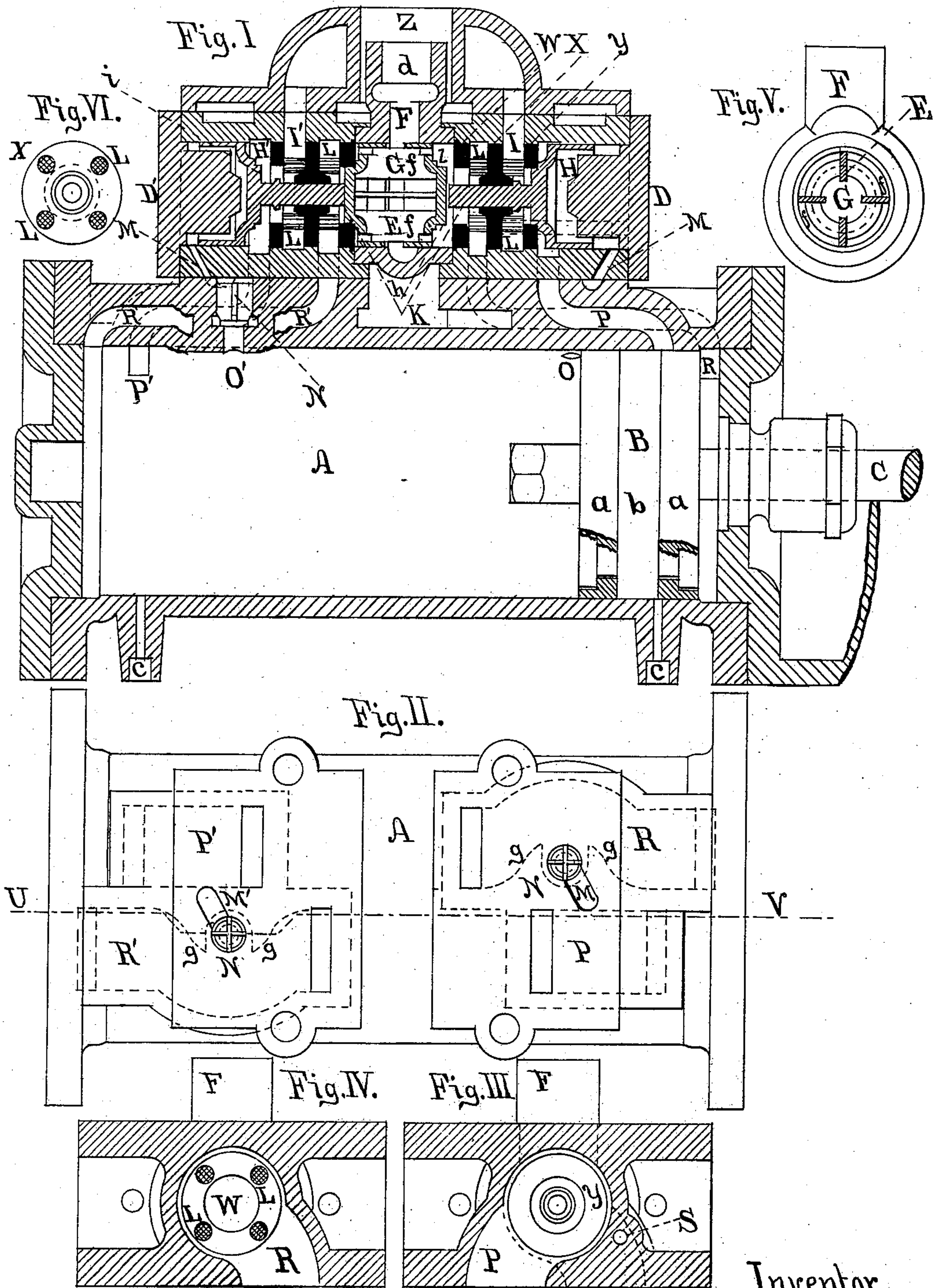


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VALVES FOR STEAM PUMPING ENGINES.

No. 189,290

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Attest

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IMPROVEMENT IN VALVES FOR STEAM PUMPING-ENGINES.

Specification forming part of Letters Patent No. 189,290, dated April 3, 1877; application filed February 27, 1877.

To all whom it may concern:

Be it known that I, NORMAN W. WHEELER, of the city, county, and State of New York, have invented a new and useful Improvement in Steam-Pumps, which improvement is fully described in the following specification and accompanying drawings, in which—

Figure I is a vertical section of the steam-cylinder upon the line U V, and of the valve-chambers upon the central line. Fig. II is a plan of the steam-cylinder, with the steam and exhaust channels indicated by broken lines. Fig. III is a transverse-section of the exhaust-valve chamber, showing the exhaust-way. Fig. IV is a transverse section of the same, showing the steamway. Fig. V is a transverse section through the lugs connecting the valve-seat with the diaphragm; and Fig. VI is an end view of the steam-valve chamber, with the connecting-bars between the steam-valves shown in section.

My invention is in part an improvement on the valves shown in patents granted me March 3, 1857, and January 26, 1858; and it consists in adding plugs or pistons to the puppet-valves shown in said patents, and in the arrangement of various valves and steam-passages, as hereinafter set forth.

The object of my invention is to furnish devices by which to distribute in and release steam from pumping or other engines by means of puppet-valves, which operate each other reciprocally, all in the same line, but in separate chambers, for diminishing the losses arising from the escape of steam past the valves while they are assuming new positions, for making more prompt live-steam cushions to arrest the motion of the piston as it approaches the end of its stroke, and for facilitating the construction of such engines.

In the drawings, A is the steam-cylinder; C, the piston-rod; B, the piston; D D', the exhaust-valve chambers, containing the valve-seats W Y and diaphragm X; F, the steam-valve chamber; G, the steam-valves, connected together by the bars E; H H', the exhaust-valves, with the distance pins K going through the diaphragms X, and making contact with the steam-valves G; I I', the final exhaust-channels, leading into the chamber Z, to which the exhaust-pipe is to be at-

tached. L L are distance lugs or studs, cast in one with the valve-seats and diaphragm, so that each set may be worked to shape at once, and inserted in the corresponding exhaust-valve chamber. N N are cushion-valves set over the ports O O' in the cylinder A, to allow the passage of live steam from the cylinder into the steam-channels when the piston passes beyond and uncovers such ports. M M' are channels for the passage of steam from the main steam-channels into the chambers D D' at the backs of the exhaust-valves, and vice versa, for the purpose of actuating the valve-gear. P P' are exhaust-channels between the cylinder A and the valve-chambers D D', and R R' the steam-channels connecting the cylinder with the steam-chest.

The valve-seats and diaphragm to the left in Fig. I are not lettered; but as they correspond in construction and function with the like parts to the right, respectively lettered W, X, and Y, the same letters will be used herein to designate each set, with the sign ' added to indicate those unlettered parts to the left.

The exhaust-valve chambers D D' are cast with the proper steam and exhaust channels R I P bored through, and small rabbets made in the ends, which abut against the steam-chamber F. The steam-valve seat W, diaphragm X, and exhaust-valve seat Y, cast as one piece, united to each other by the lugs L L, are turned to fit tightly in the bored part of the exhaust-valve chamber, and are pressed into place, a small collar upon W fitting into the rabbet in the end of D. The steam-valve chamber is bored and faced to fit against and between the ends of the chambers D D', and the three parts bolted together and to the cylinder A. I have sometimes made the exhaust-valve chambers with the seats and diaphragms cast in; but, for convenience of manufacture and repair, I prefer to make up the three chambers, divided from each other by the proper diaphragms and seats, by pressing the seat-pieces into place, as described.

The valve-seats W and Y are bored and faced as puppet-valve seats, and the diaphragms X are pierced by holes, to fit distance-pins K upon the exhaust-valves H H',

and are also faced to form seats for the collars upon the pins K to seat upon as puppet-valves when the exhaust-valves are home upon their seats. These collar-valves upon the pins K may be dispensed with if the pins fit in the holes reasonably tight, and prevent leakage of steam; but to guard against wear I use these collar-valves in lieu of stuffing-boxes in the diaphragms X.

The two puppet steam valves G are made with cylindrical guide-rings, fitting easily in the bored steam-chamber F, and are connected together by bars E, which bars are too short to permit the seating of both valves at the same time; and a steam-passage, *f f*, is cut out of the disk of each, outside of the face. Upon each steam-valve is a preventer-plug, *h*, which projects beyond the puppet-face of the valve, and fits with moderate closeness into the bored port when the valve is seated. The throw or lift of the steam-valves should be enough to withdraw the preventer-plug from the port, and so allow the flow of steam past it.

If the distance between faces of these preventer-plugs *h* be equal to or greater than that between the seats W and W', the plug of the closing valve will enter its port as soon as or before the plug of the opening valve is withdrawn from its port, and prevent the loss of steam which would otherwise occur during the time occupied in the shifting of a pair of valves from seat to seat, except such loss as may arise from leakage past the preventer-plugs before the closing valve arrives home upon its puppet-seat.

The steam-valves G may be so fitted as to be borne upon the prolonged ends of the distance pins K without support or guidance from the steam-chamber F; or the steam-chest F may be enlarged and cast in one with two exhaust-valve chambers, D D', and the valve-seats, diaphragms, and separate guide-pieces for the steam-valves be passed to their places through an opening in the side or top of the intermediate steam-chest.

The exhaust-valves H H' are disk puppet-valves, fitting with moderate closeness in their chambers D D', the chambers being considerably larger than the port through the seat, and are each provided with a distance-pin, K, which reaches, through the diaphragm X or X', to the face or some other part of a steam-valve, G, and the lengths of the distance-pins K are such that when one steam-valve is home upon its seat the exhaust-valve of the same end of the cylinder A will be held open, and the exhaust-valve of the other end of A allowed to come to its seat, with, preferably, some clearance between the open steam-valve and the distance-pin of the closed exhaust-valve.

If the several valves and the piston B are in the positions shown in the drawings, and live steam be admitted through a pipe attached at *d* to the steam-chamber F, pressure will come upon the back of the closed steam-valve G to the left, hold it shut, and also hold

the leftward exhaust-valve H' open, so that the spaces and channels inclosed to the left of the piston B will be open to the exhaust-pipe. The live steam will also pass through the opening *f f*, through the port of W and channel R, into the cylinder A to the right of B, while at the same time steam will pass through the channel M into the exhaust-valve chamber D, and press upon the back of H, holding it shut, but be prevented by the check or cushion valve N from passing through the port O into the cylinder A to the left of B.

The exhaust-channels P P' lead into the cylinder A within the stroke of the piston B, and into the exhaust-chambers between the disks of the valves H H' and their seats Y Y', and the live-steam channels R R' lead into A beyond the stroke of B, so that when the piston B is at or near either end of its stroke, the exhaust-way for that end of the cylinder is closed by B, and the live-steam way R left open.

It will be observed that the steam-channels R R' and exhaust-channels P P' are arranged side by side, as seen in Fig. II, and that the continuation of these channels into the chambers D D' is made in a one-sided fashion, as seen in Figs. III and IV, to correspond with the side-by-side arrangement of P R and P' R'.

Matters being disposed as before described, the live steam, pressing against the right surface of the piston B, will move it toward the left. When B moves so far as to uncover the opening of the channel P, live steam will fill the channel P, and also the space between the seat Y and that part of the disk of H outside of the seat, partly balancing the valve.

When the piston B reaches and covers the port of the channel, further escape of steam or gases will be prevented, and compression will take place in the inclosed space at the left of B, and when the piston B passes beyond and uncovers the port O', live steam will pass into the channel R' and inclosed spaces connected therewith, the cushion-valve N being opened by the pressure coming under it, so that the force urging B leftward will cease, and if the momentum of the reciprocating parts carry B farther in the same direction, the cushion-valve N having fallen to its seat, the live steam pervading the space to the left of B will be compressed and form a rapidly-increasing means of resistance to the movement of B before the steam and exhaust valves are shifted for the return stroke.

The pressure of steam will not come between the valve H' and its seat, being prevented from entering P' by the piston B covering its port, but will come upon the back of the exhaust-valve H', so that the closed steam-valve G being balanced, and the closed exhaust-valve H partly balanced, the pressure upon the larger area of the disk of the valve H' being resisted by a like pressure upon the smaller area of the seat of H, and by the inertia and friction of the parts, the valve H' will be thrown rightward, carrying with it the con-

nected pair of steam-valves G and the exhaust-valve H, the valves G acting as a distance-piece between the distance-pins K. After this shifting of the valves, the valves which are shown open in the drawings, Fig. I, will be open, and vice-versa, so that the rightward stroke will be made and ended in manner similar to that to the leftward.

If the preventer-plugs upon the steam-valves G project so far beyond the puppet-faces as to make the distance between the plug-faces equal to or greater than that between the valve-seats W and W', steam will only escape from the engine by blowing through during the time of the throwing of the valves; but such blowing through will occur if the preventer-plugs be not applied. But it is not necessary that the plugs *h* of the steam-valves G be so long as above indicated, if preventer-plugs *i* are also provided upon the exhaust-valves H H'. In the example before us the preventer-plugs *i* of the valves H H' are so long that the exhaust-valve, which is in the act of closing, has its plug inserted in the port before the plug upon the steam-valve for the same end of the cylinder A is fully withdrawn from its port, and vice versa, so that there is no blowing through at any time, and the losses in that way are confined to leakage, the steam and exhaust valves performing the functions of puppet-valves at one time, and those of slide-valves at another. For the sake of brevity I designate such valves as H, H', and G, having preventer-plugs *h* and *i* attached, "plug puppet-valves."

For mechanical reasons it is well not to make the distance-pins K so long that the exhaust-valve H or H' will push the pair of steam-valves G fully home to either seat W or W'. It will be sufficient if the adjustments are such that the pressure upon the back of an exhaust-valve shall shift the line of valves so far as merely to withdraw and insert the preventer-plugs from and into the corresponding ports, for the reason that when the exhaust-valve is partly open, and the steam-valve is so nearly closed that the plug prevents the flow of steam into one end of the cylinder, a differential pressure is generated, acting upon the back of the closing steam-valve, which operates to force the steam-valve home to its puppet-seat, carrying with it the opposite exhaust-valve to its full open position, as well as the opposite steam-valve, and leaving a considerable clearance between the plug-face of the open steam-valve and the distance-pin of the closed exhaust-valve. The shocks and the wear of the valves are considerably ameliorated by this clearance device, and by the fact that the moving parts in the valve-chambers are not artificially fastened to each other.

It is convenient for mechanical reasons to make the channels M M' by drilling through the metal of the exhaust-chamber, as indicated at S in Fig. III, and obscurely indicated by broken lines in the exhaust-chamber D in Fig. I; but as, by either mode of con-

struction, the same inclosed spaces are placed in communication, the difference is solely structural.

In the example before us the steam-channels R R' are curved outwardly, and a recess is made in each, as indicated by *g g*, so that the cushion-valves N N' may not be disturbed by the currents of steam passing along the channels R R'.

The piston B is composed chiefly of the usual head and follower-plates and the three rings *a a b*. The head and follower-plates are turned smaller than the bore of the cylinder A, and the rings *a a* are rabbeted, so that when they are in place the rabbeted parts project over the head and follower-plates, and the packing-rings face against the bore of the cylinder over the whole or greater part of the length of the piston B. This is for the purpose of securing a sudden and full release of steam through either of the cushion-ports O O' when the piston passes over and beyond it.

When ordinary pistons are used in combination with such ports as O O', having packing-rings included between head and follower-plates, which fit loosely the bore of the cylinder, the release of steam through such ports as O O' begins as soon as the packing-rings uncover them; but the steam is wire-drawn over the edge of the plate, until the plate itself passes beyond the port. By securing a more sudden and free release, as aforesaid, the piston-clearance may be diminished, and other advantages gained.

The channels *c c* are for the attachment of the ordinary cylinder-cocks, for the purpose of freeing the cylinder from water. I make the channels *c c* terminate in the bore of the cylinder within the stroke of the piston B, instead of the usual places in the counter-bores beyond the piston-stroke, because if one of the channels *c* is closed by the piston B at the end of a stroke, the piston-cushion will be made whether the cylinder-cocks are open or not, whereas if the channel be not covered, the cushion-steam will escape if the cylinder-cocks be open, and the cushion be spoiled, while the shifting of the valves will be delayed, so that the piston is liable to strike the cylinder-head, notwithstanding a large amount of normal piston-clearance.

I claim, and desire to secure by Letters Patent, the following, to wit:

1. The combination of the bored valve-chambers D, D', and F, valve-seats W W' Y Y', and diaphragms X X', in the same line, substantially in the manner and for the purposes described.

2. The combination of the valves G, H, and H', and their seats, the connected pair of valves G forming a distance-piece between the distance-pins K, substantially in the manner and for the purposes described.

3. The combination of the independent chamber F and seats W W' with the pair of plug puppet-valves G, connected by a bar or bars,

E, which are too short to allow both valves to be seated at the same time, substantially in the manner and for the purposes described.

4. The combination of the chambers D D' and seats Y Y' with the pair of plug puppet-valves H H', separated by distance-pins K and distance piece or pieces G E, so far as to prevent the seating of both valves at the same time, substantially in the manner and for the purposes described.

5. The combination, in the chamber D, of the seats W Y, diaphragm X, and valves G and H, which seats and diaphragm are connected by the distance-lugs L L, substantially in the manner and for the purposes described.

6. The combination of the preventer plug or plugs h and i, and seats W W' and Y Y', with the valves G and separate valves H H', which valves are capable of being thrown or actuated by steam-pressure upon the backs

of H or H', substantially in the manner and for the purposes described.

7. The combination of the channels c c, opening into the cylinder A within the stroke of the piston B, with the cushion-ports O O', cushion-valves N N', and exhaust-channels P P', substantially in the manner and for the purposes described.

8. The guarding-recess g in the steam-channel R, to receive the cushion-valve N, and prevent it from being disturbed by steam passing through said channel R, as set forth.

9. The combination of the rabbeted packing-rings of the piston B with the cushion-ports O O' and valves N N', substantially in the manner and for the purposes described.

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Witnesses:

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JOHN M. HACKER.