(No Model.) 2 Sheets—Sheet 1.

W. F. SCHMIDT.

ENGINE.

No. 538,433. Patented Apr. 30, 1895.

Fig. 1.

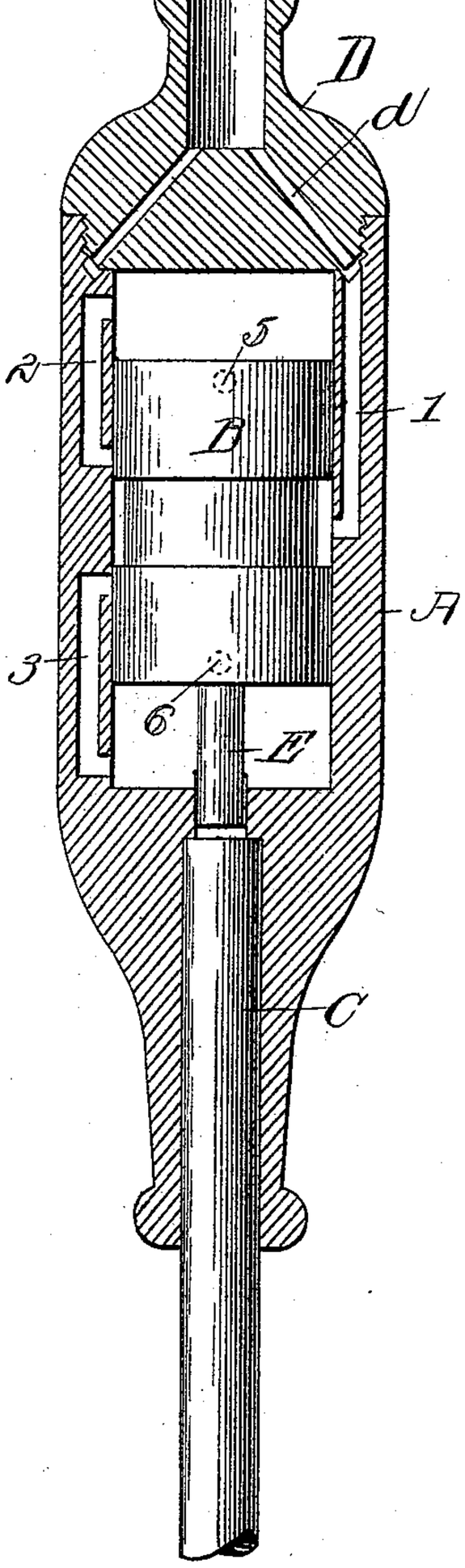


Fig. 2.

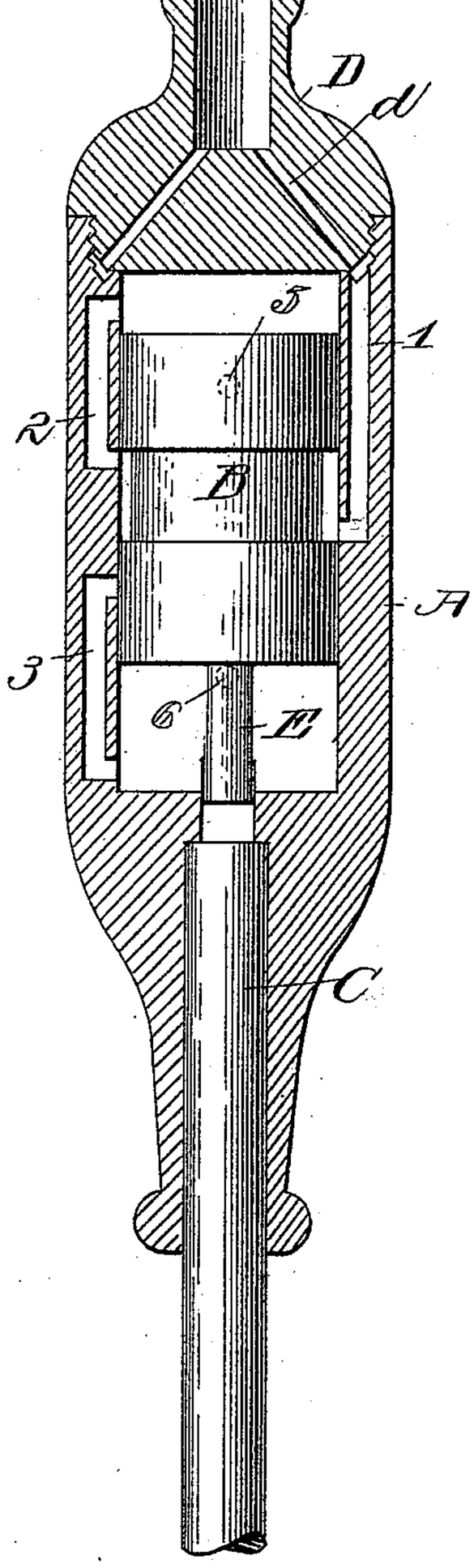
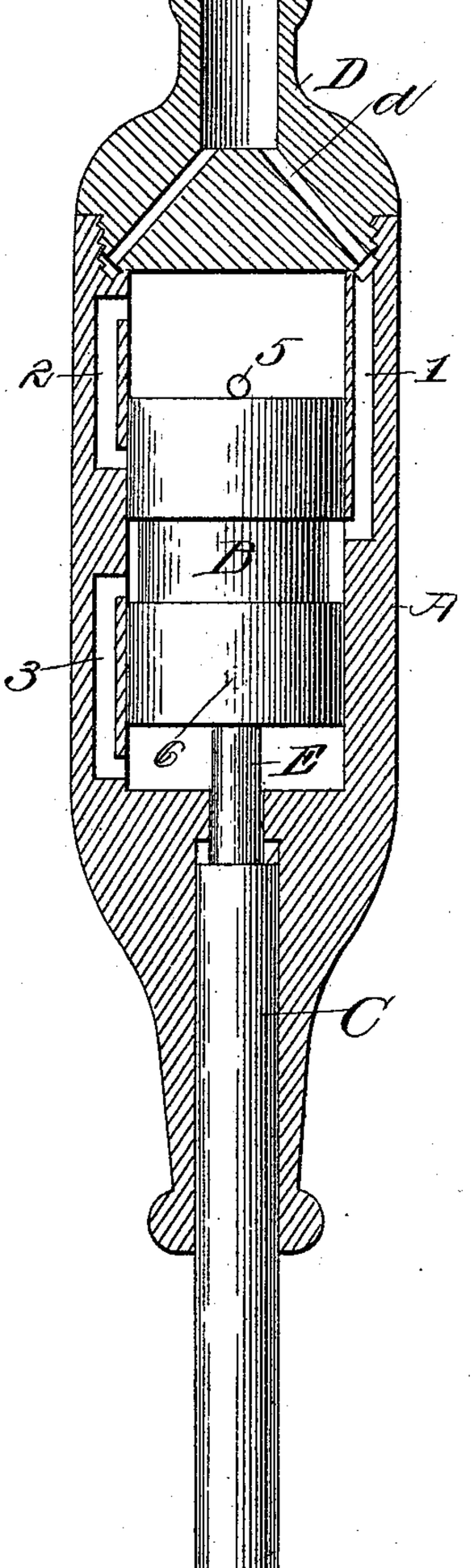


Fig. 3.



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Hugh K. O'Kagner.

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(No Model.) 2 Sheets—Sheet 2.

W. F. SCHMIDT.

ENGINE

No. 538,433. Patented Apr. 30, 1895.

Fig. 4

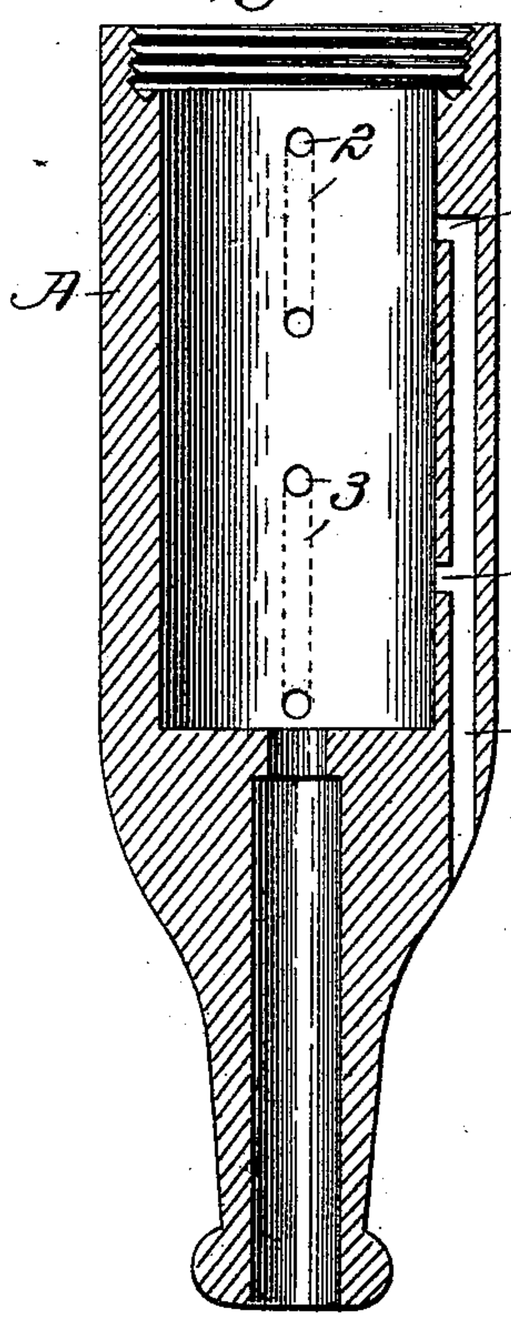


Fig. 5

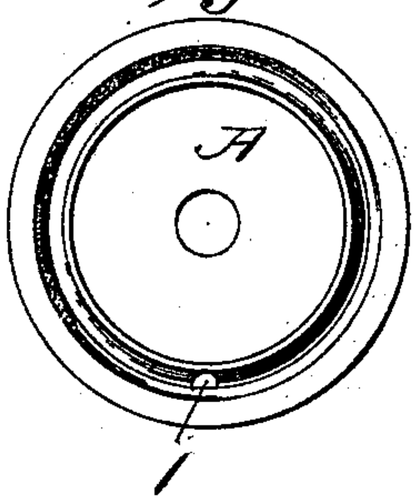


Fig. 6

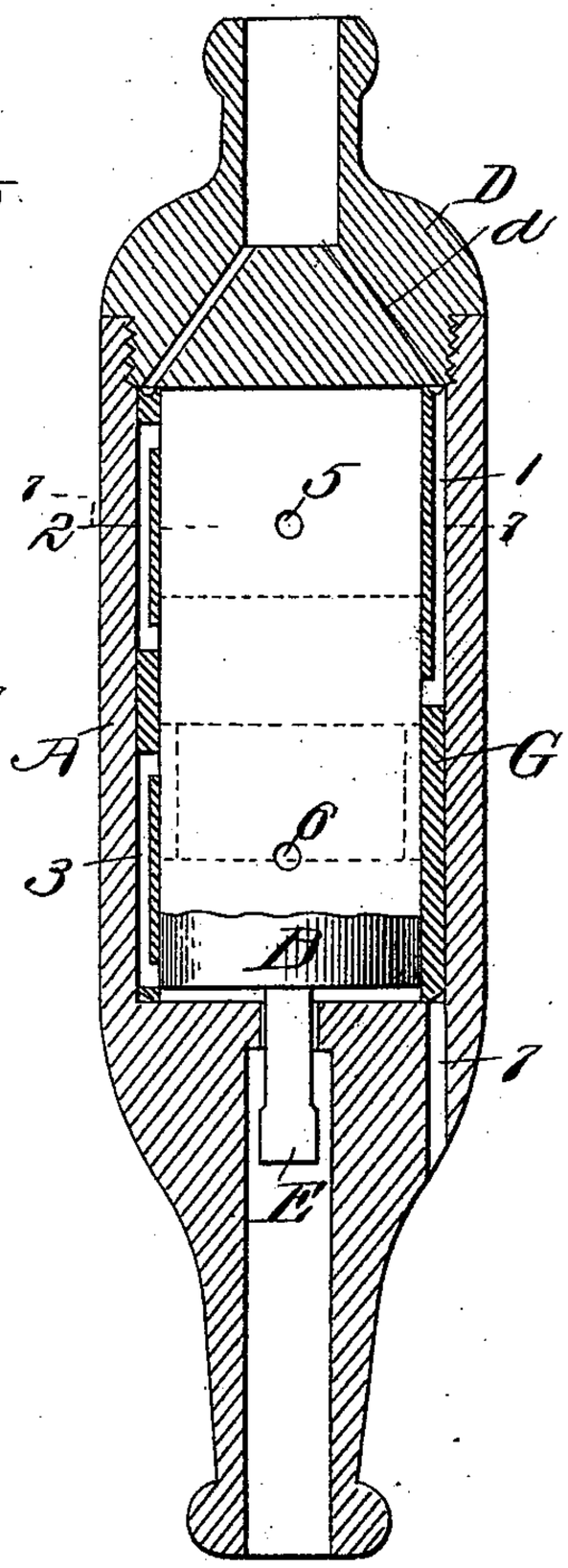


Fig. 7

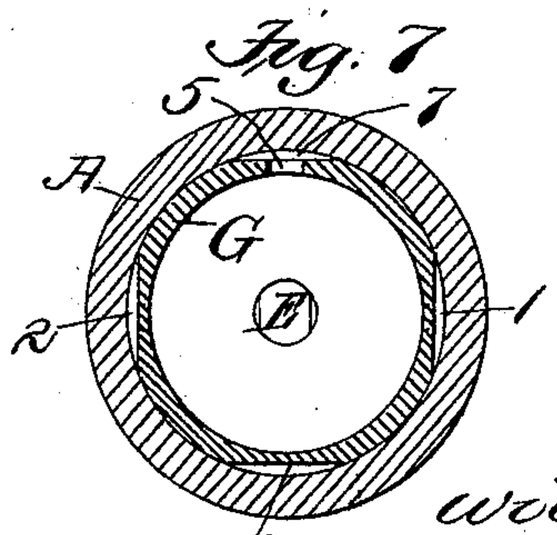


Fig. 8

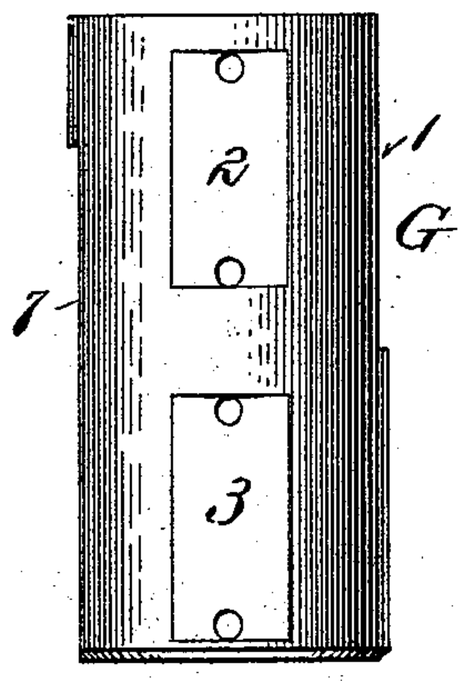
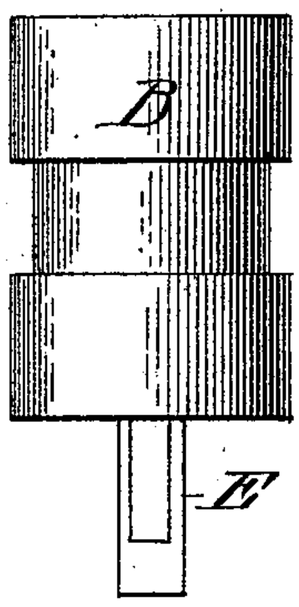


Fig. 9.



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UNITED STATES PATENT OFFICE.

WILLIAM F. SCHMIDT, OF ST. LOUIS, MISSOURI, ASSIGNOR TO PIERRE CHOUTEAU, OF SAME PLACE.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 538,433, dated April 30, 1895.

Application filed June 15, 1894. Serial No. 514,652. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. SCHMIDT, a citizen of the United States, residing in the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, wherein—

Figure 1 is a longitudinal section showing the piston in a central or "lap" position. Fig. 2 is a similar view showing the piston on its upstroke. Fig. 3 is a similar view showing the piston on its downstroke. Fig. 4 is a longitudinal section of the cylinder, showing the arrangement of the exhaust-ports. Fig. 5 is a top plan view of the same. Fig. 6 is a longitudinal sectional view of another form of cylinder, showing a portion of the piston in its extreme low position. Fig. 7 is a cross-sectional view taken on line 7 7, Fig. 6. Fig. 8 is a detailed view of the cylinder-lining shown in Fig. 6, and Fig. 9 is a detail view of the piston.

My invention relates to a new and useful improvement in engines, and is illustrated in the drawings as being applied for use in connection with what is known as a dneumatic hand-tool, or a tool in which a chisel is caused to be vibrated by the impact of a piston; but it is obvious that the principle of operation which I have here illustrated couldbe advantageously applied to other forms of engines, and to engines used for other purposes.

Heretofore, so far as I am aware, all engines of the character illustrated, and, in fact, engines of all descriptions, have included as essential elements of their construction a cylinder, a piston, and a controlling or distributing valve, which controls the exhaust and admission of the motive fluid above and below the piston. This controlling valve, in however diverse form, is found in all constructions where a piston is caused to be reciprocated by the admission and exhaust of motive fluid above and below the piston. In my present invention, I dispense entirely with this controlling or distributing valve, and by so arranging the ports in the cylinder the piston itself is caused to control the admission and exhaust of the motive fluid thereabove and therebelow.

In the drawings, A indicates the cylinder, bored for the reception of the piston B, and formed with a opening in its forward end for the reception of a tool-shank C. The upper end of the cylinder is closed by a suitable plug or cap D, which is formed with an opening *d* for the passage of the motive fluid to the inlet port 1 in the cylinder. To this cap or plug D is secured any suitable means for conducting the motive fluid from its source of supply.

The inlet port 1 opens into the bore of the cylinder at about its middle, and is opened or closed by the upper or lower head of the piston, when said piston is in either of its extreme positions. The piston B is formed with a recurved portion or annulus about its middle, into which the inlet port 1 normally opens during the operation of the machine.

2 and 3 are connecting ports opening from points above and below the middle portion of the bore to the upper and lower ends of the bore.

5 and 6 are exhaust openings connected to a common exhaust 7, leading to the exterior, or said exhausts may lead directly to the exterior, as is obvious.

On the lower end of the piston, a stem E is provided, which stem operates in an opening formed in the lower end of the cylinder and upon tool-shank C. The extreme lower end of this stem entirely fills its opening, while the upper portion of the stem is cut away at its sides, so that the motive fluid can escape through the stem opening and tool shank opening for purposes hereinafter described.

The operation of the tool constructed as above is as follows: Assuming that motive fluid is admitted through port *d* into the inlet port 1, and that the position of the piston is as shown in Fig. 1. In this position of the piston, the motive fluid can go no farther than the space formed by the annulus. Assuming now that the engine is tilted slightly, so as to cause the piston to uncover the lower opening of port 2. This will establish communication between the inlet port and the space above the piston, and cause the piston to descend with force. On the downward movement of

the piston, its upper head will close the lower opening of port 2 and its lower head will open the upper opening of port 3, thus cutting off communication between the inlet port and the space above the piston, and opening communication between the inlet port and the space below the piston. At the same time, the upper head will open port 5 so as to exhaust the air from above the piston—port 6 in the downward position of the piston being closed. The piston is now caused to ascend, which will close exhaust port 5, close the upper opening of port 3, open exhaust port 6, and then open the lower opening of port 2, in the order named, the reverse being the case when the piston is descending; and so this cycle of operations is continued.

To control the speed of the tool, I have connected the exhaust ports to a common lead-out, which lead-out or mouth, when choked or closed, and not permitting the full amount of air to exhaust, will, consequently, decrease the number of strokes of the piston, but which when permitted to exhaust fully will allow the piston to run at its maximum speed.

It will be noted that by the arrangement of the several ports, if the piston were permitted to make an extreme stroke at each operation, it would be cushioned at both ends, as the stem E does not pass beyond the shoulder formed in the cylinder to arrest the inward movement of the tool-shank until after the upper piston head has closed the inlet-port 1. The advantage of this is, that very often it is desirable to use the tool from time to time without being compelled to cut off the supply of motive fluid, nor permit the tool to run without doing any work, thus wasting the motive fluid. To stop the reciprocation of the piston, and, at the same time, have it ready for instantaneous operation, I choke the exhaust until the piston sinks to its lowest position, when the confined air beneath the piston will escape through the stem and shank openings, and the upper head of the piston will close the inlet port 1. To start the tool when the motive fluid is thus turned full on, and the tool has been dead, it is only necessary to elevate the forward end until the upper head of the piston passes above the inlet port, when it will start immediately to reciprocate.

I have shown in Figs. 1 to 4 a bored cylinder, made of one piece, but it may be found desirable to make the cylinder of two pieces, as shown in Figs. 6 to 8, and in which a lining G is inserted in the bore, which lining is formed with suitable port openings to the interior, the outer periphery of the lining being filed or otherwise reduced to form the connecting port. In the cross-section shown in Fig. 7, I have shown this lining in position in this cylinder, and have, also, illustrated a blind-port 8, which is of practically no use save for purpose of equally distributing the metal around the cylinder.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an engine, the combination with a cylinder which is formed with an inlet port opening thereinto about midway its length, ports 2 and 3 which lead from each side of the inlet port to the ends of the cylinder, and exhaust ports which lead from the cylinder at points between the openings of ports 2 and 3 into the cylinder respectively, of a two-headed piston mounted in the cylinder which co-operates with said ports, and a stem on the piston which projects through an opening in the forward end of the cylinder, said stem being so formed that when the piston is in an extreme forward position, it permits the motive fluid in front of the piston to exhaust so that one of the heads will align with the inlet port to close the same; substantially as described.

2. In an engine, the combination with a cylinder provided with suitable inlet and exhaust ports, of a piston operating therein, a stem on the piston which projects through the forward end of the cylinder, said stem being so formed that when the piston is in an extreme forward position it exhausts the motive fluid in front of the piston and permits the piston to close the inlet port, substantially as described.

3. In an engine, the combination with a cylinder, of a piston mounted therein, and a stem on the piston which projects through an opening in the forward end of the cylinder, said stem being formed with reduced sides and a cylindrical outer portion, substantially as described.

In testimony whereof I hereunto affix my signature, in presence of two witnesses, this 9th day of June, 1894.

WILLIAM F. SCHMIDT.

Witnesses:
F. R. CORNWALL,
HUGH K. WAGNER.