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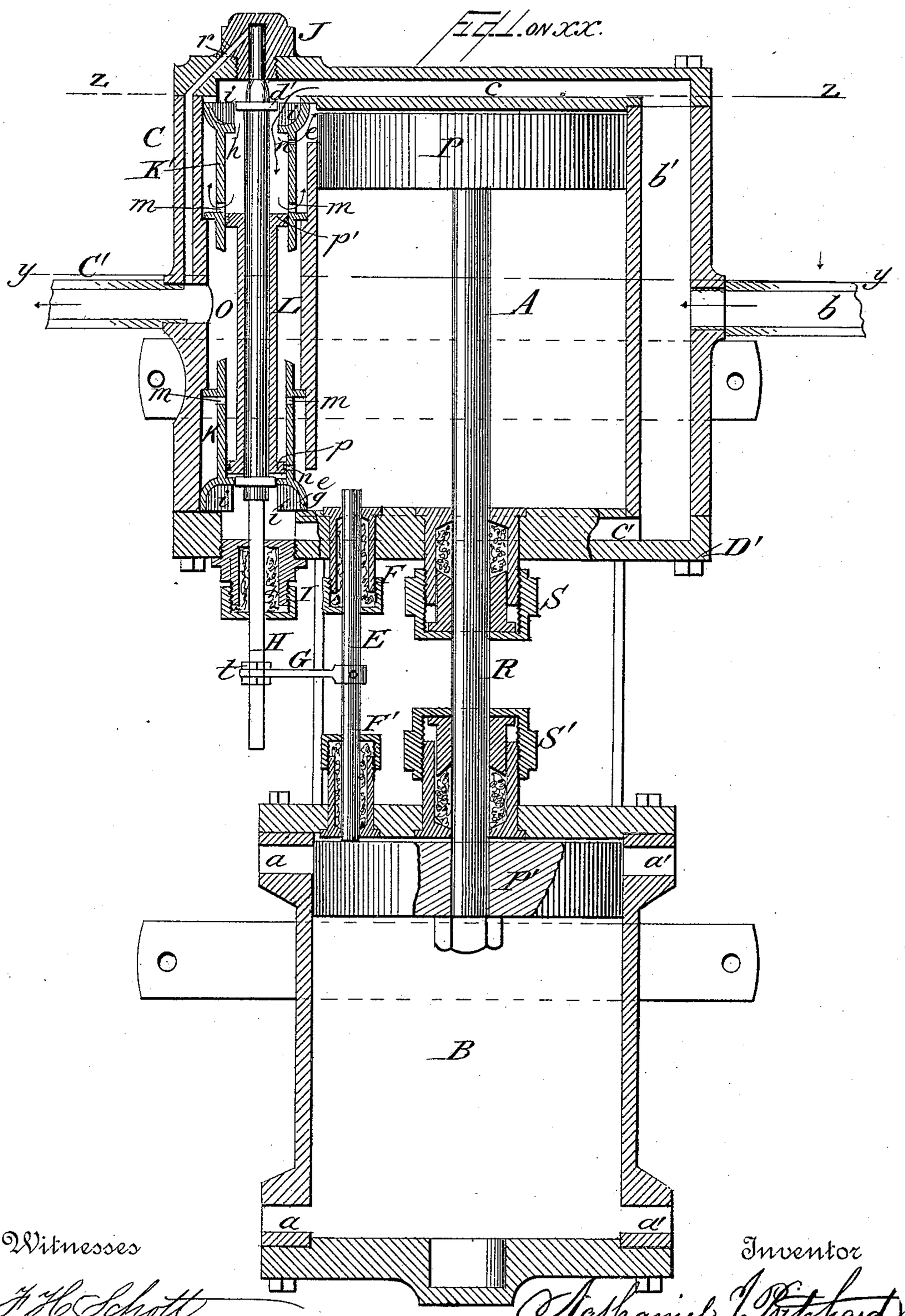
N. J. PRITCHARD.

STEAM PUMP.

No. 405,116. Patented June 11, 1889.



Witnesses

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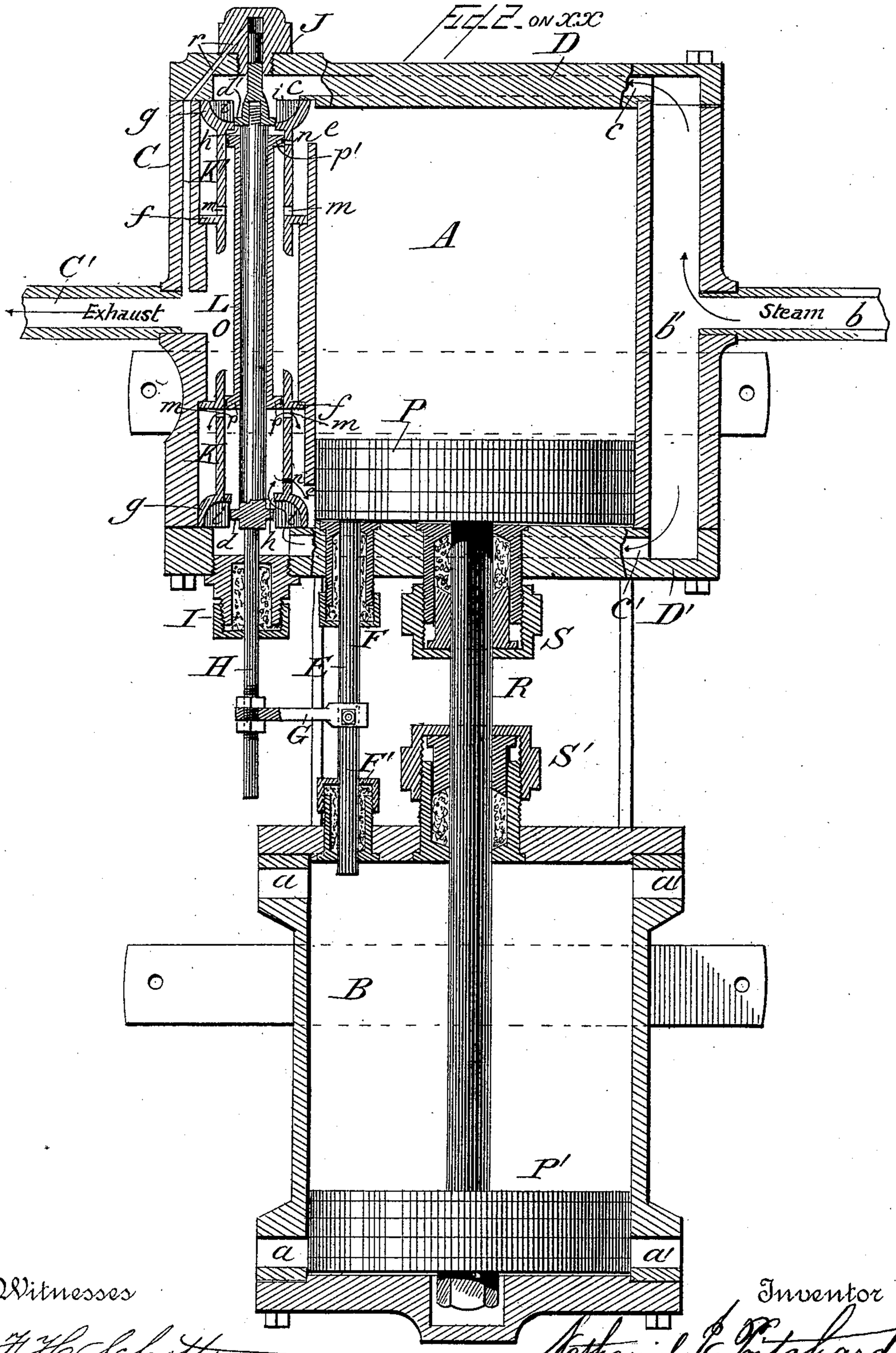
(No Model.) 4 Sheets—Sheet 2.

N. J. PRITCHARD.

STEAM PUMP.

No. 405,116. Patented June 11, 1889.



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4 Sheets—Sheet 3.

N. J. PRITCHARD.

STEAM PUMP.

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Fig. 3 on yy.

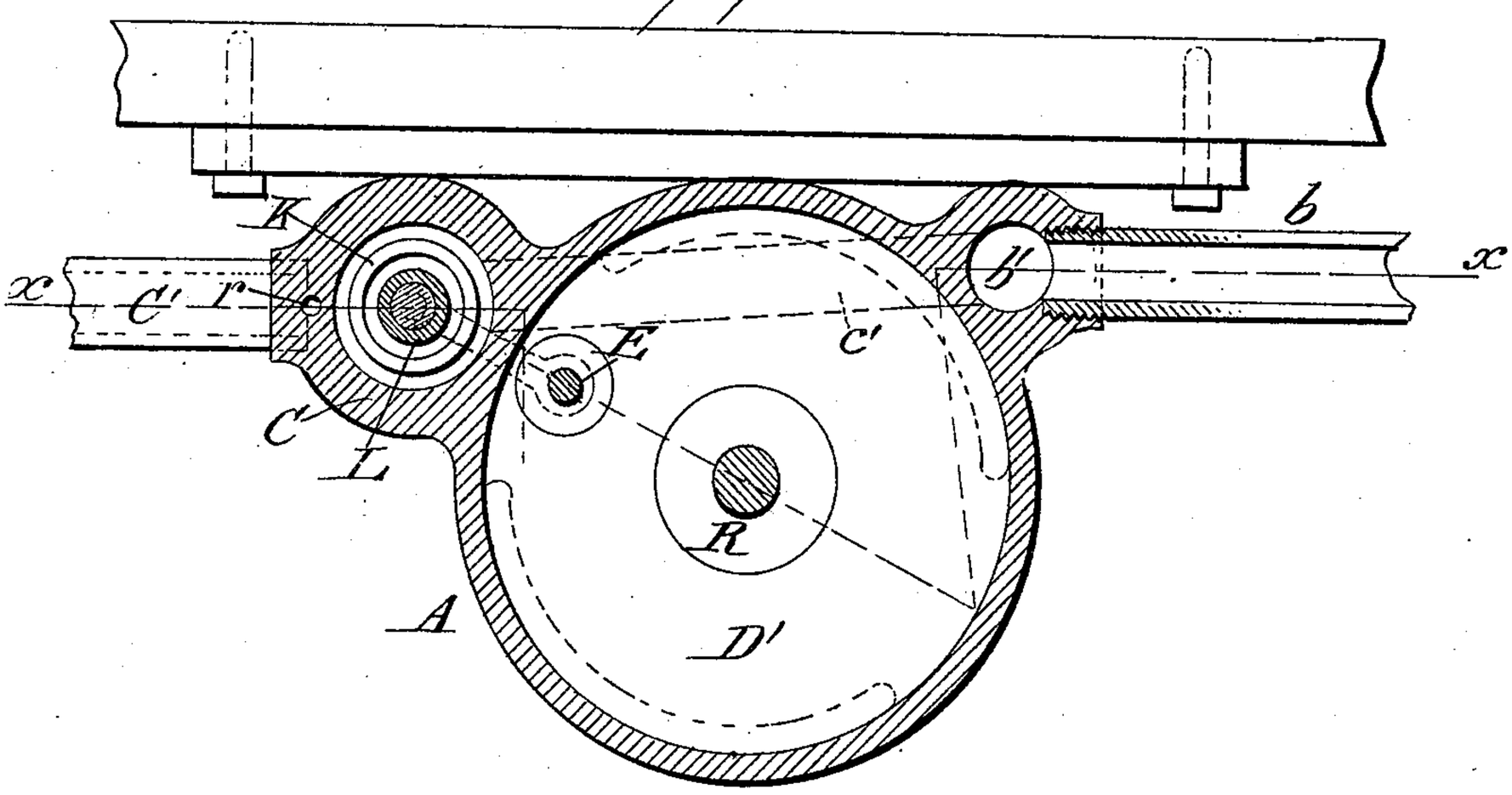


Fig. 4 on zz.

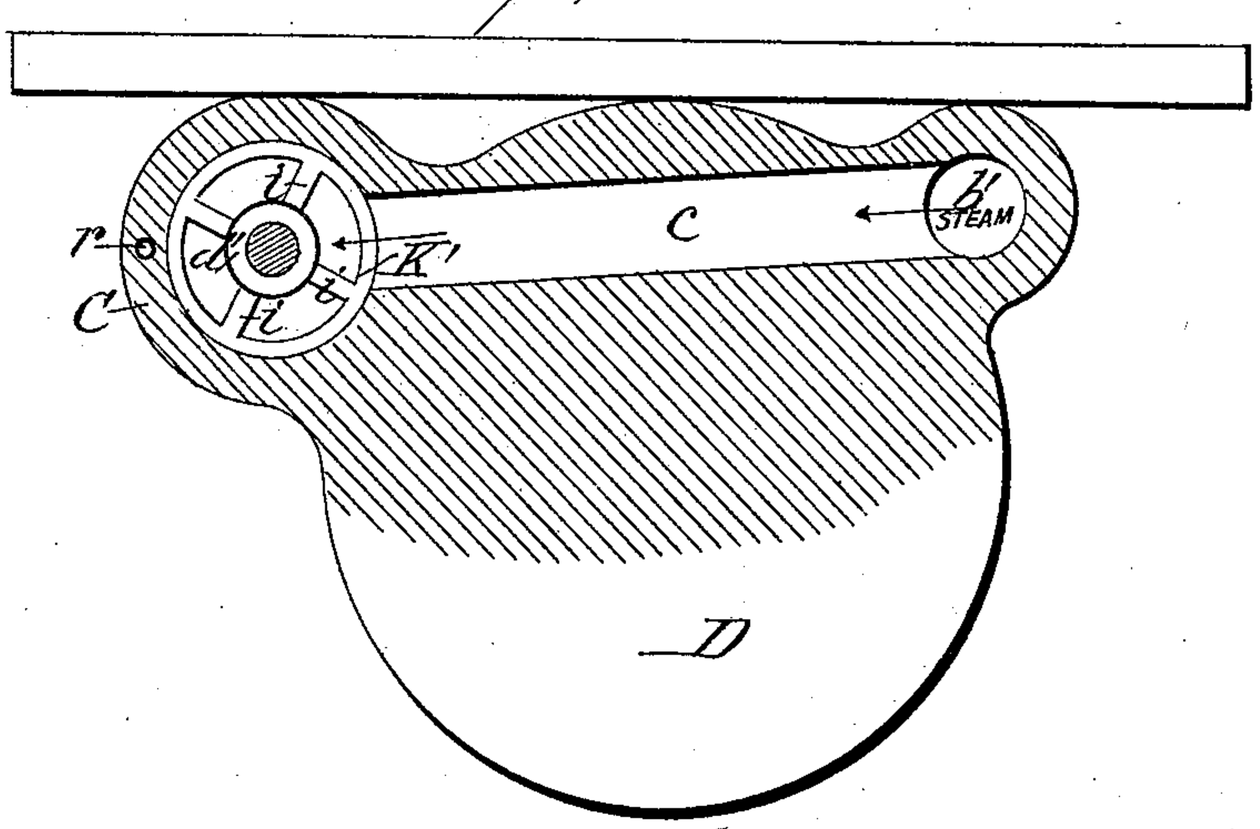
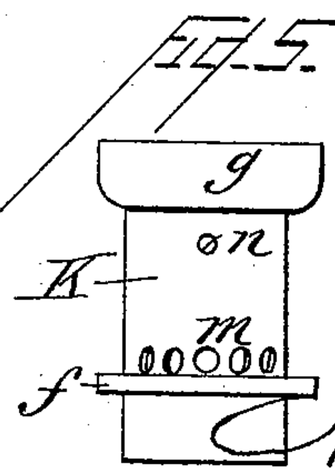


Fig. 5.



Attest:

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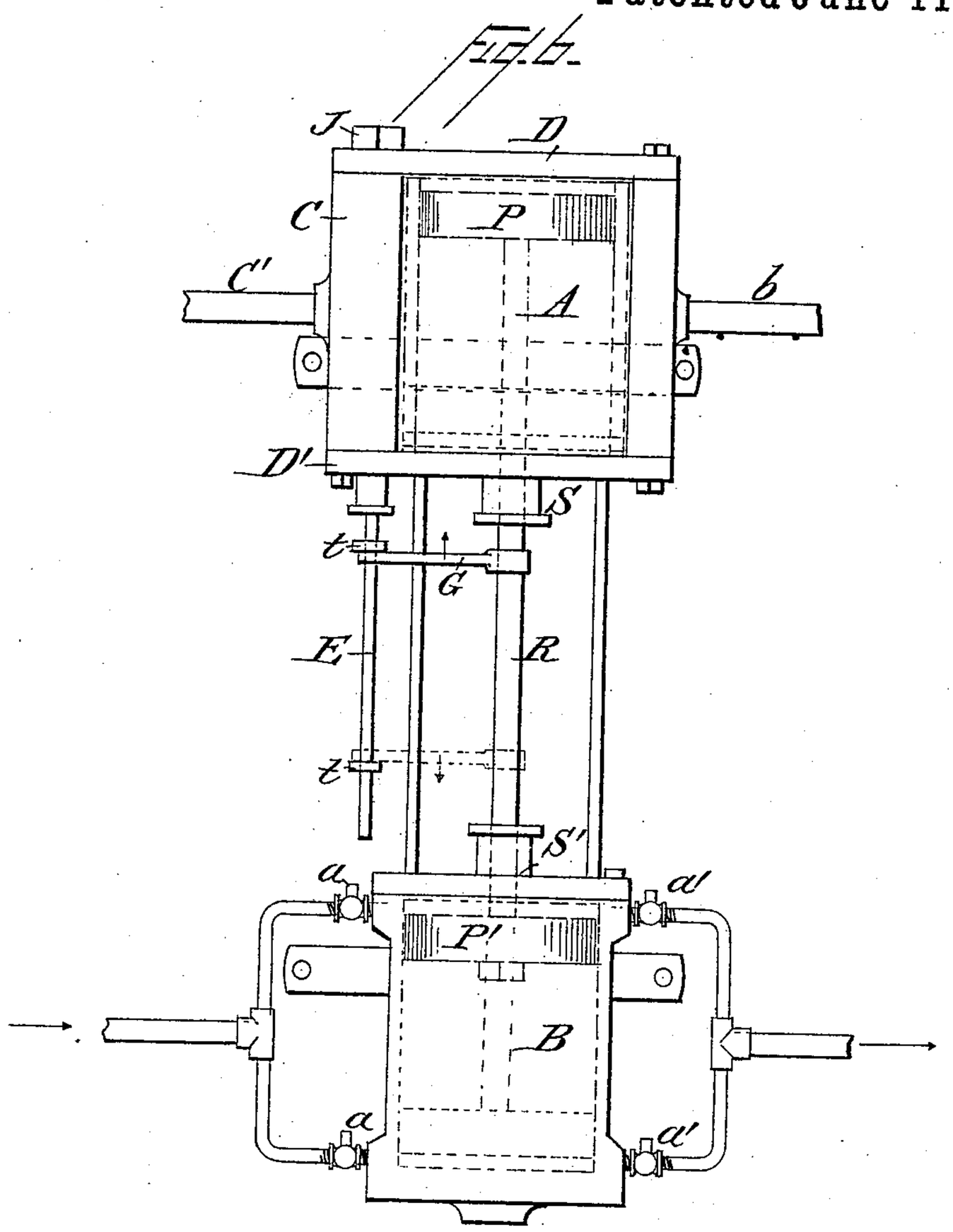
(No Model.)

4 Sheets—Sheet 4.

N. J. PRITCHARD.

STEAM PUMP.

No. 405,116. Patented June 11, 1889.



Attest:

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Inventor:

Nathaniel J. Pritchard,

per John C. Tasker,

atty.

UNITED STATES PATENT OFFICE.

NATHANIEL J. PRITCHARD, OF MILNES, ASSIGNOR TO THE PRITCHARD BRAKE COMPANY, OF ROANOKE, VIRGINIA.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 405,116, dated June 11, 1889.

Application filed September 6, 1888. Serial No. 284,719. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL J. PRITCHARD, a citizen of the United States, residing at Milnes, in the county of Page and State of Virginia, have invented certain new and useful Improvements in Steam-Pumps; 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.

This invention relates to improvements in that class of steam-pumps commonly employed for the purpose of compressing air to operate air-brakes, signals, and for other analogous purposes, as well as for pumping water and other liquids, the object being to produce a pump that may be readily attached to a locomotive or set up in any desired position where such an engine may be required, and it may not only be used as a machine for compressing air, but with a slight change in the construction of some parts will form an effective pump for the purpose of raising water or other fluids. This feature of the invention will be found of great service in conducting mining operations, as the pump may be readily set up in the shaft or tunnel and receive power from the compressed air generally employed in such situations to operate the drills; and the invention consists, essentially, in the construction of the engine-valves and devices for operating the same, as hereinafter fully described.

In constructing this machine two cylinders are employed, one (commonly the longer) being the power-cylinder and the other the pump-cylinder. These two cylinders may be cast integral with the bed or support upon which they are carried, or they may be cast separately and secured to said bed by suitable fastenings. These two cylinders are so placed that their axial line is the same and continuous, allowing a single piston-rod to serve for both, said rod carrying upon one end the piston of the power-cylinder and upon the opposite end that of the pump or compressor. A system of valves is provided which receive their motion directly from the movements of the pistons without the intervention of eccentrics or rotation of shafts, the movements of the valves being positive and so arranged as to give the needed cushioning to the power-piston at each end of its stroke.

In the drawings which form a part of this specification, Figure 1 is a longitudinal section through both cylinders on the line *x x* of Fig. 3, showing the pistons at one end of their stroke at the point of taking steam, the exhaust from the opposite end of the power-cylinder being open. Fig. 2 is a similar sectional view, the pistons being at the opposite end of their stroke. Fig. 3 is a cross-section of the power-cylinder on the line *y y* of Fig. 1, showing the positions of the steam and exhaust pipes and the side pipe containing the valves with relation to said cylinder. Fig. 4 is a cross-section of one of the power-cylinder heads on line *z z* of Fig. 1, showing the passage for steam through said head. Fig. 5 is a side elevation of one of the valve-chambers, and Fig. 6 shows a modification in which the valves are operated by an arm attached to the piston-rod between the cylinders.

In the several figures, A represents the steam or power cylinder, and B the pump or compressing cylinder. The cylinder B may be of ordinary construction and provided with inlet pipes and valves, as *a a*, and outlet pipes and valves, as *a′ a′*, said valves and pipes being adapted to the work the machine is required to perform, valves differing in construction from those used in an air-compressor being employed for pumping.

The power-cylinder A receives steam or compressed air from the pipe *b* into the channel *b′*, passing from end to end of said cylinder and opening at one end into the channel or opening *c*, extending across one end of the cylinder through the cylinder-head D to the side pipe C, containing the valve-chambers. One or more channels *c′*, formed in the head D′ of the cylinder, connect the opposite ends of the channel *b* and side pipe, thus causing the latter to have free communication at both ends with the pipe *b*. The power-piston P and the pump-piston P′ are connected by the piston-rod R, so that the movement of the two pistons is simultaneous, each of them reaching the end of its stroke at the same time. The piston-rod passes through stuffing-boxes S and S′ in

the adjoining ends of the two cylinders. As in engines of this class it is necessary to admit steam behind the piston during nearly its full stroke, and at the same time admit a sufficient quantity in advance of it as it approaches the end of said stroke to serve as a cushion to prevent the striking of the piston against the cylinder-heads, valves of a peculiar construction and method of operation are required. Therefore, to operate the valves a rod E extends parallel with the pistons and passes through the stuffing-boxes F and F′ into each of the cylinders. This rod is of slightly greater length than the distance between the inner surfaces of the adjacent cylinder-heads, so that when the pistons are at either end of their stroke one of them will strike the end of the rod and force it a short distance into the opposite cylinder, and when the movement of the pistons is reversed this projecting end will be struck by the other piston and forced back, so as to project the same distance into the opposite cylinder, thus giving to the rod E an intermittent reciprocating movement parallel to that of the piston-rod, but of much less extent. Adjustably attached to the rod E between the stuffing-boxes F and F′ is an arm G, projecting sufficiently to reach the axial line of the side pipe C. In this projecting end of the arm is secured, preferably by adjusting-nuts, the valve-rod H. It is therefore apparent that when an endwise movement is imparted to the rod E by the pistons the same movement will be communicated through the arm to the valve-rod. This rod passes through a stuffing-box I into the side pipe C, its opposite end being received into and guided by the nut J, which closes an opening in the cylinder-head D into the side pipe C. The rod H is provided with two valves or disks *d d′*, securely attached thereto and serving as valves for the admission of steam to the opposite ends of the cylinder A. In each end of the side pipe opposite the ports *e e* of the cylinder is secured one of the valve-chambers K K′. These chambers are encircled near their inner ends by a radially-projecting flange *f*, the periphery of which fits the bore of the side pipe, and by engaging with a shoulder in the same prevents endwise movement of the chamber, but leaves a free passage for the steam around it. The outer end of the valve-chamber is also provided with a projecting cup-shaped flange *g*, which serves to hold this end of the chamber in place and support the guide-flanges *i*, that are placed radially at suitable distances around the opening *h* in the end of the chamber that serves as a passage for steam, and is opened and closed by the valves *d* or *d′* on the rod H.

The valve-chambers between the openings *h* in their outer ends and their inner ends are bored out cylindrically and pierced radially near the cup-shaped flanges with a series of holes *m m*, through which the steam passes to and from the cylinder.

As it is necessary that a certain amount of steam should be admitted to the cylinder before the piston reaches the end of its stroke, other small openings *n n* are made in the walls of the valve-chambers directly opposite the ports *e e*. These openings admit steam in a small quantity at the moment the rod E is struck by a piston. On the valve-rod between the valves *d* and *d′* is placed a sliding sleeve L, which sleeve carries at opposite ends the pistons *p p′*. This sleeve is of such length that when one of the pistons has passed the series of openings *m* in one valve-chamber the piston at the opposite end of the sleeve will cover the opening *n* in the opposite valve-chamber. In order to allow for the escape of any steam which may enter the orifice in the nut I, which forms the guide for the upper end of the valve-rod E, a passage *r* is formed from the outer end of the same to the exhaust-pipe C′, thus preventing any accumulation in said orifice which might interfere with the free working of the valve-rod. The operation of these valves is as follows: When the pistons P and P′ have reached the end of their stroke, as shown in Fig. 1 of the drawings, the piston P′ will have struck the end of the rod E, projecting into the cylinder B, and moved the rod longitudinally. This movement of the rod E carries with it the valve-rod H, closing the valve *d* in one valve-chamber and opening the valve *d′* in the opposite chamber. The opening of this valve allows steam to pass into the valve-chamber K′, and as the valve *d* is closed to permit the admission of steam to the chamber K at the opposite end of the cylinder the pressure of steam on the piston *p′* forces it into the chamber K′, first opening the orifices *n* in said chamber and allowing a sufficient quantity of steam to enter the cylinder to form a cushion for the piston P, then as it passes on, opening the series of radial orifices *m* and allowing the steam in full force to pass into the cylinder and exert its power in reversing the movement of the piston P, forcing it toward the opposite end of the cylinder. In order to allow the steam which has already been used in moving the piston to escape, it will be observed that the movement of the sleeve L and piston *p′* in admitting steam to the chamber K′ has carried the piston *p* at the opposite end of the sleeve to the bottom of the chamber K, thus opening the series of radial orifices *m* in said chamber and allowing free egress for the steam in that end of the cylinder to pass through said radial orifices into the exhaust-chamber O, surrounding the sleeve, and from the same through the exhaust-pipe O′ to a condenser or into the atmosphere.

In Fig. 2 of the drawings the piston of the power-cylinder is shown at the opposite end of the cylinder, the rod E having been struck by said piston and the position of the valves reversed from that shown in Fig. 1. This of course reverses the movement of the power-

piston, and its reciprocation continues automatically so long as the supply of steam is kept up.

In Fig. 6 is shown a modification of the devices for operating the valves, the valve-rod E being extended and provided with two adjustable stops, as *t t*, placed at such a distance from each other as to be struck at each reciprocation of the power-piston by an arm G, attached to the piston-rod B between the cylinders. When the valves are operated by this arrangement of devices, it is necessary to place the power and pump cylinders so far apart as to allow for the full length of the stroke between the stuffing-boxes of said cylinders, thus greatly increasing the length of the rod which connects the pistons of said cylinders, as well as the bed to which the cylinders are attached. The first-described devices for operating the valves are therefore preferred, as it allows the power and pump cylinders to be brought close together, thus shortening the piston-rod, as well as the bed on which the cylinders are carried. It will be understood that this power-cylinder may be operated by compressed air or any other elastic fluid in place of steam without changing in any way the construction of the several parts.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. As an improvement in the valve-operating mechanism of steam pumps or compressors, the combination, with the pistons of the power and pump cylinders, of a valve-actuating rod passing through the heads of said cylinders and moved alternately in opposite directions by contact with the said pistons, the valves secured on said rod, and the valve-chambers having an opening to receive the valves and flanges to guide the same, substantially as set forth.

2. In a valve mechanism for steam pumps or compressors, the valve-actuating mechanism, as described, in combination with the valve-rod, the valves secured thereto, the reciprocating sleeves and pistons mounted upon and guided by said rod, and the valve-chambers having an opening to receive the valves and flanges to guide the same, substantially as described.

3. As an improvement in valves for steam-engines, the valve-rod provided with valves attached thereto, as described, and the reciprocating sleeve guided by said rod, in combination with the radially-pierced valve-chambers placed at opposite ends of the power-cylinder, as set forth.

4. As an improvement in the valve mechanism of steam-engines, the valve-chambers secured at each end of the cylinder in a side pipe and provided with a valve-opening at one end, a series of perforations surrounding the same for the passage of steam near the opposite end, and a single perforation near the valve-opening to allow the passage of a sufficient amount of steam to cushion the stroke of the piston, as set forth.

5. In a valve mechanism for steam-engines, the combination of the valve-rod and valves secured thereon with the valve-chambers having an opening to receive the valves and flanges to guide the same, substantially as specified.

6. As an improvement in steam pumps or compressors, the combination of the power-cylinder, the pump-cylinder, the pistons of said cylinder, the rod connecting said pistons, the valve-rod operated by the same, the valves attached to said rod, the sliding sleeve and pistons, the valve-chambers, and the side pipe inclosing said chambers and forming the steam and exhaust chambers, all constructed and arranged for joint operation substantially as shown and described.

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

NATHANIEL J. PRITCHARD.

Witnesses:

J. O. HARRIS,

C. H. HIX.