(No Model.) 3 Sheets—Sheet 1.

# S. O. JONES.

## PISTON VALVE.

No. 509,037. Patented Nov. 21, 1893.

Fig. 1.

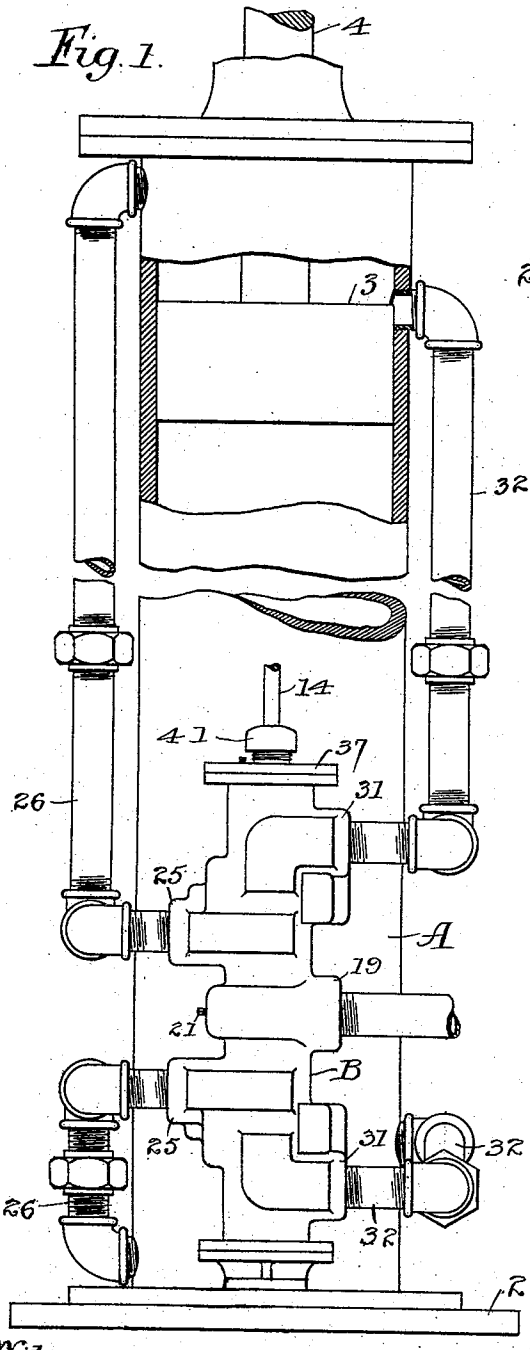
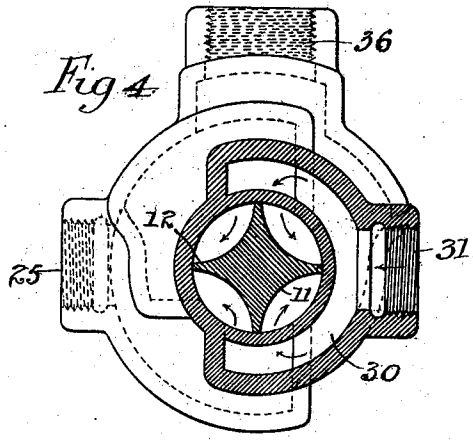



Fig. 4



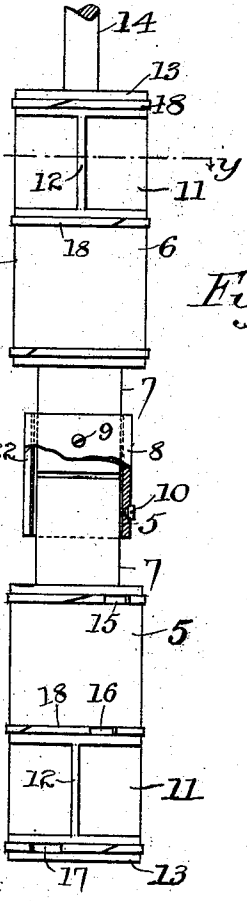
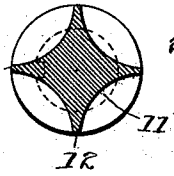




Fig. 5.

Fig. 6

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(No Model.) 3 Sheets—Sheet 2.

# S. O. JONES.

## PISTON VALVE.

No. 509,037. Patented Nov. 21, 1893.

Fig. 2.

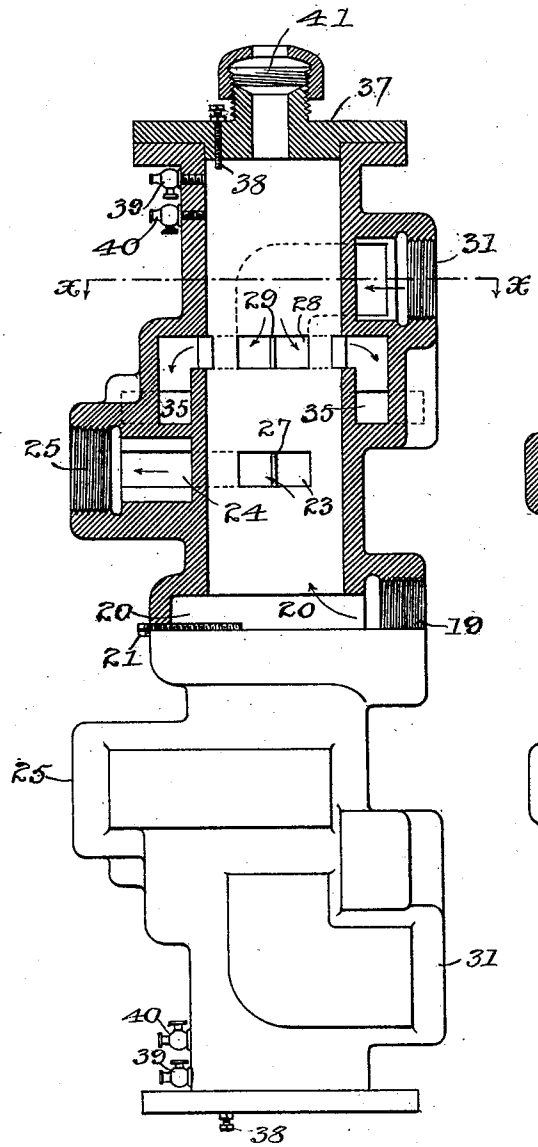
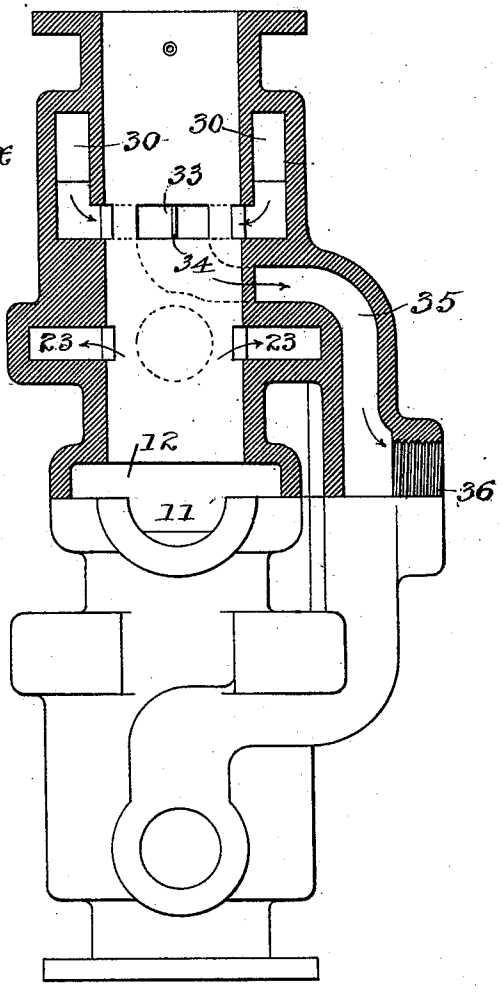



Fig. 3.

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# S. O. JONES.

## PISTON VALVE.

No. 509,037. Patented Nov. 21, 1893.

*Fig. 7.*

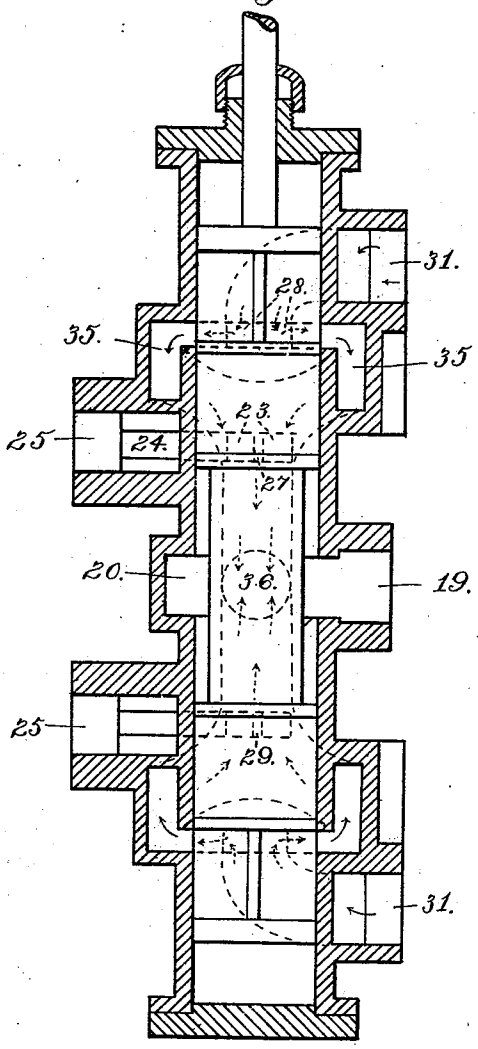
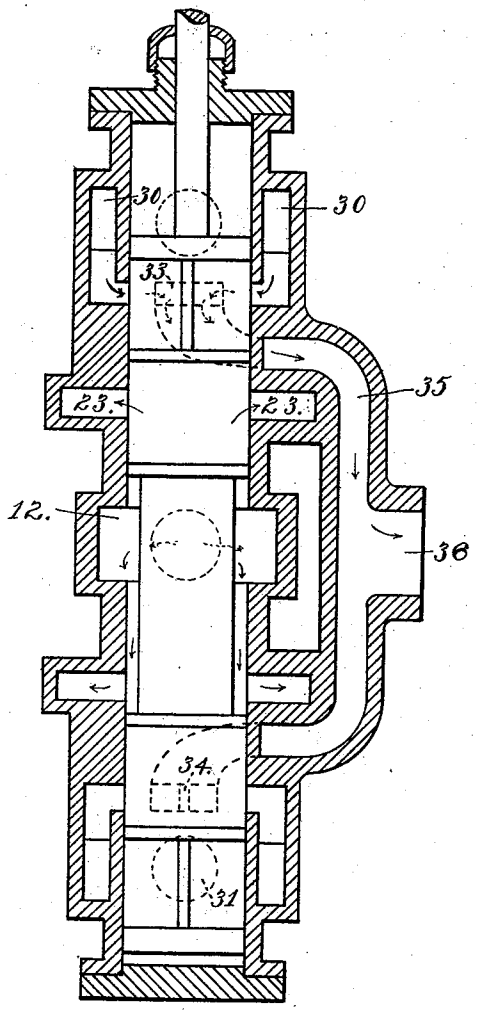



*Fig. 8.*

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# UNITED STATES PATENT OFFICE.

SAMUEL O. JONES, OF STILLWATER, MINNESOTA, ASSIGNOR OF ONE-HALF TO GEO. H. ATWOOD, OF SAME PLACE.

## PISTON-VALVE.

SPECIFICATION forming part of Letters Patent No. 509,037, dated November 21, 1893.

Application filed June 9, 1893. Serial No. 477,098. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL O. JONES, of Stillwater, Washington county, Minnesota, have invented certain Improvements in Piston-Valves, of which the following is a specification.

My invention relates to improvements in steam piston valves, its object being to provide a valve which is accurately balanced so as to move without friction, and so constructed that it will adapt itself to any warping or bending of the valve chest by reason of the pressure of the steam.

Its object further is to so construct the valve chest that it can be connected to the steam cylinder without gum joints, and so that the steam ports on both the valve chest and cylinder may be independently varied at will. I also seek to provide a valve which shall have the maximum of lap with the minimum of travel. I further seek to provide means for adjusting the travel of the valve and the amount of cushion at the end of the chest, and to dispense with the necessity of any packing whatever for the valve stem.

To this end my invention consists in the features of construction hereinafter more particularly described and claimed.

In the accompanying drawings forming part of this specification, Figure 1 shows an elevation of my improved valve chest and the valve to which it is connected. Fig. 2 is a partially sectional detail of the valve chest shown in front elevation. Fig. 3 is a similar detail of a side elevation of the same. Fig. 4 is a cross section of the valve chest on line *x*—*x* of Fig. 2. Fig. 5 is a detail of the valve removed from the chest. Fig. 7 is a conventional line drawing, showing the valve in mid position with the outlet live steam ports all closed, but with the exhaust ports at both ends of the chest, partly open, and Fig. 8 is a similar view, the chest being shown in central, longitudinal section at right angles with the section plane of Fig. 7, the valve being shown moved to its limit toward one end of the chest, with the live steam ports at that end of the chest full open, and the exhaust ports at the opposite end of the chest full open, the valve extending beyond the exhaust ports so as to cut off communication between them and the interior of the chest beyond the valve. Fig. 6 is a cross section of the valve through the copings on line *y*—*y* of Fig. 5.

In the drawings A represents the cylinder and B the valve chest, both shown in upright position supported upon the base 2, their respective ports being connected by means of pipes as hereinafter described.

3 represents the cylinder piston having the rod 4.

C represents the valve, which works in the chest 2. This valve is of the piston type and is made in two parts, 5 and 6. Each of these parts or members has the narrowed neck 7, the ends of which are joined to form a loose or universal joint with limited movement, by means of the sleeve 8, which is slipped over and embraces the abutting ends, and is secured to them by means of screws 9 and 10 which pass through the sleeves and necks at right angles with each other, thus serving as the pivots of the universal joint for the purpose hereinafter described. The four copes 11 are cut out of each member of the valve near the end, leaving intermediate bridges 12 between the copes, as shown clearly in Fig. 6. The part of the valve intermediate of the copes and the reduced portion or neck, is left full size to fit closely into the valve chest, and there is also a disk 13 of full size at the end. To the member 6 is connected the valve stem 14 by means of which the valve can be operated in the usual manner.

In order to compensate for the wear of the full sized portions of the valve, and thus prevent any leakage of the steam past the same, I provide the circumferential grooves 15, 16 and 17 into which fit the packing rings 18.

The valve chest has a central side port 19 for the admission of live steam, and connecting with this is a circumferential chamber 20 which surrounds the neck or narrowed portion of the valve. The valve is held from rotating in the chest preferably by means of a set screw 21 tapped through the side wall of the chest and working in a groove 22 in the sleeve 8. On each side of the chamber 20 are live steam ports 23 which unite in a common, partially circumferential passage 24 leading to the port 25, which is screw threaded to receive the steam pipe 26 leading to the adja-

cent or corresponding end of the cylinder A. (See Fig. 1.) The ports 23 are preferably provided with a central bridge 27 extending longitudinally of the chest, to serve as an additional bearing surface for the packing rings of the valve. The distance between the opposite walls of the chamber 20 and ports 23 is substantially equal to the length of the narrowed or neck portion of the valve, so that free communication is open between them for the passage of steam when the valve is in such position that the neck extends over both. Beyond the ports 23 toward the end of the valve chest are oppositely arranged ports 28 having bridges 29 which communicate with a common, partially circumferential passage 30, leading to the port 31, which is screw threaded to receive the exhaust pipe 32 communicating with the corresponding end of the steam cylinder A at such distance from the end as to furnish the necessary space for cushioning the piston. (See Fig. 1.) Lying in the same transverse plane and intermediate of the ports 28, are the oppositely arranged ports 33 having the bridges 34, which ports communicate with the passage 35 leading to the common exhaust port 36, opening to the outer air. Through each of the heads 37 of the valve chest is tapped a screw 38 which serves as an adjustable stop to limit the travel of the valve, and through the side walls near each end are arranged valve controlled air vents 39 and 40, arranged at such distances from the heads as to furnish an adjustable cushion for the valve. The head at the upper end of the chest is fitted with any suitable box 41 through which the valve stem works, but no packing is necessary as steam has no access to that portion of the valve chest.

It will be understood that the described ports and connecting pipes are duplicated at the other end of the valve chest, and connections so made with the cylinder that their functions are identical with those of the parts described. The relative positions of the various ports, and chambers and passages are such that when the valve stands exactly in mid position, the chamber 20 has no outlet, but when the valve is moved in the chest until the narrowed or neck portion begins to overlap the ports 23, steam is allowed to pass from the chamber into the pipe 26, and thence into the cylinder above the piston, while the body of the valve closes the exhaust ports 28, the exhaust ports at the opposite end of the chest being at the same time opened. With the opposite travel of the valve a reverse connection is made with the cylinder.

It will be seen that with steam passing freely around the narrowed or neck portion of the valve, pressure is equal and the valve is balanced. So also with the ports 23 arranged opposite each other, there is no unbalanced pressure at that point, and also since the exhaust ports are oppositely arranged and each opens equally to the two sides of the adjacent bridge between the copes, there is absolute balancing of pressure at this point. (See Fig. 4.) The valve is thus at all times free to move in the chest wholly uninfluenced by the steam pressure, the packing rings being so arranged that they are interposed in the various positions of the valve between the live steam chamber and steam ports, and also between the steam and exhaust ports, so as to shut off communication between them by leakage. If however notwithstanding the rings there is any leakage from the chamber 20 to live steam ports when the ports are closed by the valve, the piston is moved in the cylinder only far enough to slightly open the exhaust port connecting with the exhaust pipe 32. (See Fig. 1.) When it has reached this position any steam entering the cylinder will be allowed to pass outward through the exhaust pipe, and the exhaust ports being open will permit the escape of the steam without further disturbing the position of the piston, thus avoiding any gradual travel of the piston, as in other constructions. By providing a plurality of live and exhaust steam ports around the walls of the valve chest, a greater length of wall space between the ports and steam chamber is possible, thus securing a maximum amount of lap of the piston on the walls against which it bears, and making it possible to open communication between the ports with the minimum amount of travel of the valve. The length and position of the copes 11 is such that when the live steam ports at the other end of the chest are opened however slightly, the exhaust ports are full open, whereby the live steam port area may be varied at will without interfering with the exhaust port area, thus preventing any possible back pressure. It is also obvious that by means of pipe connections between the valve chest and cylinder the relative position of the ports in the one with regard to those in the others, may be varied at will, which is not the case where the valve chest is seated directly upon the cylinder. This construction also dispenses with gum joints, which are required where the two parts are seated directly together. In some cases under high pressure the valve chest may be sprung by the pressure of the steam against the side walls of the chamber 20 at the side where the steam enters, so that if the valve were solid it would cause friction between it and the chest. This however is entirely obviated by the described joint in the valve, which permits each end of the valve to maintain perfect alignment with the corresponding part of the chest even if the chest be slightly sprung.

I claim—

1. The combination with the valve chest having inlet and outlet live steam ports, of a series of inlet and outlet exhaust ports arranged alternately and equi-distant from each other in a common plane at right angles with the axis of the chest, and the piston valve fitted to said chest and having a series of

similar copes cut out of its surface near each end, and so arranged that each inlet and outlet exhaust port when opened by the superposing of the copes, shall communicate equally with two copes, substantially as described.

2. The combination with the cylinder, of the piston valve chest having a common, centrally arranged inlet steam port, series of outlet steam ports, and inlet and outlet exhaust ports on each side of said inlet steam port, the valve fitted to said chest exteriorly cut away to form communicating passages between the inlet and outlet steam ports and the inlet and outlet exhaust ports, when in proper position, the dimensions of said valve and the position of said ports being such that when the valve stands in mid position communication is cut off between the inlet and outlet steam ports, while communication remains between the series of inlet and outlet exhaust ports at each end of the chest, the pipe connecting each series of outlet steam ports with one end of the cylinder, and the pipe connecting one series of inlet exhaust ports with the same end of the cylinder at a slightly greater distance from the end of the cylinder, whereby when the valve stands in mid position and the piston in the cylinder is moved by the leakage of steam past the valve and into the cylinder so as to open communication with the exhaust pipe, such steam is thereby allowed to exhaust without further moving the piston, substantially as described.

3. The combination with the piston valve chest, of the valve working therein and extending over all of the ports in the chest so as to cut off communication between them and the chest beyond the ends of the valve, and the valve controlled air vents in the wall of the chest near each end thereof, whereby any desired amount of cushion may be provided for the valve, substantially as described.

4. The combination with the piston valve, of the chest therefor having inlet and outlet steam ports and inlet and outlet exhaust ports so arranged that the exhaust ports at one end of the chest are full open before the steam ports in the other end of the chest are opened, and the adjustable stop at each end of the chest for limiting the throw of the valve, whereby the live steam port area may be limited at will without diminishing the exhaust port area, substantially as described.

5. The combination with the valve chest having a plurality of inlet exhaust steam ports, and alternating outlet exhaust steam ports, all arranged equi-distant from each other, in a plane at right angles with the axis of the chest, of the piston valve having the same number of similar copes, cut around its surface as there are inlet and outlet exhaust ports, and so arranged that each will communicate equally with two adjacent copes, substantially as described.

6. The combination with the piston valve chest, having a steam chamber, steam ports, and inlet and outlet exhaust ports on each side of the steam chamber, of the valve fitted thereto and adapted as reciprocated to open and close all said ports, said inlet and outlet exhaust passages standing normally open when the steam ports are closed, and the inlet and outlet ports at one end of the chest being full open before the steam ports at the other end of the chest, begin to open, substantially as described.

7. The combination with the piston valve chest having a side inlet steam port, and outlet steam ports, and inlet and outlet exhaust ports intermediate of said inlet steam port and each end of the chest, of the valve fitted thereto, and exteriorly cut away to furnish communicating passages between the inlet and outlet steam ports, and between the adjacent inlet and outlet exhaust ports, and extending over all said ports so as to cut off all communication between said ports and the chest, beyond either end of the valve, substantially as described.

8. The combination with the piston valve chest, having lateral inlet and outlet steam ports, and lateral inlet and outlet exhaust ports, of the valve fitted thereto and exteriorly cut away to furnish, when placed in proper position, communicating passages between the inlet and outlet steam ports and inlet and outlet exhaust ports, while at all times preventing communication between any of said ports and the chest beyond the valve, an adjustable stop at each end of the chest for regulating the throw of the valve, and the valve controlled air vents at each end of the chest for controlling the amount of cushion for the valve, substantially as described.

In testimony whereof I have hereunto set my hand this 29th day of May, 1893.

SAMUEL O. JONES.

Witnesses:
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