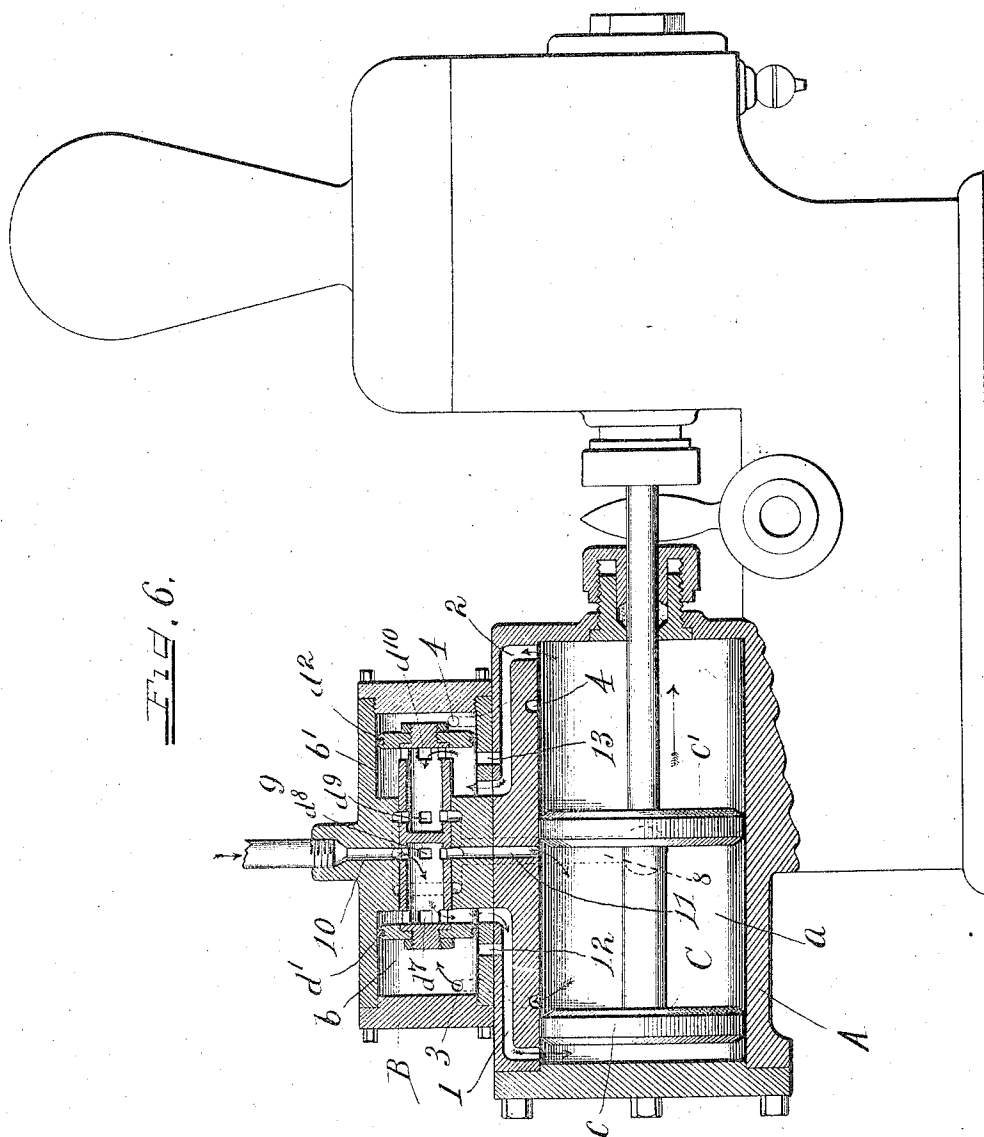
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

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FLUID-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 655,737, dated August 14, 1900.

Application filed November 17, 1899. Serial No. 737,338. (No model.)

To all whom it may concern:

Be it known that I, JAY B. RHODES, a resident of Harvey, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Motive-Fluid-Actuated Valves for Engines, of which the following is a specification.

My invention relates to motive-fluid-actuated engines in general, but more particularly to steam-pumps, and especially to steam-pumps provided with steam-actuated reversing-valves.

The objects of my invention are to provide a simple and highly-efficient construction of steam-pump, to provide a construction tending to reduce the cost of manufacture, to improve the working of the valve, to facilitate the admission and exhaust, and to provide certain details and features of improvement tending to render a device of this character serviceable and thoroughly reliable.

To the attainment of the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 is a side elevation of a steam-pump embodying the principles of my invention, the cylinder and valve-casing or steam-chest being shown in vertical section. Fig. 2 is a cross-section on line *x x* in Fig. 1. Fig. 3 is a horizontal section through the central portion of the valve-casing on line *y y* in Fig. 2. Fig. 4 is an enlarged view of the steam-actuated reversing-valve, the same being shown in longitudinal section. Fig. 5 is a cross-section of the valve on line *z z* in Fig. 4. Fig. 6 is a view similar to Fig. 1, but showing the piston at the limit of its stroke to the left and the valve at the right, and in this view the valve is shown in longitudinal section.

In Figs. 1 and 6 it will be understood that the right-hand portion of the pump, which is simply shown in outline, may be of any known or approved construction and may comprise any suitable arrangement of valves, plunger, &c., requisite to a pump of this character. The left-hand portion of the pump, which is shown in vertical section, comprises the cylinder A and the steam-chest or valve-casing B. The said cylinder incloses a spool-shaped or double-headed piston C. The steam-chest

contains a spool-shaped reversing-valve D. Between the two heads of the piston there is, it will be observed, sufficient space to afford a chamber, and into this chamber steam is admitted at full-boiler pressure, as will hereinafter more fully appear. The reciprocation of the piston is effected in the usual manner—that is to say, by alternate admissions of steam to the opposite ends of the cylinder A. Such admission of steam to the cylinder, as well as the exhaust therefrom, is controlled by the steam-actuated reversing-valve D. The piston is reciprocated by steam admitted from the valve, and the valve is actuated by steam admitted from the space between the two heads of the piston. In this way each serves as a valve for reversing the other. The system of ports and passages by which such action is obtained consists as follows: The valve-casing B is constructed with a couple of end chambers *b* and *b'*, and leading from these two chambers to the ends of the cylinder are the two passages 1 and 2. These passages serve alternately as supply and exhaust passages, and for such purpose each leads from the inner end of a valve-chamber to and opens into one end of the piston-chamber *a*. Further communication between the cylinder and steam-chest is afforded by a couple of passages 3 and 4, it being observed that the former leads from the outer end of chamber *b* to and opens into the cylinder at a point somewhat inside of the port or passage 1 and that the latter leads from the outer end of chamber *b'* to and opens into the cylinder at a point a similar distance inside of port 2. The cylindric middle portion *d* of the valve D is arranged to fit and slide in the cylindric opening or bore *b²*, which connects the two chambers *b* and *b'* and which is of course of smaller diameter than the latter. (See Fig. 3.) This middle chamber *b²* is provided with three circumferential grooves 5, 6, and 7, which encircle the valve. Grooves 5 and 7 serve as exhaust-passages and for such purpose are connected and arranged to open into the common exhaust-passage 8. (See Figs. 2 and 3.) Groove 6, which occupies a middle position, is, however, a live-steam passage and is connected with the steam-pipe 9 through the medium of a passage 10. A

centrally-situated passage 11, which connects the passage 6 with the cylinder, permits live steam to enter the constant-pressure chamber in the piston. The by-pass openings or passages 12 and 13, which respectively connect chamber *b* with passage 1 and chamber *b'* with passage 2, complete the system of portage in the engine-casing.

The steam-actuated reversing-valve D, which co-operates with the ports in admitting and exhausting steam to and from the cylinder, is, as previously stated, spool-shaped or double-headed in form and comprises the cylindric middle portion *d* and the two heads or disks *d'* and *d''*. The heads or disks *d'* and *d''* are held upon the ends of the cylindric portion *d* by means of nuts *d³*. Preferably the cylindric portion *d* is made hollow and provided with a central wall or diaphragm *d⁴*, which divides the interior of the valve into two compartments *d⁵* and *d⁶*. Each of these two compartments or chambers is provided with lateral ports or openings, the chamber *d⁵* being provided with ports *d⁷* and *d⁸* and the chamber *d⁶* with ports *d⁹* and *d¹⁰*. The ports *d⁷* and *d⁹* are in constant communication with the chambers *b* and *b'*, and the ports *d⁸* and *d¹⁰*, which, it will be observed, open into the valve at either side of the wall or diaphragm *d⁴*, are designed to register alternately with grooves 5 and 6 and 6 and 7 for the purpose of admitting steam alternately to the opposite ends of the cylinder. These ports in the valve also serve as exhaust-passages, as will more fully appear from the following, which is a description of the operation of my improved pump.

In Fig. 1, the valve being at the left, steam is entering the right hand end of the cylinder by way of port 10, groove 6, ports *d⁹* in the valve, chamber *d⁶* in the valve, ports *d¹⁰* in the valve, chamber *b'*, and the duct or passage 2. In this figure, therefore, the piston is traveling to the left and the exhaust from the left-hand end of the cylinder is escaping by way of passage 1, chamber *b*, ports *d⁷* in the valve, chamber *d⁵* in the valve, ports *d⁸* in the valve, groove 5, and the ultimate exhaust-passage 8. The head *c* of the piston is, it will be observed, about to uncover the port 3 and to thereby establish communication between the chamber *b* and the constant-pressure chamber in the piston. The live steam thus admitted to the left of the valve will shift the latter to the right, and the admission and exhaust of steam will then be as follows: In Fig. 6 the piston is shown at the limit of its stroke to the left, and the valve, by reason of the aforesaid admission of steam at its left, is at the right. With these relative positions of the valve and piston live steam is entering at the left of the piston by way of passage 10, groove 6, ports *d⁹* in the valve, chamber *d⁶* in the valve, ports *d¹⁰* in the valve, chamber *b'*, and the duct or passage 1. Also in this figure the exhaust from the right of the piston is escaping by way of

passage 2, chamber *b'*, ports *d¹⁰* in the valve, chamber *d⁶* in the valve, ports *d⁹* in the valve, groove 7, and the final exhaust-passage 8. It will also be seen that an exhaust has taken place from the right of the valve by way of passage 4, the right-hand end of the cylinder, passage 2, chamber *b'*, ports *d¹⁰*, chamber *d⁶*, ports *d⁹*, groove 7, and the exhaust-passage 8, and the exhaust from the left of the valve when the latter shifts in such direction is of course permitted to escape in a similar manner by way of passage 3. In this said Fig. 6 the piston is therefore just starting on its stroke to the right. The movement of the piston to the right will cause the head or disk *c* to cover the port 3, thereby cutting off the admission of steam from the constant-pressure chamber to the left of the valve, and at such time the valve would but for the by-pass 12 fly back to the position shown in Fig. 1 as a result of the preponderance of pressure on the inner surface of the disk *d'*. This by-pass 12, however, permits live steam to enter at the left of the valve from the passage 1, and in this way the valve is maintained in the proper position until the piston has reached the limit of its stroke to the right. The by-pass 13 serves in a similar manner to maintain the valve at the left while disk *c* is passing port 4 and until the piston has reached the limit of its stroke to the left. It will also be seen at this juncture that, for instance, the valve when shifting to the right will pass or uncover by-pass 12 before bringing the ports *d⁸* into register with the groove 6 and that consequently the reversal of the piston is in this case accomplished, primarily, by an admission of steam from the constant-pressure chamber by way of port 3, chamber *b*, by-pass 12, and the passage 1. In this way the piston is effectively cushioned at the end of its stroke to the left, and by reason of the ports 2, 4, and 13 a similar result is of course obtained at the end of its stroke to the right.

Thus it will be seen that while I employ live steam for actuating the valve the construction of the latter is simple and, together with the arrangement of ports, &c., of a character to render the manufacture of the pump comparatively inexpensive. The two chambers in the valve serve alternately as supply and exhaust passages, and the long bearing-surface afforded by the bore or opening *b²* permits the valve to reciprocate smoothly and with but little wear. In this way leakage is avoided, and, furthermore, the construction is, it will be seen, such as to render the pump easy of repair.

What I claim as my invention is—

1. The combination of a cylinder, valve-casing, piston and steam-actuated reversing-valve, the said cylinder and valve-casing having suitable ports or passages for admitting and exhausting steam to and from the piston-chamber, and the valve being provided with a cylindric portion having ports which serve

alternately as supply and exhaust passages for the cylinder.

2. The combination of a cylinder, valve-casing, piston and steam-actuated valve, the cylinder and valve-casing having suitable ports or passages for admitting and exhausting steam to and from the piston-chamber, and the said valve being ported and having a couple of chambers which serve alternately as supply and exhaust passages for the cylinder.

3. The combination of a cylinder, valve-casing, piston and steam-actuated reversing-valve, the cylinder and casing having suitable ports or passages for admitting and exhausting steam to and from the piston-chamber, and the said valve having a reduced cylindric middle portion which slides in a bore or opening in the casing, and which is provided with ports serving alternately as supply and exhaust passages.

4. The combination of a piston provided with a constant-pressure chamber, a cylinder and valve-casing having suitable ports or passages, and a valve which is actuated by steam from said constant-pressure chamber and which is provided with a cylindric middle portion having ports which serve alternately as supply and exhaust ports.

5. The combination of the spool-shaped piston and the spool-shaped valve, the cylindric middle portion of the latter being hollow and provided with ports whereby both the live steam and the exhaust are conducted through the interior of said valve.

6. The combination of a cylinder, valve-casing, piston and steam-actuated reversing-valve, the valve-casing having a central bore or opening provided with three grooves or channels which encircle the cylindric middle portion of said valve, and the said cylindric portion of the valve being provided with ports which cooperate with said grooves or passages and which serve alternately as supply and exhaust passages.

7. The combination of a recessed or chambered piston, a spool-shaped steam-actuated reversing-valve, and a cylinder and valve-casing having the ports or passages 1, 2, 3, 4 and 11, and the by-pass openings 12 and 13; the valve being provided with ports which serve alternately as supply and exhaust ports, substantially as shown and described.

8. The combination of a cylinder, valve-casing, piston and steam-actuated reversing-valve, the cylinder and casing being provided with suitable ports or passages, and the valve

being provided with ports which serve alternately as supply and exhaust passages for the cylinder and which also serve as exhaust-passages for the exhaust from the valve.

9. In combination with a suitable cylinder, piston and valve-casing, the spool-shaped steam-actuated reversing-valve D, having the chambers d^5 and d^6 and the lateral ports d^7 , d^8 , d^9 and d^{10} , substantially as and for the purpose set forth.

10. In a steam or other motive-fluid actuated engine, the combination of a cylinder and piston, the said piston being recessed or chambered to provide a constant-pressure chamber, and the said cylinder being provided with suitable ports or passages for admitting and exhausting steam to and from the ends of said cylinder, and also with a passage for supplying live steam to the said constant-pressure chamber in the piston; a steam-actuated reversing-valve which is substantially spool shape in form and which is provided at each end with a chamber and also with suitable ports by which live steam is admitted through the valve to the piston-chamber and by which the steam is exhausted from the piston-chamber by way of the said chambers and ports in the valve; and means for supplying steam to the valve at a point substantially midway between its heads or end-positions.

11. In a steam-pump, the combination of the cylinder, the steam-chest, the spool-shaped piston arranged for reciprocation within said cylinder, the spool-shaped steam-actuated reversing-valve arranged for reciprocation within said steam-chest, both the cylinder and steam-chest being provided with suitable ports or passages for admitting and exhausting steam to and from the said cylinder and steam-chest, and a passage being also provided for supplying live steam to the cylinder at a point between the heads of the piston; and the said spool-shaped reversing-valve, which is actuated by steam admitted from the constant-pressure chamber in the piston, having a hollow and cylindric middle portion which is ported to permit live steam to pass through the valve to the cylinder, and which is also ported to permit the exhaust from the cylinder to escape through the said valve, substantially as shown and described.

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Witnesses:

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