No. 606,961. Patented July 5, 1898.

D. DRAWBAUGH.

PNEUMATIC TOOL.

(Application filed Jan. 10, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

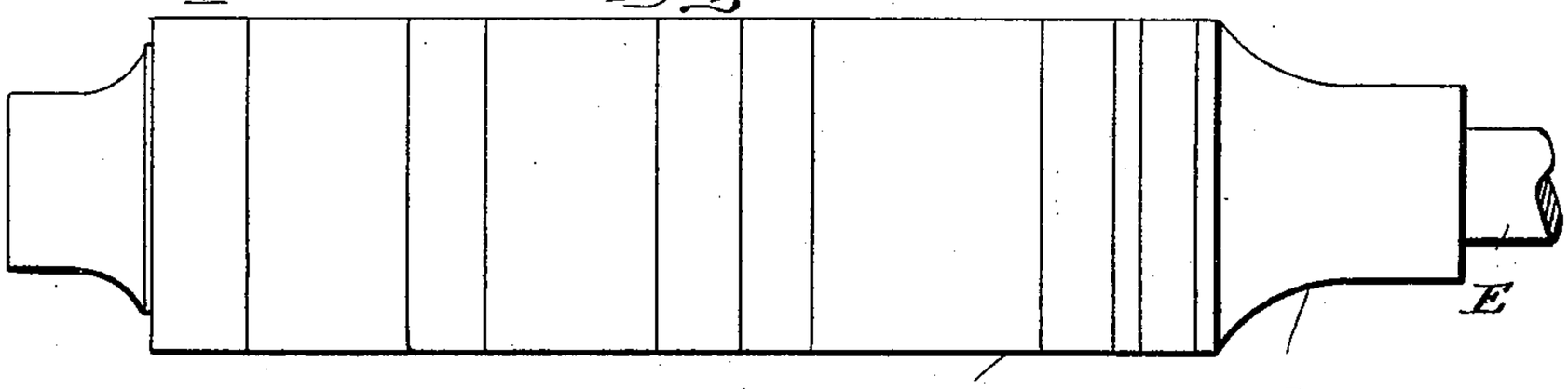

Fig. 2.

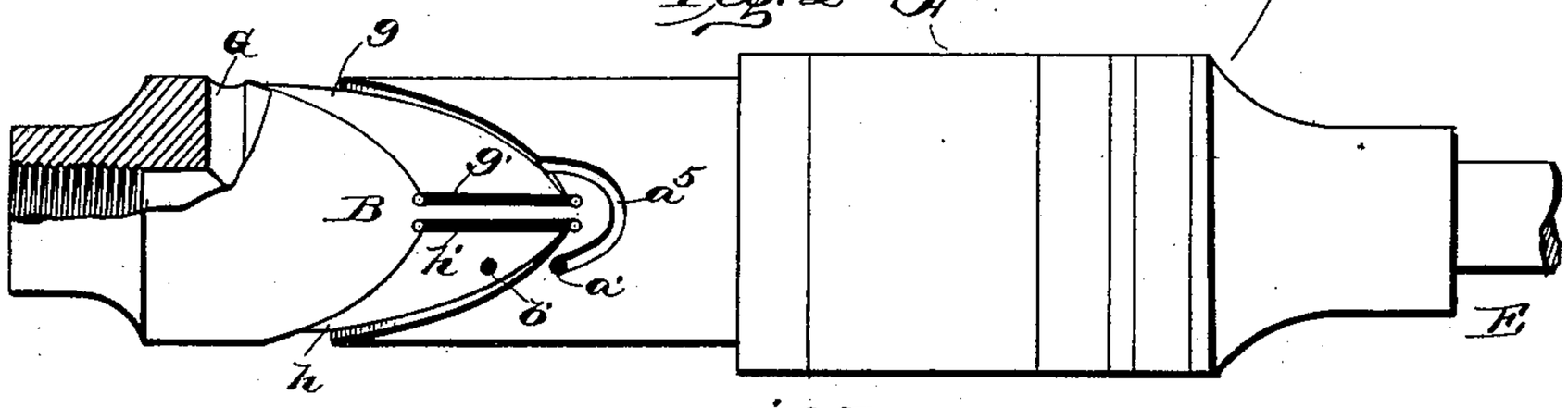

Fig. 3.

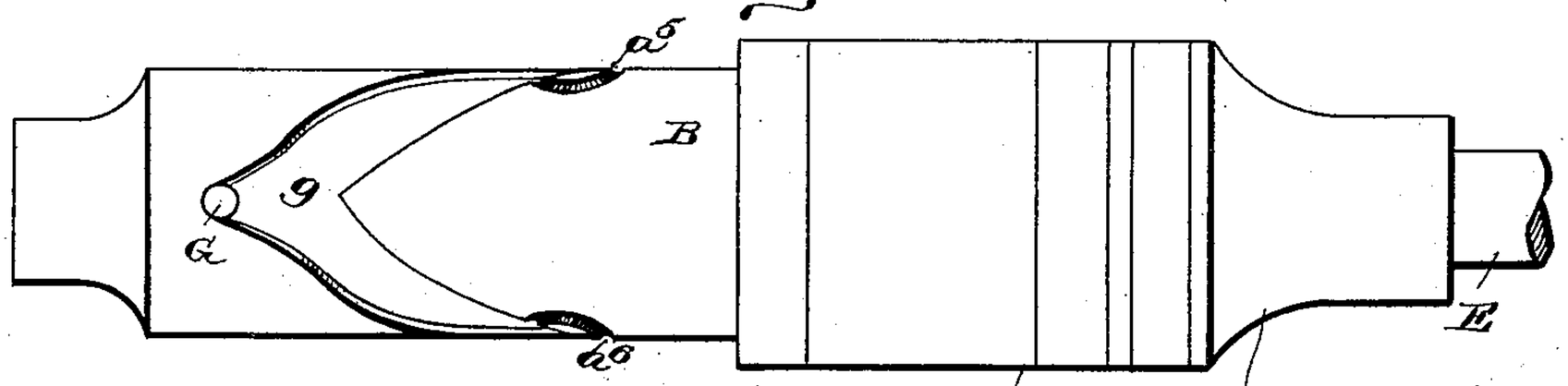

Fig. 4.

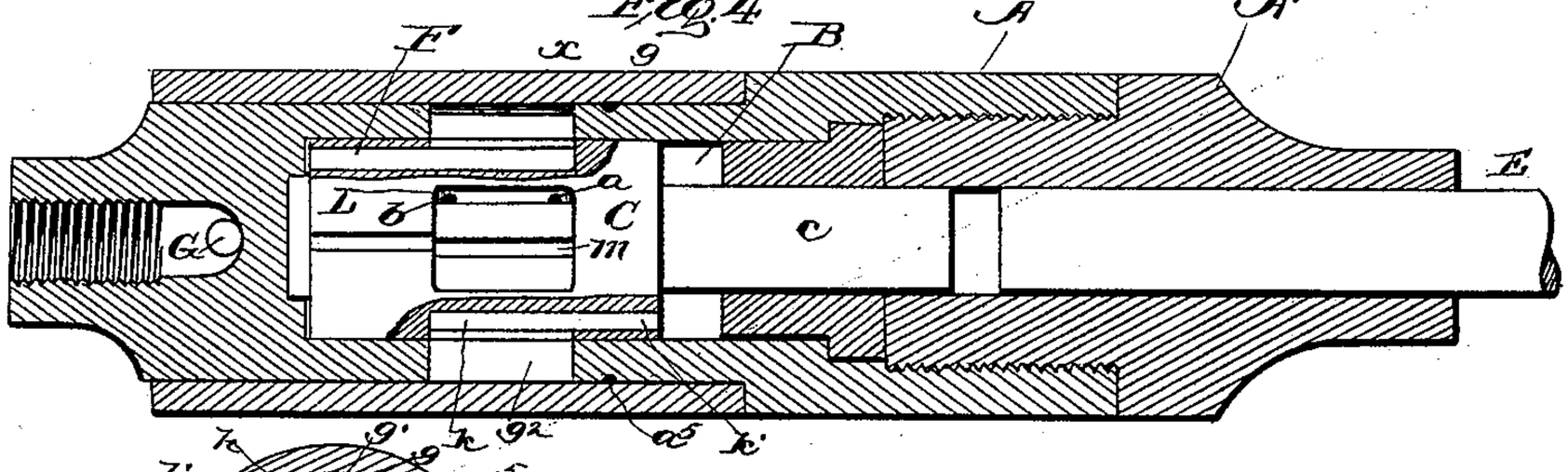

Fig. 5.

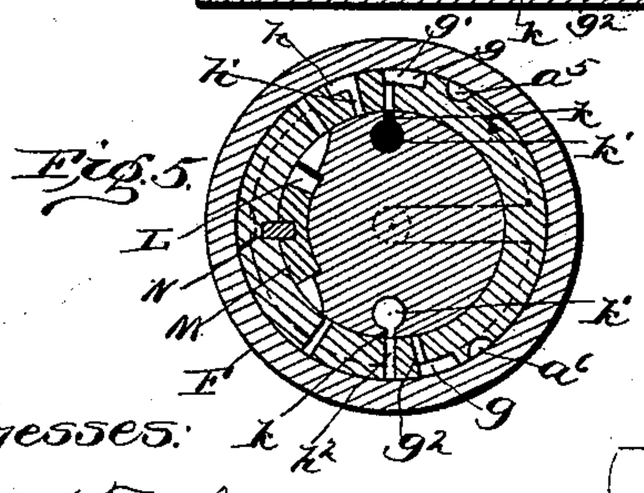

Fig. 6.

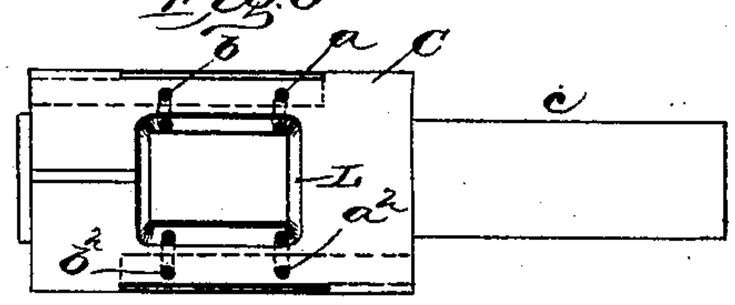

Fig. 7.

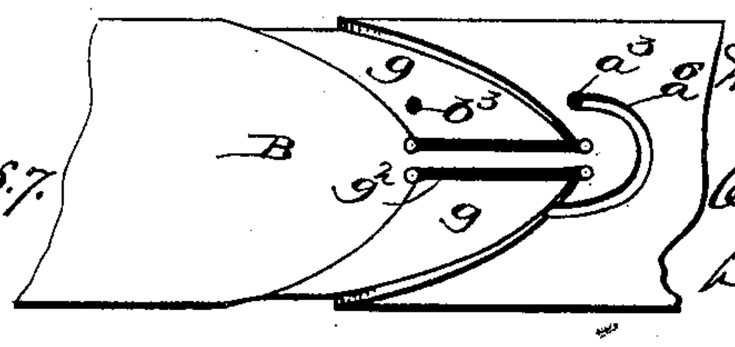

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Fig. 8.

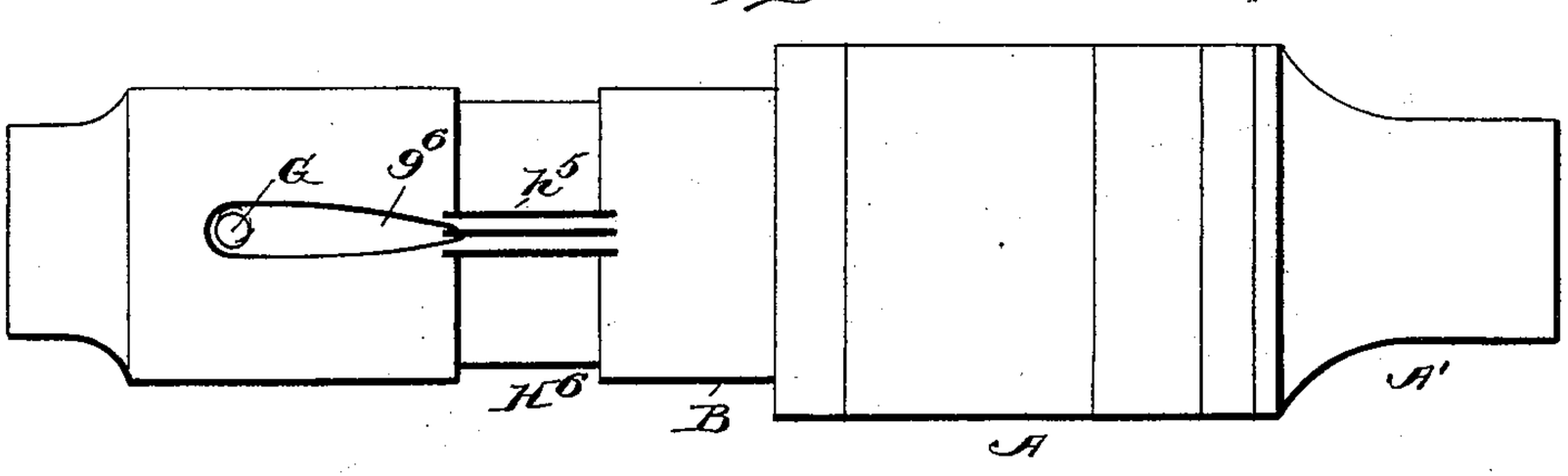
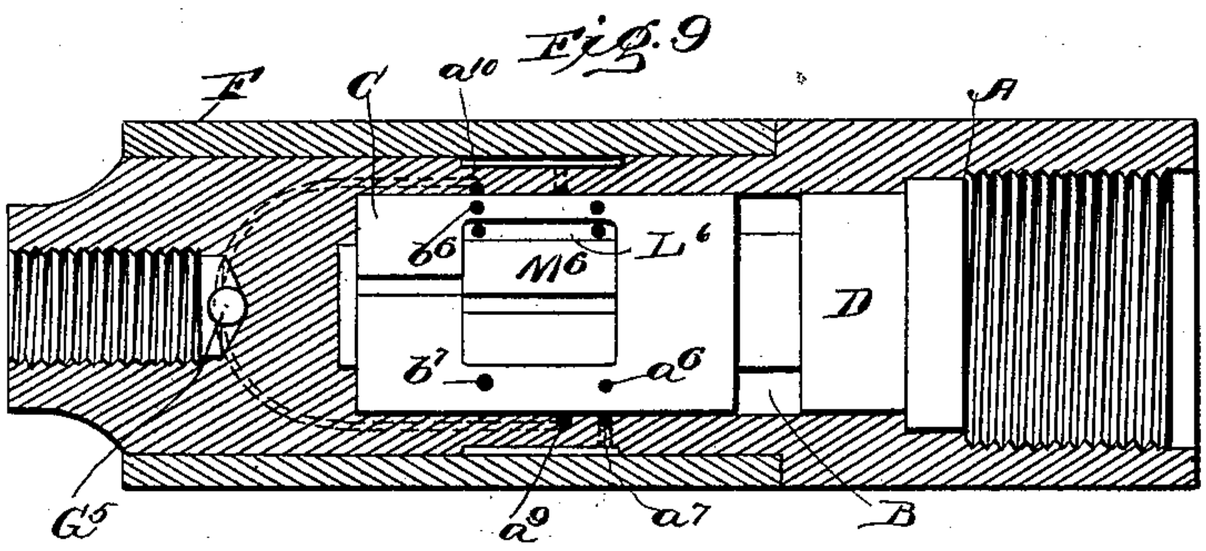


Fig. 9



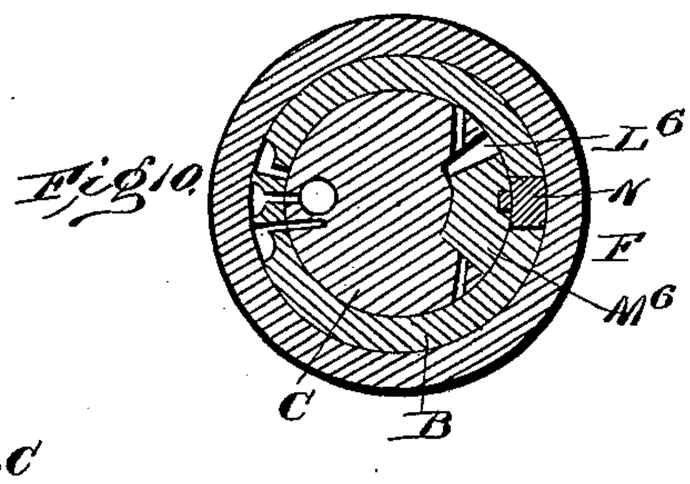


Fig. 10.

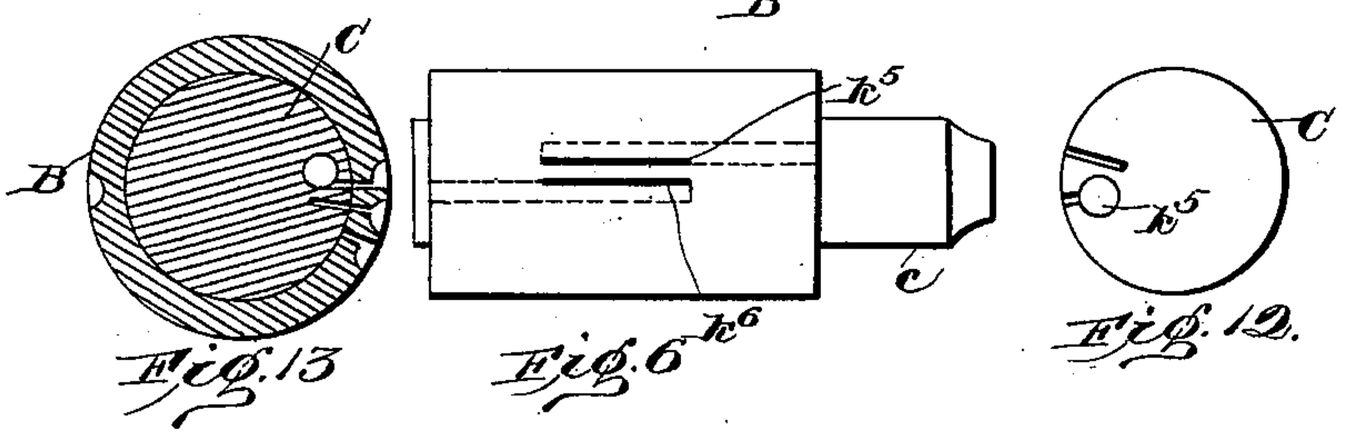


Fig. 13. Fig. 6. Fig. 12.

k⁶

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UNITED STATES PATENT OFFICE.

DANIEL DRAWBAUGH, OF EBERLY'S MILL, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO H. B. EBERLY, OF SHIREMANSTOWN, PENNSYLVANIA.

PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 606,961, dated July 5, 1898.

Application filed January 10, 1898. Serial No. 666,201. (No model.)

To all whom it may concern:

Be it known that I, DANIEL DRAWBAUGH, a citizen of the United States, residing at Eberly's Mill, in the county of Cumberland and State of Pennsylvania, have invented certain new and useful Improvements in Pneumatic Tools; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in hammer-tools, commonly known as "pneumatic" tools, because most commonly driven by compressed air and adapted to be held in the hand of the operator for cutting, chipping, and repoussé work, and while the invention relates primarily to tools of this class it will be understood that the invention may be embodied in larger tools for heavier work or tools designed for other kinds of work.

The invention has for its object to produce a tool in which the hammer or piston proper will operate as its own valve for admitting pressure to drive it, being for this purpose given an oscillatory motion at right angles to its line of reciprocation to cover and uncover the appropriate ports, such oscillation being secured by the pressure of the operating medium applied directly to the piston or hammer itself.

Referring to the accompanying drawings, Figure 1 is a side elevation of a tool embodying my present invention. Fig. 2 is a similar view with the sheath or casing removed to show the arrangement of the pressure and exhaust ports on one side. Fig. 3 is a similar view looking at that side of the tool shown at the top in Fig. 2. Fig. 4 is a longitudinal section with portions shown in elevation and broken away to illustrate the arrangement of the internal mechanism. Fig. 5 is a sectional view at right angles to Fig. 4, taken on the line $x\,x$. Fig. 6 is a detail view of the hammer or piston; and Fig. 7, a detail view of the ports, looking at the opposite side of the tool from that shown in Fig. 2. Fig. 8 is a view corresponding to Fig. 2, showing a modified arrangement of the ports. Fig. 9 is a longitudinal section through the tool shown in Fig. 8, with the hammer or piston in elevation. Fig. 10 is a sectional view taken at right angles to Fig. 9. Figs. 11 and 12 show the hammer or piston in side and end elevation, respectively. Fig. 13 is a cross-sectional view of the piston illustrated in Figs. 11 and 12 and adapted for use in connection with the tool shown in Figs. 8, 9, and 10.

Like letters of reference in the several figures indicate the same parts.

The body of the tool in the accompanying drawings (lettered A) is shown as formed of an integral piece of steel internally bored to form the cylinder B, in which the piston or hammer C reciprocates. The front end of the cylinder in the form of tool shown is closed by a long washer D, centrally apertured for the passage of the nose-piece c of the hammer or piston C. This nose-piece also preferably extends into the nose A′ of the tool itself, which latter—*i. e.*, the nose A′—screws into the body of the tool and holds the washer D in place. The nose A′ is also bored longitudinally and serves as a seat for the end of the tool or chisel, which is indicated by the letter E.

It is obvious that the particular means for delivering the blow to the tool may be varied in accordance with the construction of other tools of this character, and I do not wish to be limited to the particular form shown and described, although it is a highly-efficient construction.

To facilitate the construction of the ports and passages, the rear end of the tool-body is preferably somewhat reduced in diameter, and the passages are formed in the exterior surface of this reduced portion, and when completed this reduced portion is inclosed by a sheath or casing F, Fig. 1, which also forms the outer walls of said passages.

Referring particularly now to Figs. 2, 3, and 7, it will be seen that the inlet or pressure-supply opening is formed in the rear end of the tool, and it communicates through a passage G with two diagonally-arranged channels g, extending to opposite sides of the body of the tool and terminating in ports g', Fig. 2, and g^2, Fig. 7. Arranged adjacent to and parallel with these ports g' g^2 are two ports h' h^2, which communicate through channels

h with the exhaust-opening, passing out between the casing F and body of the tool at the rear end.

For coöperation with the inlet and exhaust ports arranged in this manner the piston or hammer is provided on approximately diametrically opposite sides with ports k, which lead out, respectively, through passages k' to opposite ends of the piston or hammer, the arrangement being such that when the inlet-port on one side is in registry with the port k the exhaust-port on the opposite side is in registry with the port k on that side, and hence pressure will be admitted to one end of the piston or hammer and exhausted from the opposite end, and in order that the piston or hammer may be shifted transversely or given an oscillation on its longitudinal axis in proper sequence to secure a reciprocatory movement thereof I provide in said piston or hammer a chamber L for the reception of an abutment-block M, the block M being of substantially the same length as the chamber, but of a less width than the chamber, the space between the sides of the block and the sides of the chamber corresponding in width to the distance between the ports g' and h' or g^2 h^2. The abutment-block M is provided with a groove or keyway m, into which projects a fixed key or spline N, mounted in the body of the tool, by which arrangement the abutment-block M is permitted to move back and forth longitudinally in unison with the piston or hammer, but is held against transverse movement therewith, and hence constitutes a stop which will limit the movement of the hammer in its transverse oscillation in each direction. Leading into the chamber L on each side of the abutment-block M are two ports or passages a b, Fig. 6, and a^2 and b^2, and in the walls of the tool corresponding ports and passages are formed, communicating with the steam and exhaust passages for the purpose of alternately admitting the pressure and exhausting the pressure from the chamber L on opposite sides of the abutment-block and thereby secure the transverse oscillation of the piston or hammer. The ports in the body of the tool which register with the ports a and b are lettered, respectively, f' and a', Fig. 2, the port a' communicating with the pressure-passage g' through the channel a^5, and the port b' opens directly into the exhaust-passage. The ports in the body of the tool which coöperate with the ports b^2 a^2 are shown in Fig. 7 and are lettered b^3 a^3, the latter communicating through the channel a^6 with the pressure-passage g. When the piston or hammer is at the upper end of the cylinder, pressure is admitted through the port a', which rotates the piston or hammer to bring one of the ports k into registry with the port g', and simultaneously the port b^2 is in registry with the port b^3 to permit the pressure in the chamber L on that side of the abutment-block M to escape. When the ports k and g' are in registry on one side, the port k on the opposite side of the piston or hammer is in registry with the port h^2 on that side, the result being that pressure is admitted to the upper end of the cylinder and exhausted from the lower end, the piston or hammer being caused to advance. When it reaches the lower end of the cylinder, the port b is brought into registry with the port b' and the port a^2 is brought into registry with the port a^3, permitting the pressure to be admitted on the opposite side of the abutment-block M and exhausted from the side to which it was formerly admitted. Thus the piston or hammer is oscillated or turned on its longitudinal axis in a reverse direction, which movement reverses the relative positions of the ports k and inlet and exhaust ports g' h and g^2 h^2, admitting pressure to the lower end of the cylinder and permitting the upper end to exhaust. It will thus be seen that the piston itself operates as its own valve and at the same time a certain action of the piston is secured.

As thus far described it will be noted that the inlet and exhaust ports are located on opposite sides of the cylinder, whereby the pressure is equalized on the piston or hammer and it is caused to wear evenly and liability to stick in the cylinder by reason of lateral pressure is largely obviated; but it is obvious that the inlet and exhaust passages may be located, if desired, on one side only, and the arrangement in this instance would be very similar to that of an ordinary steam-engine, wherein there are three ports, one central and two side ports, which are controlled by the valve to admit pressure alternately to opposite ends of the cylinder.

In Figs. 8 to 13 I have illustrated a construction of this character, and by reference to Fig. 8 it will be seen that the inlet or pressure passage g^5 communicates with the port g^6, leading into the cylinder, and on each side and in proximity to the port g^6 there is a port h^5, communicating with an exhaust-passage H^6, which may lead out to the open air at any suitable point. (Not shown.) The piston or hammer C^6, together with the abutment-block M^6, are made in this instance just as in the first-described construction, and in the walls of the cylinder there are formed ports a^7, a^8, a^9, and a^{10}, the ports a^7 and a^8 being in communication with the exhaust-passage H^6 and the ports a^9 a^{10} being in communication, as shown by the dotted lines in Fig. 9, with the pressure-passage G^5. The coöperating ports in the piston or hammer for admitting pressure to give the lateral oscillation to the piston or hammer are lettered a^5 a^6 and b^6 b^7. With this arrangement when the piston or hammer is at the upper end of its stroke, as shown in Fig. 9, the port b^6 is in registry with the port a^{10}, admitting pressure to the chamber L^6 and causing the piston or hammer to rotate on its longitudinal axis, so as to bring the port k^5 into registry with the port h^5, so as to exhaust from the lower end of the cylinder, and also so as to bring the port k^6

into registry with the port g^6, so as to admit pressure to the upper end of the cylinder, and at the opposite side of the chamber L^6 the port a^5 is in registry with the port a^7, so as to permit the pressure to exhaust from that side of the chamber, the result being that the piston or hammer is advanced. When it reaches the forward portion of its stroke, the port b^6 is brought into registry with the port a^8, permitting pressure to exhaust from that side of the abutment-block, and simultaneously the port b^7 is brought into registry with the pressure-port a^9 to admit pressure to the opposite side of the abutment, thereby causing the piston or hammer to move on its longitudinal axis in a reverse direction and the port k^5 to be brought into registry with the port g^6, so as to admit pressure to the lower end of the cylinder, and simultaneously the port k^6 is brought into registry with the port h^5 to exhaust pressure from the upper end of the cylinder. This sequence of movement will be continued so long as the pressure is supplied in the well-understood manner.

Obviously the particular location of the ports for controlling the admission of pressure alternately to opposite sides of the abutment-block may be varied within a very wide limit in accordance with the well-understood principles of steam-engineering, the object to be attained being simply that when the piston is at one end of its stroke pressure shall be admitted, so as to rotate the piston and secure a proper registry of the main steam and exhaust ports to cause a reverse movement of the piston, and vice versa.

It will be observed that the construction of the tool is exceedingly simple and the wear on the parts reduced to a minimum. By securing the oscillation of the tool on its longitudinal axis by the pressure of the propelling medium only, which medium is elastic, it will be noted that lateral vibration of the tool is entirely overcome, inasmuch as the only shock which can be imparted to the workman's hands would be the shock tending to twist the tool on its longitudinal axis—that is, of course, leaving out of view the longitudinal shock incident to the vibration of the hammer or beater lengthwise of the tool, which is incident to all pneumatic tools. The main pressure and exhaust ports g' h and g^2 h^2, together with the coöperating ports k, are made of relatively great length and slight width in order that the full pressure of the driving medium may be exerted upon the piston or hammer until the end of its stroke is reached or until the relative positions of the ports are shifted by the registration of the subordinate ports which control the transverse oscillation of the piston or hammer. These subordinate ports which control this transverse oscillation, it will be understood, are preferably made quite short in the direction of the longitudinal axis of the piston or hammer, and hence they act only at the moment when the piston or hammer reaches the extreme of its movement or a point approximately at the extreme of such movement, as it is frequently desirable to reverse the movement of the piston or hammer before it actually contacts with the ends of the cylinder, thereby securing a cushioning of the same.

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

1. In a pneumatic tool, the combination with a cylinder or body and a piston or hammer adapted to reciprocate therein, said piston or hammer having lateral ports with passages leading out to opposite ends of the said piston or hammer, pressure and exhaust ports in the body of the tool with which the ports in the piston or hammer are adapted to be brought into registry by the oscillation of the piston or hammer on its longitudinal axis, of an abutment mounted in a recess in said piston or hammer, means for preventing the lateral movement of the abutment and coöperating pressure and exhaust ports for admitting pressure alternately to opposite sides of said abutment, whereby the transverse oscillation of the piston or hammer is secured; substantially as described.

2. In a pneumatic tool, the combination with the body of the tool having the cylinder formed therein together with main pressure and exhaust ports and subordinate pressure and exhaust ports, of a piston or hammer mounted in said cylinder and having ports and passages leading out to opposite ends of the same, and adapted to be alternately put into communication with the main exhaust and pressure ports in the body of the tool by a transverse oscillation of the piston or hammer, said piston or hammer having a chamber or recess therein and an abutment located in said chamber or recess and held against transverse movement, said piston or hammer having ports communicating with said chamber or recess and adapted to be alternately brought into communication with the subordinate ports in the body of the tool by the longitudinal movement of the piston or hammer whereby pressure is admitted to opposite sides of the abutment and the transverse oscillation of the piston or hammer secured; substantially as described.

3. In a pneumatic tool, the combination with the body of the tool having a cylinder formed therein and having main pressure and exhaust ports leading into the side of said cylinder with subordinate pressure and exhaust ports also leading into the side of the cylinder, of a piston or hammer adapted to reciprocate in said cylinder and having ports adapted to register with the pressure and exhaust ports in the body of the tool and leading out to opposite ends of the piston, and also having a chamber or recess substantially as described, with ports for admitting and exhausting pressure alternately to opposite sides of said recess or chamber when brought into registry with the subordinate

ports in the body of the tool, and an abutment-block located in said chamber to divide the same longitudinally, a keyway formed in said abutment-block and a fixed pin or spline for preventing the transverse oscillation of said abutment-block while permitting it to reciprocate in unison with the piston or hammer; substantially as described.

4. In a pneumatic tool, the combination with the body of the instrument having a cylinder formed therein, of the piston adapted to reciprocate in said cylinder and having a chamber formed in the cylindrical face thereof, an abutment-block mounted in said chamber and adapted to divide the same longitudinally, said block having a longitudinal keyway and a fixed key or spline for preventing the transverse oscillation of the abutment-block, the body of said tool and the piston or hammer having coöperating ports and passages whereby, when the hammer is reciprocated longitudinally, pressure is alternately admitted and exhausted to and from the chamber on opposite sides of the abutment-block, whereby the transverse oscillation of the piston or hammer is secured, and also having ports and passages whereby when said piston is oscillated transversely, pressure will be alternately admitted and exhausted to and from opposite ends of the cylinder; substantially as described.

5. In a pneumatic tool, the combination with the body of the tool having a cylinder formed therein, of a piston adapted to reciprocate in said cylinder and having a chamber formed in the side thereof, an abutment-block mounted in said chamber and adapted to divide the same, with means for preventing the transverse oscillation of the abutment-block, said tool-body and piston or hammer having coöperating longitudinally-extended and relatively narrow ports for admitting and exhausting pressure to the opposite ends of the cylinder and also having coöperating ports for admitting pressure to opposite sides of the chamber to secure the transverse oscillation of the piston or hammer and thereby bring the first-mentioned ports into proper registry to reciprocate the piston and maintain the pressure thereon throughout practically its entire movement in each direction; substantially as described.

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