(No Model.) 2 Sheets—Sheet 1.

A. J. BATES.

PNEUMATIC DRILLING TOOL.

No. 364,081. Patented May 31, 1887.

Fig. 1.

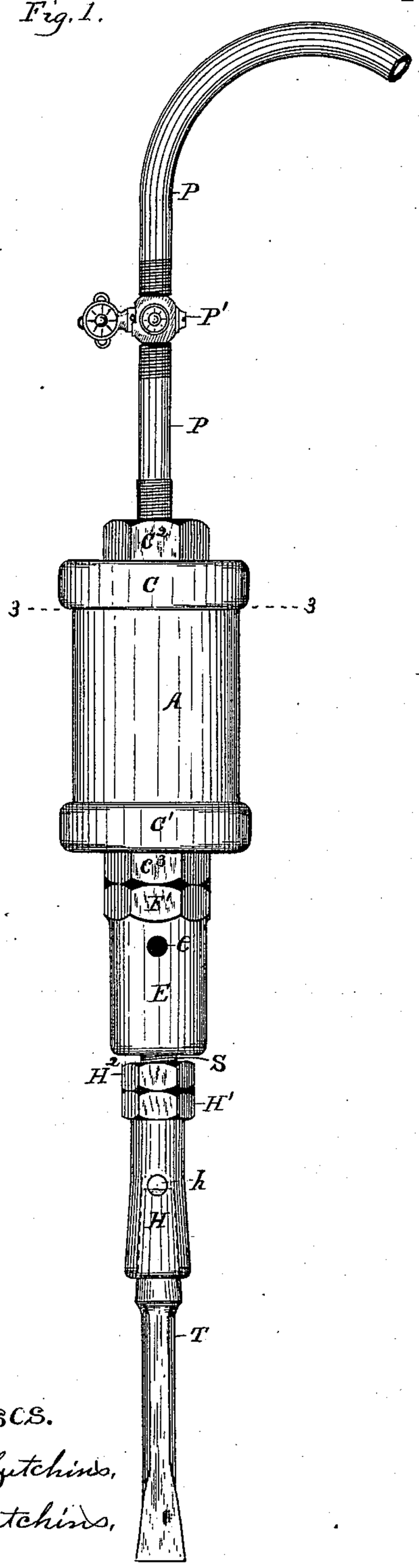


Fig. 2.

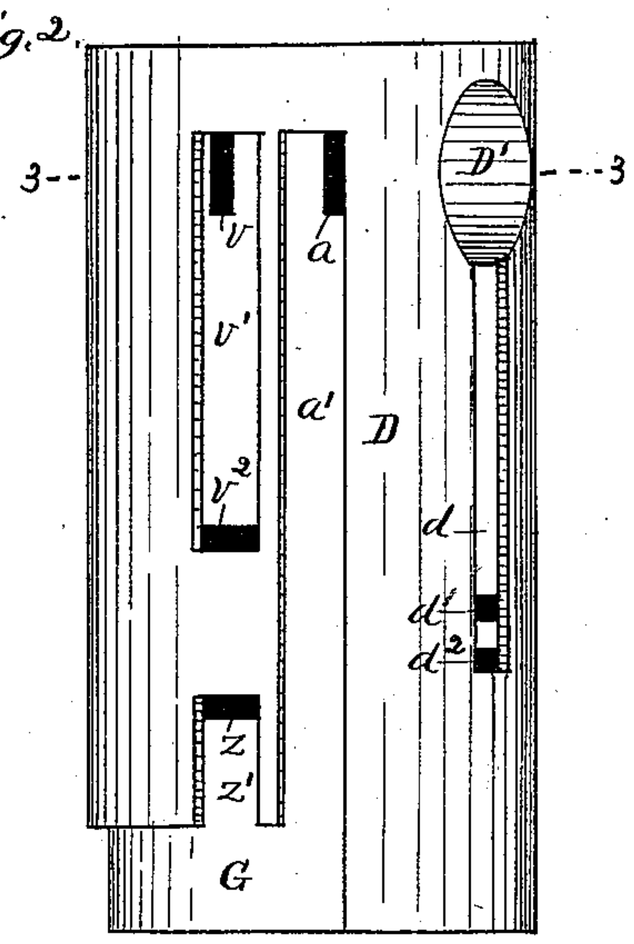
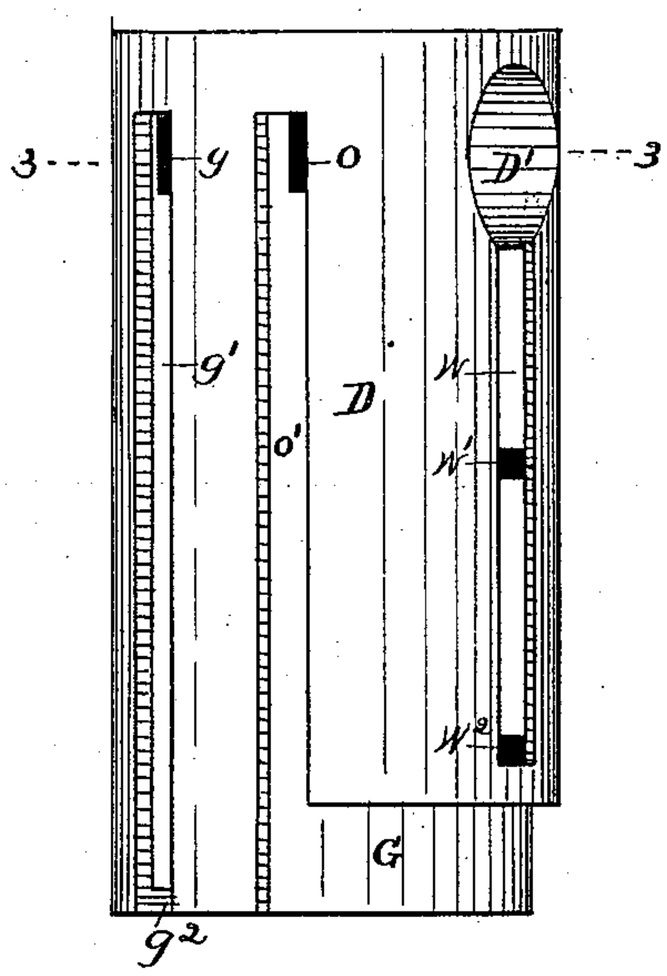


Fig. 3.



Witnesses.

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Wm. J. Hutchins,

Inventor.

Albert J. Bates,

(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

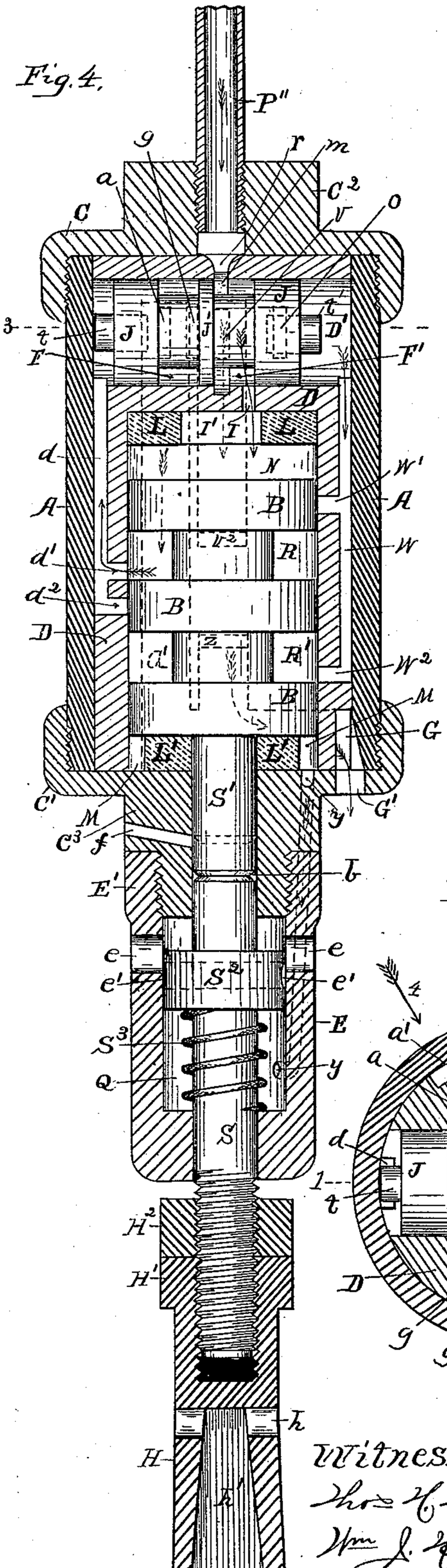

Fig. 5.

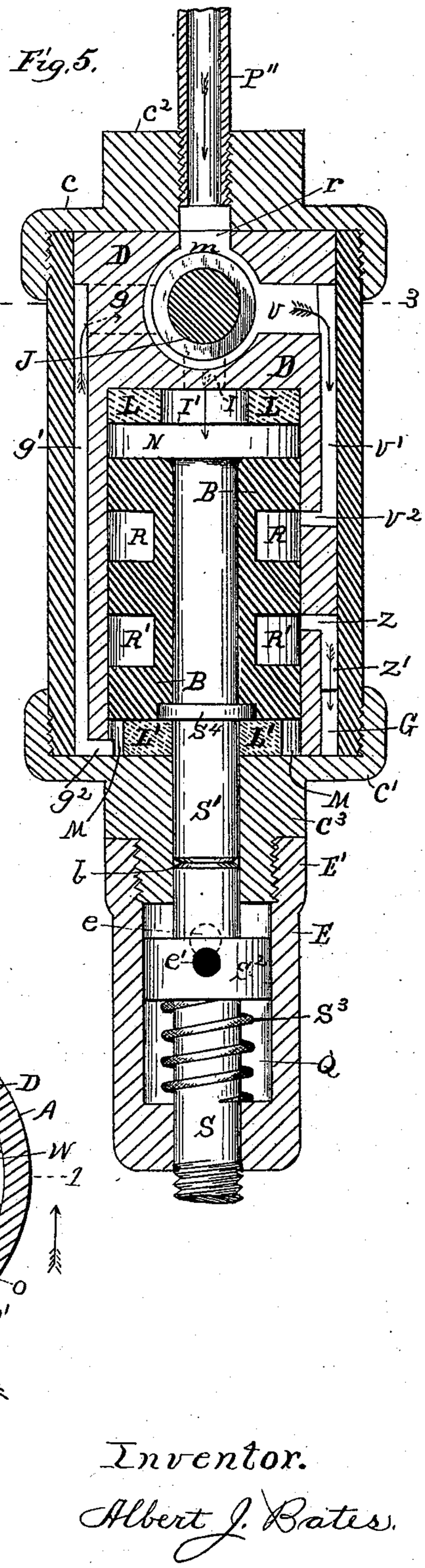

Fig. 6.

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UNITED STATES PATENT OFFICE.

ALBERT J. BATES, OF JOLIET, ILLINOIS.

PNEUMATIC DRILLING-TOOL.

SPECIFICATION forming part of Letters Patent No. 364,081, dated May 31, 1887.

Application filed February 28, 1887. Serial No. 229,255. (No model.)

To all whom it may concern:

Be it known that I, ALBERT J. BATES, a citizen of the United States of America, residing at Joliet, in the county of Will and State of Illinois, have invented certain new and useful Improvements in Pneumatic Drilling-Tools, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain improvements in pneumatic drilling-tools, the construction and operation of which are fully set forth and explained in the following specification and claims, reference being had to the accompanying drawings and the letters of reference and figures marked thereon, which form a part of this specification, in which—

Figure 1 is a reduced exterior side view of the tool as it would appear ready for use. Fig. 2 is a side plan view of the cylinder of the tool, looking at said cylinder in the direction indicated by arrow 4, Fig. 6, showing the air-ports and channels in that side; also showing a portion of the valve-chamber. Fig. 3 is a similar view looking at said cylinder in the direction indicated by arrow 5, Fig. 6, showing the air ports and channels in the opposite side; also showing a portion of the valve-chamber. Fig. 4 is a central longitudinal section of the stationary or fixed parts of the tool and of its chuck on line 1 of Fig. 6, looking in the direction indicated by the arrow, and a side view of the operative parts represented as having descended to their full capacity in making a stroke. Fig. 5 is a central longitudinal section of the stationary or fixed parts of the tool and also of the piston and valve on line 2 of Fig. 6, looking in the direction indicated by the arrow, and a side view of the striker, spindle, and spring, represented as having descended to their full capacity in making a stroke; and Fig. 6 is a cross-sectional view of the cylindrical case and cylinder of the tool on lines 3 of Figs. 1, 2, 3, 4, and 5, looking down, showing the air ports and channels in said cylinder, communicating with the valve-chamber; also showing a side view of the valve in its chamber, represented as having made a complete movement to the left. In this device the cutting-tool is attached to a spindle, which is operated by a striker attached directly to the piston, and is driven down by the admission of compressed air above the piston, and retracted when the air is admitted below the piston, giving from two thousand to three thousand blows per minute.

Referring to the drawings, A represents a cylindrical case screw-threaded at each end, and has fitted thereon the screw-threaded caps C and C′, as shown in Figs. 1, 4, and 5, said caps respectively having the integral hexagon-shaped hubs C^2 and C^3, on which a wrench can be fitted to turn said caps tightly on said case. Extending from and integral with hub C^3 is a screw-threaded shank, upon which is fitted the depending spindle-case E by means of the hexagon-shaped nut E′, integral with said spindle-case, which is turned on said shank, as shown in Figs. 1, 4, and 5.

D represents the cylinder, which is the same length as case A, and is closely fitted within said case, (see Figs. 4, 5, and 6,) and is formed with a central chamber extending longitudinally into it from the bottom, into which is fitted and operated the piston B of the tool. (See Figs. 4, 5.) A chamber, D′, is also formed through and across the upper part of said cylinder, which is divided from the piston-cylinder, into which is fitted and operated the valve J of the tool. (See Figs. 2, 3, 4, 5, and 6.)

Piston B is formed with two annular grooves of considerable size, which form within the cylinder the annular chambers R and R′, and as the said piston is shorter than the chamber into which it operates, space is left at each end thereof, forming the chambers N and M; hence the piston B divides its general chamber in cylinder D into four separate and distinct chambers, N, R, R′, and M. (See Figs. 4 and 5.)

Within chambers N and M are respectively arranged leather packings L and L′, which are alternately engaged by piston B when operated to cushion its stroke and prevent metal striking metal. (See Figs. 4 and 5.)

S′ represents the striker of the tool, centrally arranged through piston B and firmly secured to said piston by means of the integral annular flange S^4, shouldered into the lower part of said piston and by riveting down its upper end, (see Fig. 5,) and extends from the lower end of said piston into hub C^3 of cap C′, which

is chambered for that purpose, and is operated by piston B. (See Figs. 4 and 5.) A chamber, *b*, is formed by the space at the lower end of said striker, between it and the spindle S below, by means of the meeting ends of said striker and spindle being chamfered off, and when said striker is on its upstroke (as shown by dotted lines in Fig. 4) said chamber will be considerably enlarged, for the purpose hereinafter set forth.

S represents the cutting-tool spindle, ararranged below and on a line with striker S′ in spindle-case E, its upper end extending into chamber *b*, where it is engaged by said striker and thus operated, and its lower end, which is screw-threaded, extends from said spindle-case and has fitted thereon the chuck H, having a socket, *h*′, into which are fitted the various kinds of tools to be operated. H′ is an integral hexagon-shaped nut of said chuck, on which a wrench can be placed to adjust the chuck on said spindle; and H^2 is a hexagon-shaped lock-nut for holding adjusted said chuck. *h* is a hole bored transversely through said chuck at the upper end of the tool-socket, and is for the purpose of admitting a wedge-shaped instrument for removing the cutting-tool T from the chuck. (See Figs. 1 and 4.)

S^2 is an integral annular flange of spindle S, and is fitted and arranged to operate in chamber Q in spindle-case E, and is assisted in its upward movement by coil-spring S^3 in said chamber bearing against the lower part of said flange. (See Figs. 4 and 5.)

e and *e* are oppositely-arranged openings through spindle-case E across chamber Q, and *e*′ is a corresponding hole through flange S^2, (see also said figures,) and when spindle S is at its upper position a pin may be passed through said openings and hole, to prevent said spindle from rotating while the chuck H is being adjusted thereon.

P″ is a metal pipe-screw fitted in hub C^2 of cap C at the upper part of the tool, (see Figs. 4 and 5,) and communicates through the medium of aperture *r*, direct with the annular groove *m* in the valve-chamber D′, (see Figs. 4 and 5;) and P represents a flexible pipe secured on pipe P″, (see Fig. 1,) and communicates with a compressed-air tank, (not necessary to be shown,) which constantly supplies live compressed air to the valve-chamber D′.

P′ represents an ordinary cut-off cock, which may be turned to either start or stop the operation of the tool by letting on or cutting off the air to the tool.

The different ports for feeding and exhausting air to and from the different operative parts of the tool are formed in cylinder D, and channels formed in the outer part of said cylinder-shell properly connect the different ports, as shown particularly in Figs. 2 and 3; also in Fig. 6. By incasing said cylinder, as described and shown, said channels are inclosed, and thus form separate and distinct passage-ways.

All the ports and channels which feed live air to the different ports of the tool communicate with valve-chamber D′, and by the action of valve J the proper ports are alternately opened and closed, or alternately opened to the live-air chamber and to the exhaust-ports for the purpose of reciprocating said valve and the piston B.

Valve J is formed with two annular grooves of considerable size, forming chambers, as shown at F and F′ in Figs. 4 and 6, leaving a narrow annular flange, J′, between and separating said chambers. (See also said figures.) A pair of hard-wood buffers, *t t*′, (see Figs. 4 and 6,) are respectively set one in each end of said valve, which prevents metal striking metal, and also regulates the position of said valve at each throw by the engagement of said buffers against case A.

Valve J is adapted to reciprocate within its chamber in such manner that its central annular flange, J′, will move alternately from one side of annular groove *m* to the other, thus alternately admitting live air into said chambers F and F′, and when said valve changes from one position to the opposite, the flange J′, in passing groove *m*, will be entirely surrounded by live air bearing equally on all sides, which balances and prevents side friction to said valve; and, further, by means of said groove *m*, the feed-supply of air to other parts is not cut off during the time said flange J′ is passing said groove.

The annular chamber R in the piston B communicates with groove *m* in the valve-chamber through the medium of ports *v* and v^2, connected by channel *v*′, (see Figs. 2, 5, and 6, and by dotted lines in Fig. 4,) and a constant supply of live compressed air is retained in said chamber, and is utilized in operating the valve J. (See direction of arrows.)

The annular chamber R′ in the piston B is a receiving-chamber for exhaust-air from the valve-chamber and communicates with exhaust port or exit G′ through the medium of port *z*, channel *z*′ and channel G, and is constantly open to exhaust. (See full lines in Figs. 2, 4, and 5; also, dotted lines in Fig. 4; also, see arrows.)

Referring to Fig. 4, the valve-chamber D′ at the right is in communication with exhaust-chamber R′ through the medium of channel *w* and port w^2, and the air in that end of chamber D′ which was utilized in forcing the valve J to the position represented can now be exhausted and relieve that end of said valve from pressure. On the left the valve-chamber is in communication with the compressed-air-supply chamber R through the medium of channel *d* and port *d*′, and live compressed air can now enter said valve-chamber at that end and force the valve J to the opposite side, and thus shift the annular chambers F and F′ in said valve, the position of which and the end sections of said valve regulate the air pressure and exhaust to operate the piston B. In

said figure piston B is represented on its full downstroke, it being the result of operating said valve as described; but when said piston is moved to its reverse or full upstroke ports w' and d^2, opening into said channels w and d, which are represented as closed by said piston, will be opened, and the ports w^2 and d' will be closed, and port d^2 opened to chamber R′ to exhaust the air from the left of valve-chamber D′, and port w' opened to the compressed-air-supply chamber R, which will admit compressed air in the valve-chamber at the right, and thus the action of air and the movement of valve J will be exactly reverse from that first described, and at each stroke of the piston B in either direction the pressure of air on valve J is reversed to operate said valve, and thus the air is supplied in an alternate manner through each channel w and d.

The port for admitting compressed air in chamber N above the piston B is shown at I in Fig. 4, and communicates direct with valve-chamber D′, (a central opening, I′, being made in the leather packing L as an air-space and so such communication can be made,) and when valve J is in the position represented said port I is in communication with the feed-pipe P″ through the medium of the annular chamber F′ in valve J, and thus the pressure is applied to force the piston B to the position represented, being its full downstroke. When the said downstroke of piston B is made, it is necessary that the air below said piston in chamber M should be exhausted, and at such time is exhausted from said chamber M through port g^2, (see Figs. 3 and 5,) thence up through channel g', thence through port g (see Figs. 3 and 6 and dotted lines in Figs. 4 and 5) into the annular chamber F in valve J, (the position of port g being represented by dotted lines in Fig. 4, said port being, however, in the broken-away section of said view,) thence through port a, which also is at such time open to chamber F, thence down through channel a', and through channel G out at the exhaust or exit port G′. (See full lines showing port a and channel a' in Figs. 2 and 6 and in dotted lines in Fig. 4.)

When the position of valve J is reversed from the position shown, port a will be closed by said valve sliding over it, and the compressed-air communication will be cut off from port I by means of flange J′ shifting to the opposite side of groove m, as before stated, and then port g will be open to chamber F, communicating with feed-pipe P″, and compressed air will then be admitted to the chamber M at the lower end of piston B, through the medium of said port g, channel g', and port g^2, (see Figs. 3, 5, and 6,) and at such time it is necessary for the air above piston B in chamber N to exhaust, said exhaust being backward through port I into chamber F′, thence from said chamber through port o, and thence down through channel o' to channel G, and out through the exhaust port or exit G′. (See full lines in Figs. 3, 4, and 6 and dotted lines in Fig. 6.) The position of port o is represented by dotted lines in Fig. 4, said port being, however, in the broken-away section of said view, and thus the ports which alternately admit compressed air to the upper and lower end of said piston are also brought into service as exhaust-ports, acting as feed and exhaust ports in an alternate manner. As the piston B reciprocates, striker S′ is in like manner reciprocated with it, and on its downstroke engages the upper end of spindle S and strikes it a hammer-blow, and thus operates it in the direction of the blow. To prevent metal striking hard on metal where the said striker engages said spindle, air is admitted into chamber b between said striker and spindle when said striker is on its upstroke through port f, (see Fig. 4,) and as said striker moves on its downstroke port f is closed, and the air in said chamber b is confined, and when said striker and spindle meet said air is compressed and cushions the blow. Said engaging ends of striker S′ and spindle S are made of hardened steel in order that they may be very durable. When the striker S′ moves back on its upstroke the suction in chamber b assists in returning spindle S. The port y, (see Fig. 4,) leading from chamber M below piston B to chamber Q, connects said two chambers so that they operate in conjunction with each other, and when compressed air enters chamber M to force up piston B, said air likewise enters the chamber Q through port y, and forces up spindle S by pressing against its flange S^2. The air is exhausted from chamber Q backward through port y into chamber M. When the air exhausts from said chamber, the springs S^3 acts simply as an assistant to return spindle S.

The stroke of the cutting-tool T can be regulated at will by adjusting the chuck H up or down on spindle S, upward adjustment shortening the stroke by means of nut H^2 engaging spindle-case E, arresting said spindle on its upward movement, and thus preventing as great movement as would result from downward adjustment of said chuck.

It is not absolutely necessary that the valve J should be located in the precise locality shown, only so it is separate from the piston B, and operates to admit air at either end of the cylinder, as set forth. The tool T shown may be substituted for any other character of tool, adapting the device for use not only as a drill, but for carving, mortising, channeling, riveting, or any other like purpose, and is especially adapted to carving, cutting, and dressing granite and other stone.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows, to wit:

1. In the pneumatic drilling-tool described, and in combination with the case A and caps C and C′, having, respectively, the inlet and exhaust ports P″ and G′, the cylinder having

the ports, channels connecting its ports and valve and piston chambers described, piston B, having the annular chambers R R′, striker S′, and valve J, having the annular chambers F and F′, and annular flange J′, substantially as and for the purpose set forth.

2. In the pneumatic drilling-tool described, and in combination with the case having an inlet and exhaust port, the cylinder D, having the ports, channels, and chambers set forth, piston B, having the supply air-chamber R, exhaust air-chamber R′, and striker S′, and the valve J, for controlling said piston, and having the chambers F F′ and annular flange J′, substantially as described.

3. In the pneumatic drilling-tool described, and in combination with the case having an inlet and exhaust port, the cylinder D, having a piston-chamber and a valve-chamber arranged separate from each other and connected by means of ports and air-passages, the piston B, and valve J, for controlling said piston through the medium of said ports and air-passages, substantially as and for the purpose set forth.

4. In the pneumatic drilling-tool described, and in combination with the case having an inlet and exhaust port, the cylinder D, having the ports, channels, and chambers set forth, the piston B, having the chambers R R′ and striker S′, valve J, for controlling said piston, and having the chambers F F′ and annular flange J′, packings L L′, spindle-case E, having the chamber Q, provided with the port *y*, connected with the lower end of the piston-cylinder, spindle S, having the annular flange S^2, for operating in said chamber Q, and cap C′, having the chamber *b*, provided with the port *f*, substantially as and for the purpose set forth.

5. In the pneumatic drilling-tool described, and in combination with the cylinder D, having the valve-chamber D′, provided with the annular groove *m*, the valve J, having the chambers F F′, annular flange J′, and wood buffers *t t*, substantially as and for the purpose set forth.

6. In the pneumatic drilling-tool, and in combination with the piston and valve constructed and arranged substantially as set forth, the cap C′, having the chamber *b*, provided with the port *f*, and the striker S′ and the spindle S, for operating in said chamber, and having their contact parts chamfered for the purpose of forming a receptacle for the compressed air, substantially as specified.

7. In the pneumatic drilling-tool constructed substantially as described, the piston having an annular chamber communicating with the supply-pipe and valve-chamber through the medium of ports and air-passages and constantly supplied with live compressed air for operating the valve which regulates the air-pressure of the tool, and also having an annular chamber communicating with said valve-chamber through the medium of ports and air-passages and constantly open to the exhaust-port through the medium of an air port and passages, being a receiving-chamber for the exhaust-air from the valve-chamber, as specified.

8. In a pneumatic drilling-tool, in combination with casing A E and caps C and C′, the cylinder D, having the chambers, ports, and channels, substantially as set forth, and the piston B and valve J, having, respectively, the annular grooves forming independent chambers, as described, wherein said piston and valve are independently arranged and adapted to alternately reciprocate to regulate the air-pressure and exhaust to operate the tool, in the manner specified.

9. In the pneumatic drilling-tool shown and described, and in combination with the case having an inlet and exhaust port, the cylinder D, having the ports *a v* v^2 *z d′* d^2 *g o w′* w^2, and channels *a′ v′ z′ d g′ o′ w* G, and valve and cylinder chambers and the valve J, and piston B, as and for the purpose set forth.

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Witnesses:
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