No. 627,703. Patented June 27, 1899.

T. OFFICER.

VALVE FOR ROCK DRILLS.

(Application filed Aug. 21, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

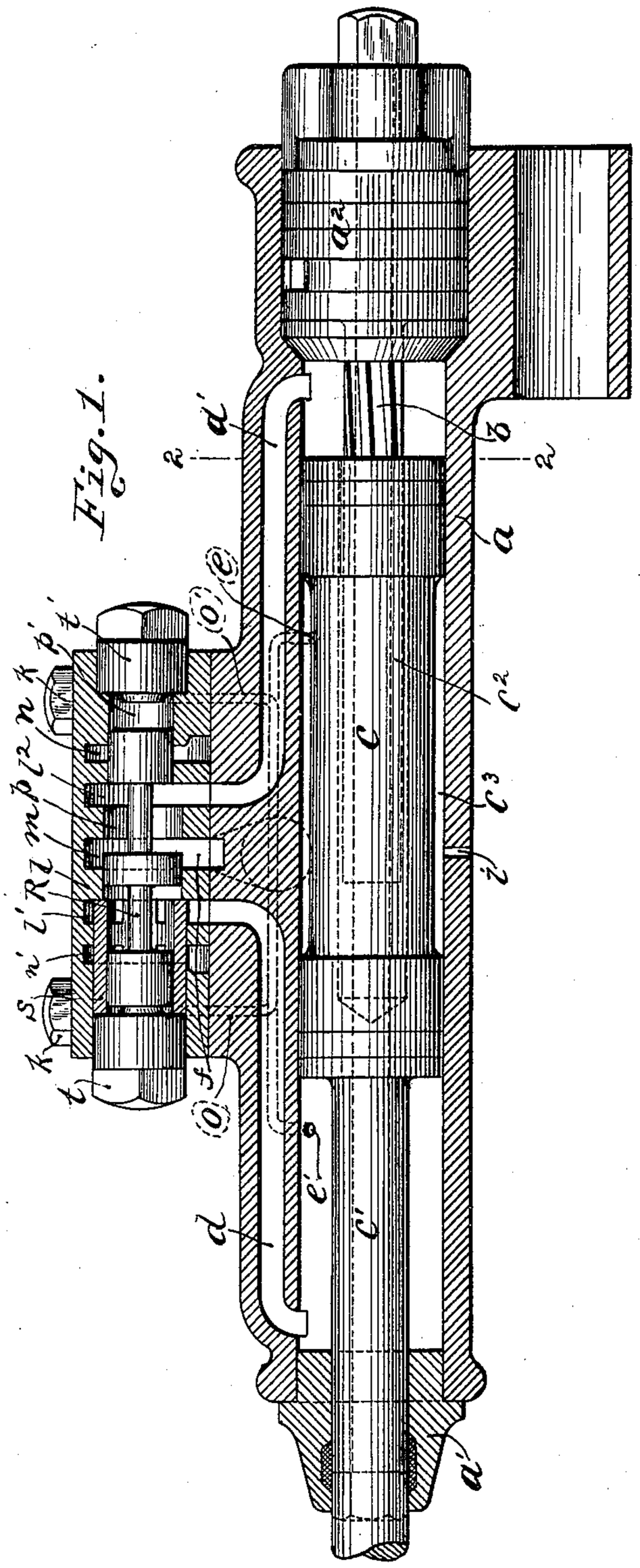


Fig. 2.

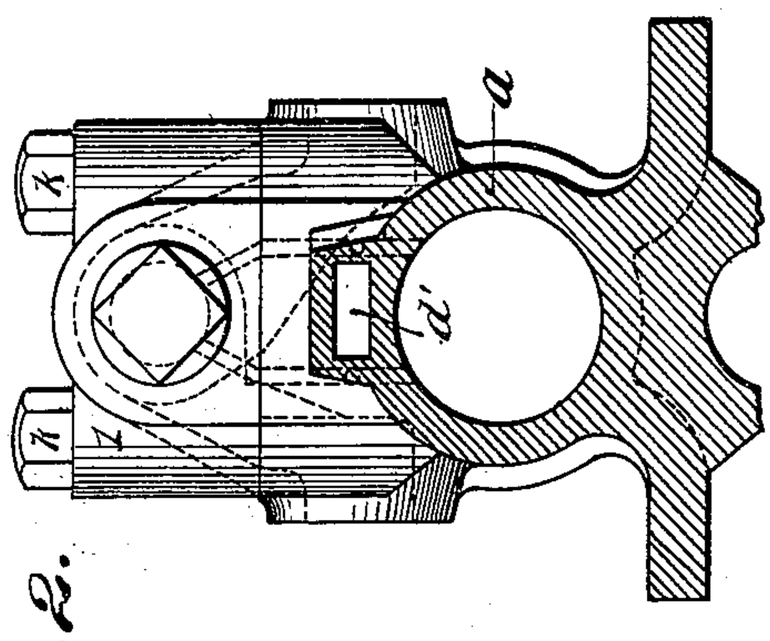
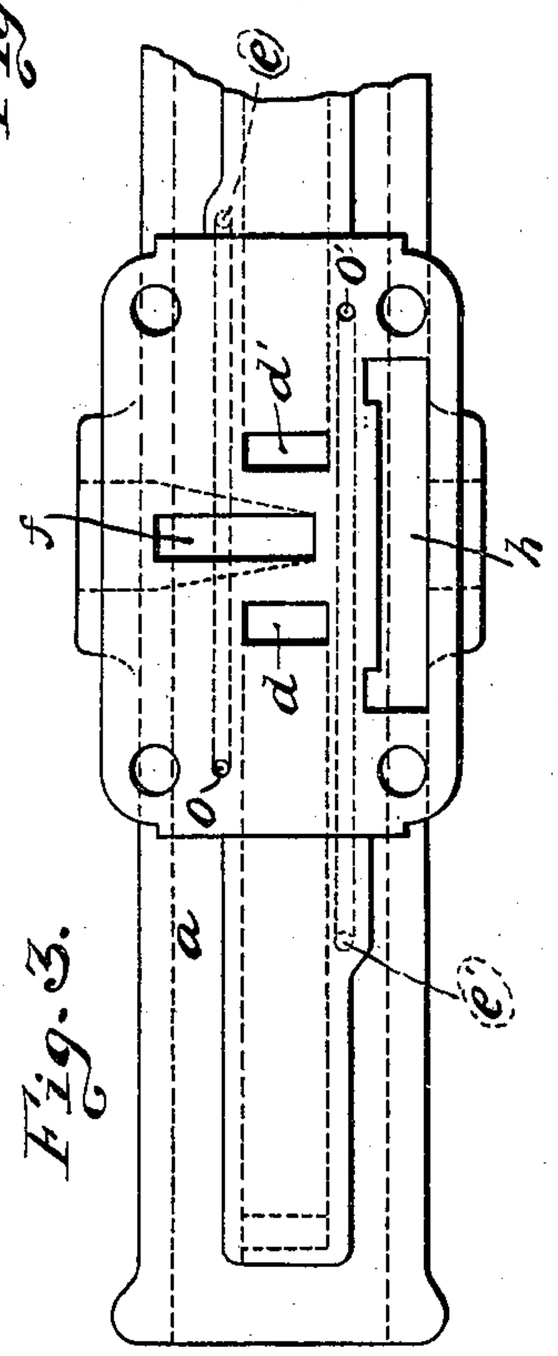


Fig. 3.



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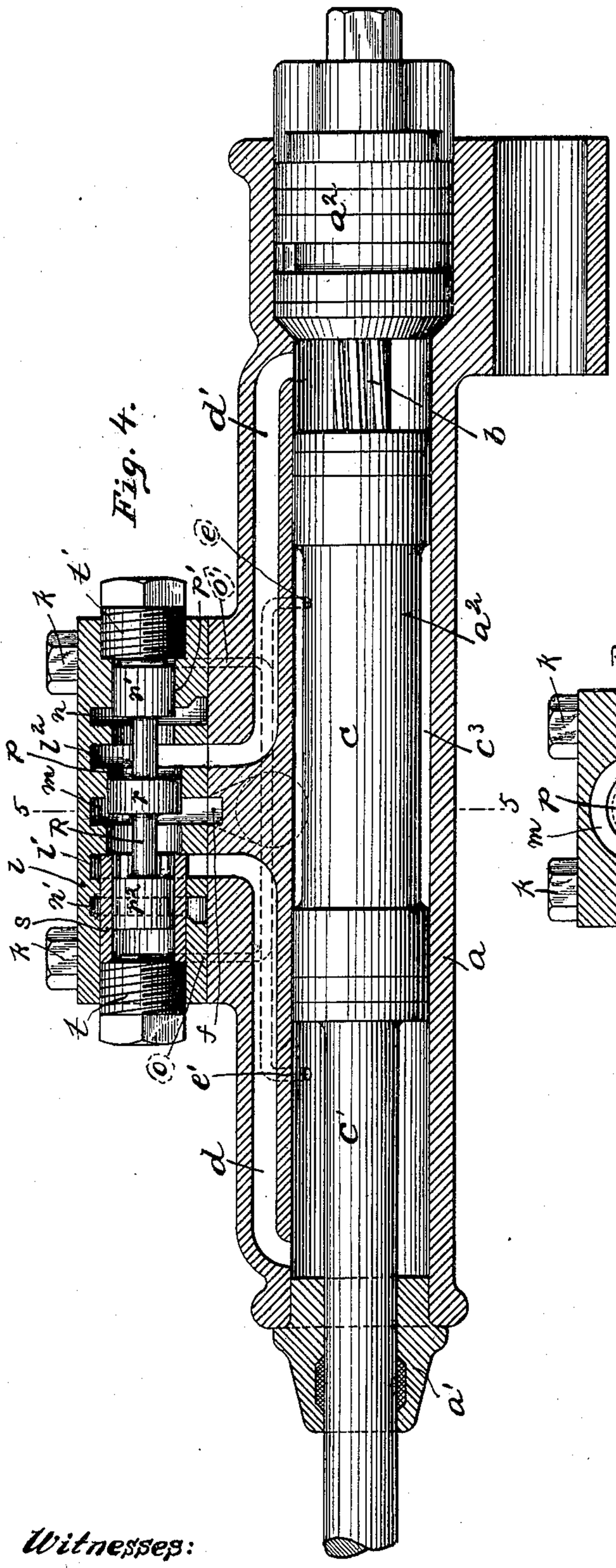

Fig. 4.

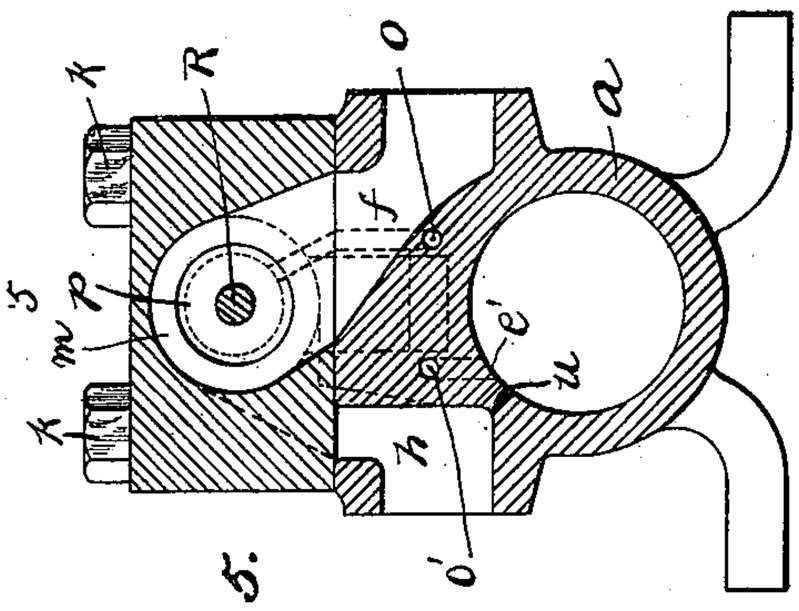

Fig. 5.

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UNITED STATES PATENT OFFICE.

THOMAS OFFICER, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO THE SULLIVAN MACHINERY COMPANY, OF NEW HAMPSHIRE.

VALVE FOR ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 627,703, dated June 27, 1899.

Application filed August 21, 1897. Serial No. 649,065. (No model.)

To all whom it may concern:

Be it known that I, THOMAS OFFICER, a resident of Claremont, in the county of Sullivan and State of New Hampshire, have invented a new and useful Improvement in Valves for Rock-Drills; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to valve mechanism. What I claim as new will be found in the claim annexed hereto.

In the accompanying drawings, Figure 1 is a longitudinal section of my improved valve as applied to a drill. Fig. 2 is a section on the line 2 2, Fig. 1. Fig. 3 is a plan view of the cylinder, showing the ports. Fig. 4 is a longitudinal section of a modified form of my invention. Fig. 5 is a cross-section on line 5 5, Fig. 4.

Like letters indicate like parts in each of the figures.

As my invention will be found to be very applicable for use in connection with rock-drills, I have illustrated it in connection with such a drill, although I do not wish to limit myself to its use in connection with any one class of machines.

The letter a designates the cylinder of a rock-drill, said cylinder being closed at its ends by the front and back heads a' a^2, respectively. Secured to the back head a^2 is the spiral rifle-bar b, which engages a corresponding spiral seat formed in the piston c. Accordingly as the piston reciprocates the rifle-bar b imparts a rotary movement to said piston and also to the piston-rod c', which carries the drill-bits. This is a well-known construction in rock-drills and does not need a fuller description.

The cylinder a is provided with the customary inlet-ports d d', the one, d, leading to the bottom of cylinder and the other, d', leading to top end of cylinder, taking the drill as working in a vertical position, as shown in Fig. 1. The cylinder a is also provided with the valve-reversing ports e e', which lead from said cylinder to opposite ends of the air or steam chest, as will more fully hereinafter appear. The main air or steam inlet f may also be formed in the cylinder a, as well as the exhaust h. The piston c is cut with a clearance or contracted portion c^2 between its ends, which forms a chamber c^3 around said piston. This space around the piston c within the cylinder is vented by the vent i. By venting the space around the piston I include any means for carrying off the air, whether said vent leads to the open air or to the exhaust. Accordingly I do not wish to limit myself in any way to the particular manner of venting shown and described.

Secured to the cylinder a by means of the cap-screws k is the chest l. This chest l has the ports l' l^2, coinciding with the ports d d', respectively, the port m communicating with the port f, the ports n n' communicating with the exhaust-port h, and the ports o o' (shown in dotted lines) communicating with the ports e e', respectively. The chest l has the cylindrical chamber p formed therein, adapted to receive and hold the piston-valve R. This piston-valve R has the pistons or disks r r' r^2 formed thereon. The piston r is larger than the pistons r' r^2, and said piston r controls the inlet-port m. The piston r' fits in the contracted portion p' of the cylindrical chamber p, while the piston r^2 fits in the lining s, which is driven into the chamber p. When putting the parts together, the valve R is first inserted in the chamber p, and the lining s is then driven down over the end of valve. The buffer t holds said lining in place. A buffer t' is also secured to the opposite end of the chest. By removing the buffers and driving on the piston r' the lining will come out with the valve.

When my improved valve is in use, the operation is as follows: With the parts in the positions shown in Fig. 1 and taking the valve as working in a vertical position the air, steam, or other motive power employed is entering the inlet-port m and passing through the ports l^2 d' to the upper end of cylinder. For convenience I will describe the operation of the valve with reference to air as a motive power. The valve R has the piston r^2 in contact with the buffer t and held thereto by means of the live air entering the inlet-port m and acting on the differential area of the piston r. Owing to this differential area of the piston r the piston r^2 is held by the pressure of the live air against the buffer t. As

soon as the piston *c* descends and passes the port *e* the live air enters said port and passes to the lower end of the chest *l*, entering by the port *o* and filling the space below the piston r^2. The live air then acts on the area of the piston r^2 and moves the valve up until the air enters below the piston *r*. Then the combined area of the pistons *r* and r^2 moves the valve up until the piston r' is brought into contact with the buffer t'. The piston r' will be held up against said buffer t' by the pressure of the live air on piston *r*. The piston *c* will now be at the lower end of its stroke, and by the above movement of the valve the live air now passes by the ports l' *d* to the lower end of the cylinder. The valve is held by the live air with its piston r' against the buffer t' until the piston in its ascent passes the port e'. The live air enters the port e' and passes by the port o' to the upper end of the chest, where it acts upon the piston r'. For the same reason as above set forth the valve is moved to admit air to the upper end of the cylinder. The exhaust takes place through the exhaust-ports in the ordinary manner, and it is to be noted that as the valve is shown in Fig. 1 e' is open to the exhaust side of piston in the cylinder. This, however, has no effect on the valve, as the air in the inlet *m* holds the valve to the buffer *t*. The opposite reversing-port *e* is open to the space around the piston, so that the air can escape through the vent *i*. I do not, however, wish to limit myself to this particular construction.

One of the main advantages of my invention lies in the fact that the live air holds the valve to one or other of the buffers until the piston has passed the reversing-port. The consequence is that even after the port has been closed which controls the air that moves the valve the live air still acts to hold the valve in place until the reversing-port has been passed.

When drilling down, as illustrated, there will be no difficulty in holding the valve against the bottom buffer; but when the valve is reversed and requires to be held at the upper end against the upper buffer the air must hold it there until the reversing-port e' is opened. It is especially essential in connection with drills that the valve be held to either buffer when moved there, as the drills are used in all positions. The drill will work more regularly and has greater lifting power to raise the drill, as the valve will not change until the reversing-ports are passed by the piston, and consequently the action of the valve is positive.

In Fig. 4 I have illustrated my invention in a form in which the live air is taken in at the exhaust instead of what was before the inlet. When my invention is embodied in this form, I omit the vent *i*, which vented the space around the piston, and instead I employ the aperture *u*, which connects the exhaust to the chamber around the piston. The connection for the live air is made with the port *h*, formerly the exhaust. With the parts in the position shown in Fig. 4 and assuming the drill to be in an upright position the valve will be at the bottom of air-chest, resting against the buffer *t*. The air having gone in through the port n' and over bridge and down the port *d* to the lower end of the cylinder, the piston has been carried up to the position shown in Fig. 4, the reverse-ports e e' having been passed. With the piston in this position the valve will be balanced. The live air coming through the aperture *u* into the chamber around piston will go into the reverse-port *e* and pass to the lower end of valve below the piston r^2, while live air from cylinder below the piston enters the reverse-port e' and passes to the upper end of valve above the piston r'. This balances the pressure on the ends of the valve. The valve being thus balanced at its ends and the area of *r* being greater than r^2, the valve is carried up by live air against the buffer t', and the valve is reversed. The live air now enters the port *n* and passes by the port d' to the upper end of cylinder. The piston descends and passes the reverse-port e'. The exhaust takes place in lower end of cylinder and takes the pressure from the reverse-port e'. The valve is then unbalanced, but the live air in port *e* holds the valve firmly to the buffer t' until the reverse-port e' is opened to the chamber around the piston. This will balance the valve again, and owing to the greater area of *r* the valve will be moved down until the piston r^2 rests against the buffer *t*.

From the above it will appear that the valve operates equally well whether the live air is admitted at what was originally the exhaust or at what was originally intended as the inlet.

I do not wish to limit myself to the exact construction illustrated, as that may be varied without departing from the scope of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

In valve mechanism, the combination of a cylinder having inlet and exhaust ports, a piston, a piston-valve controlling said ports, said valve having pistons at each end thereof and a single one intermediate thereof, said intermediate piston being of greater area than either of the end ones, and said cylinder having reversing-ports in the upper and lower portions thereof leading to the lower and upper ends respectively of said piston-valve, whereby said piston-valve is unbalanced when the piston passes the reversing-ports.

In testimony whereof I, the said THOMAS OFFICER, have hereunto set my hand.

THOMAS OFFICER.

Witnesses:

J. S. WALKER, Jr.,

GEO. E. WOLCOTT.