No. 647,415. Patented Apr. 10, 1900.

J. KELLER.

PNEUMATIC TOOL.

(Application filed Feb. 16, 1899.)

(No Model.)

Fig. 1.

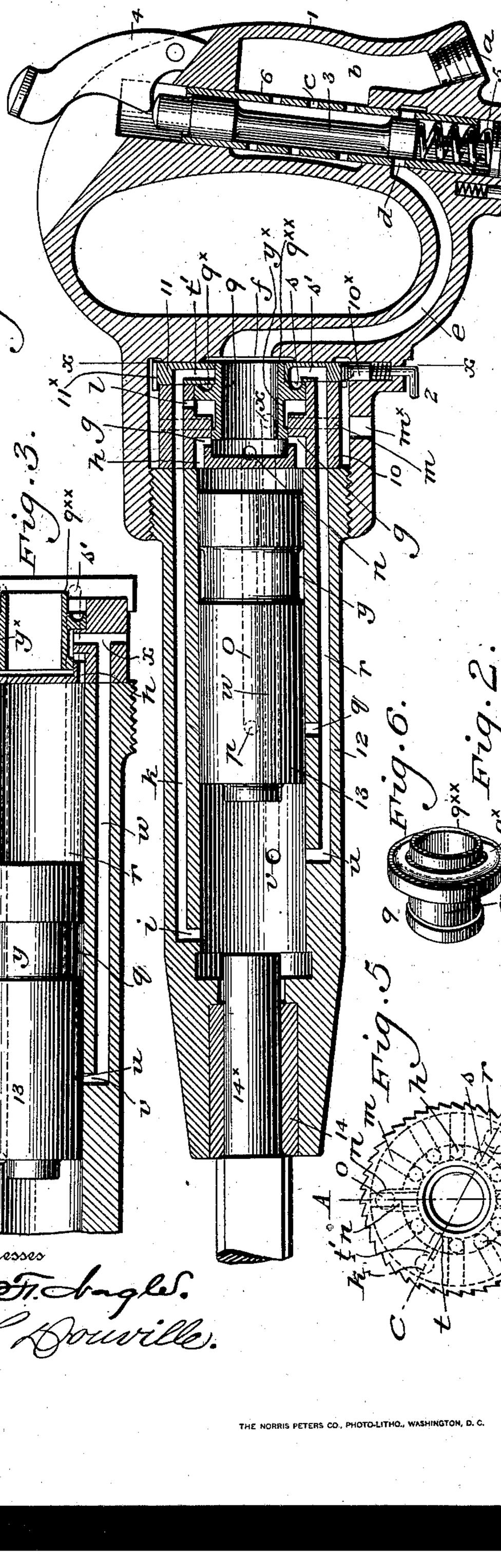

Fig. 4.

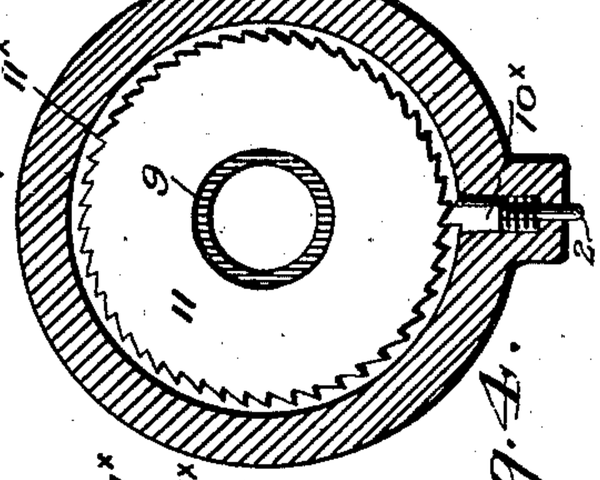

Fig. 3.

Fig. 2.

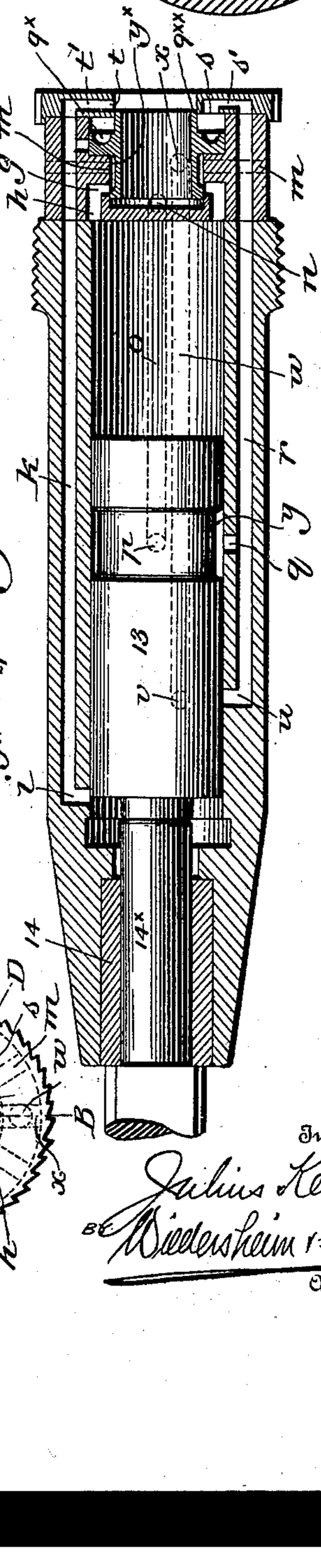

Fig. 6.

Fig. 5

Witnesses

P. F. Dowles.

L. Dowville.

Inventor

Julius Keller

by Biddlesheim & Fairbanks

Attorneys

UNITED STATES PATENT OFFICE.

JULIUS KELLER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE KELLER TOOL COMPANY, OF SAME PLACE.

PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 647,415, dated April 10, 1900.

Application filed February 16, 1899. Serial No. 705,661. (No model.)

To all whom it may concern:

Be it known that I, JULIUS KELLER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Pneumatic Tools, which improvement is fully set forth in the following specification and accompanying drawings.

My invention consists of an improved construction of pneumatic tool and valve therefor and also in a novel arrangement of ports or passages whereby the motive fluid is conducted to and exhausted from the opposite ends of the hammer in a most effective manner.

In pneumatic tools as heretofore constructed where a fluid-actuated valve is used to control the movement of the hammer or piston the valve moves either in an opposite direction or at a right angle to the movement of said hammer or piston, in which case the blow of the hammer will naturally interfere with the regular and uniform movement of the valve if the latter does not move in the same direction with the hammer, and if the valve does not work regularly and uniformly the reciprocation of the hammer will be irregular, which is a very objectionable feature and very often renders the use of pneumatic hammers impracticable. This irregular movement of the hammer also causes the valve to break or become injured and shortens the life of the tool, it being apparent that if the valve moves in an opposite direction to the hammer shortly before the latter strikes the chisel at the left, if the valve moves to the right at the moment the hammer delivers the blow, said valve will rebound from its seat, reopen the ports that should be closed, and cause the tool to jump, or, in other words, the cylinder or tool will move away from the chisel, because the exhaust from the back end does not occur at the right time. Now since the hammer strikes from two to three thousand blows per minute it can be readily seen how wearing this irregular movement will be both on the valve and the operator. By my invention, however, before the hammer strikes the chisel to the left the valve will move in the same direction, and when the blow is delivered the valve is on the left side, the blow, instead of rebounding the valve from its seat, serving to hold said valve more firmly seated, whereby all the ports are positively opened at the right time, the movement of the hammer is regular and unobstructed under all conditions, and the jumping or jarring which has heretofore been an objectionable feature in pneumatic hammers is practically overcome.

To the above ends my invention consists of the novel construction and arrangement of ports and passages of a pneumatic tool, as will be hereinafter more fully set forth, and particularly pointed out in the claims.

Figures 1 and 2 represent longitudinal sectional views of a pneumatic tool embodying my invention, the sections being taken on line C D, Fig. 5, showing the hammer in its different extreme positions. Fig. 3 represents a longitudinal sectional view on line A B, Fig. 5. Fig. 4 represents a section on line *x x*, Fig. 1. Fig. 5 represents an end view of the tool with the handle portion removed, showing in dotted lines the general arrangement of ports and passages in the cylinder thereof. Fig. 6 represents a perspective view of the valve employed, the same being shown in detached position.

Similar letters and figures of reference indicate corresponding parts in the views.

Referring to the drawings, 1 designates the handle of a pneumatic tool, in which is located the throttle-valve 3, which latter controls the flow of the motive fluid from the various ports and passages in the cylinder, said handle having the inlet-port *a* therein, to which is connected a suitable supply-pipe, the fluid under pressure flowing into the chamber *b* and then entering the ports *c* in the throttle-bushing 6, said throttle-valve being held by the spring 5 against the throttle-lever 4.

7 designates a regulating-screw engaging the handle 1, which can be readily manipulated to regulate the movement of the throttle-valve, the regulating device being held in position by means of the latch-pin 8, provided with the pointed end $8^{\times}$. When the throttle-lever 4 is pressed downwardly, the throttle-valve 3 will open the port *d*, whereupon the motive fluid will pass through the passage *e*

and enter the inner chamber of the valve 9 through the port *f*, the construction of said valve being readily understood from Fig. 6. When the valve 9 and the hammer 13 are moved to the right or toward the handle 1, as seen in Fig. 1, the ports *g* in the valve-chamber are open and permit the motive fluid to pass into the cylinder-casing 12 through the port *h* and drive the hammer to the left or forwardly until it strikes the tool or chisel $14^{\times}$, contained within the chisel-bushing 14. Just before the hammer reaches its extreme forward position the neck or groove *y* therein will permit communication between the ports *p* and *q*, whereupon live air passes through the port *n*, the passage *o*, and the port *p*, passing thence through the port *q* and passage *r* to the ports *s'* and *s*, at which point the motive fluid enters the valve-chamber, acting on the large concave pressure area $9^{\times}$ of the valve 9, thereby driving the same toward its left or forward position, as seen in Figs. 2 and 3, the ports *g* and *h* being now closed for the inlet and open to the exhaust port *m* by means of the groove $y^{\times}$ in said valve, wherefrom it will be seen that the motive fluid from the back end of the hammer can now exhaust through the ports *h* and *g*, groove $y^{\times}$, and exhaust-port *m* into the atmosphere through the port $m^{\times}$.

If we assume the parts to be in the position seen in Fig. 2 and the valve 9 seated or moved to the left, it will be seen that the port *t* is open for the admission of the motive fluid, which latter will flow through the passages *t' k* and port *i* to the front end of the hammer and drive the latter to the right or backwardly until the port *u* is open. The air which acted on the large pressure area of the valve to hold the same down is now relieved, as the exhaust-port *v* is open at the same time when the port *u* is open. The air from the large pressure area of the valve exhausts through the port *s*, passage *r*, port *u*, port *v*, passage *w*, and the port *x* into the atmosphere. The constant pressure which is always acting on the smaller pressure area of the valve now drives the latter to the right or backwardly into the position seen in Fig. 1, thereby closing the inlet-port *t* and opening the exhaust-port *l*. The air from the front end of the hammer will now exhaust partly through the port *v* and when the same is closed by the hammer through the port *i*, passage *k*, and port *l*, the latter being connected with the exhaust-port *m* by means of the neck or groove $y^{\times}$ in the valve 9, the port *g* being now open again to admit fluid-pressure into the cylinder.

By making the valve 9 solid and providing the same with the reduced portion $y^{\times}$ and the concavity $9^{\times}$, which permits fluid-pressure to be equally exerted on all parts thereof, and also with the projecting portion $9^{\times\times}$, which controls the port *t*, a simple, cheap, and durable valve is produced. The valve box or body 10, in which the valve 9 is located, has the cap or retaining piece 11 suitably secured thereto, the whole being secured to the tool-cylinder 12, to which latter the handle 1 is secured, said cap having the ratchet-teeth $11^{\times}$, which are engaged by the spring-pressed pawl or plunger $10^{\times}$, which has a member 2 for enabling the same to be readily manipulated.

I desire to lay especial emphasis upon the advantages of my invention, since before the hammer strikes the chisel at the left the valve will move in the same direction, and when the blow is delivered the valve is on the left-hand side, the blow instead of rebounding the valve from its seat tending to hold said valve more firmly seated, since the momentum or slight forward movement imparted to the tool-cylinder when said blow is struck must simultaneously impart a slight forward movement to the valve, since the latter and said hammer move in the same direction, all the ports being open at the right time and the regular and uniform movement of the valve, and consequently of the hammer, being unobstructed, whereby jump, jarring, and other objectionable features of pneumatic tools now in use are practically overcome.

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

1. In a pneumatic tool, a valve for controlling ports common thereto and to a hammer, and consisting of a hollow shell or cylinder, the interior surface thereof being always open to fluid-pressure, said valve being located exteriorly to said hammer in alinement therewith, and adapted to move in the same direction as the latter.

2. In a pneumatic tool, a solid hammer and a valve adapted to move in the same direction as the latter, said valve consisting of a cylindrical shell having its interior surface always open to fluid-pressure, and located out of the path of said hammer, the movement of the latter terminating exterior to said valve, the latter being provided with opposing pressure areas against which the motive fluid acts to shift the valve in opposite directions.

3. In a pneumatic tool, the combination of a hammer, ports and passages for conducting the motive fluid to and from said hammer and a hollow valve having its inner surface always open to fluid-pressure, and located out of the path of said hammer, said valve moving in the same direction as said hammer when the latter is in the act of striking a blow.

4. In a pneumatic tool, a valve consisting of a hollow cylindrical shell located out of the path of the hammer the movement of the latter terminating exterior to said valve, the latter being provided with opposing surfaces of different area, against the smaller of which the motive fluid constantly acts to press the valve in one direction and to the larger of which the motive fluid is intermittently admitted to move the valve in the opposite direction, said valve moving in the same direction as said hammer.

5. In a pneumatic tool, the combination of a cylinder containing a hammer and a valve

located out of the path of said hammer the movement of the latter terminating exterior to said valve which latter is provided with opposing pressure areas against which the motive fluid acts to shift the valve in the opposite direction, said valve moving in the same direction as said hammer.

6. In a pneumatic tool, a valve for controlling the movement of a hammer, the same consisting of a cylindrical shell having its interior constantly open to fluid-pressure and out of the path of said hammer, said valve moving in the same direction as said hammer and having opposing pressure areas to which the motive fluid is admitted to shift the valve in the opposite direction, the movement of said hammer terminating exterior to said valve.

7. In a pneumatic tool, the combination with the cylinder and its hammer of a valve moving in the same direction as the latter and located exteriorly to said hammer and out of the path thereof, the movement of said hammer terminating exterior to said valve, the latter consisting of a cylindrical shell having its interior subject to fluid-pressure and provided with differential pressure areas against the smaller of which the motive fluid constantly acts to press the valve in one direction, and passages controlled by the piston for intermittently admitting the motive fluid to the larger pressure area to move the valve in the opposite direction.

8. In a pneumatic tool, the combination of a hammer, a valve located exteriorly to and out of the path of said hammer, the movement of said hammer terminating exterior to said valve, the latter being provided with different pressure areas against the smaller of which the motive fluid constantly acts to press the valve in one direction and passages controlled by the piston and opened by the latter at its forward stroke to admit the motive fluid to the larger area of said valve, the latter moving in the same direction as said hammer.

9. In a pneumatic hammer for a pneumatic tool, the herein-described valve, consisting of a cylindrical shell having a reduced portion or neck $y^{\times}$ and an enlarged pressure area $9^{\times}$, the latter being provided with a projecting flange $9^{\times\times}$ controlling a live-steam port, the interior of said shell being constantly subjected to fluid-pressure.

10. The herein-described valve consisting of a cylindrical shell having a reduced neck $y^{\times}$, the differential pressure areas formed by the enlargement $9^{\times}$ having an annular cavity therein and the projecting portion $9^{\times\times}$.

11. In a pneumatic tool, a hammer, a valve moving in the same direction as said hammer, and located at the rear and out of the path thereof, the movement of said hammer terminating exterior to said valve, the latter consisting of a cylindrical shell provided with differential pressure areas against the smaller of which the motive fluid constantly acts to press the valve in one direction, a passage controlled by the hammer and opened by the latter to admit motive fluid to a larger area of the valve to move the latter forwardly, said valve being moved backwardly by the constantly-acting pressure against its smaller area.

12. In a pneumatic tool, a cylinder containing a hammer, a valve for controlling the passage of the motive fluid within said tool, said valve being located out of the path of said hammer and having differential pressure areas the movement of said hammer terminating exterior to said valve, ports controlled by said valve for conducting motive fluid to the back end of the hammer, ports controlled by said valve for admitting steam to the forward end of said hammer, and a port leading from the valve-chamber and thrown into communication by a neck in said hammer, with a discharge-passage leading to the larger area of said valve, whereby the latter is seated, said valve moving in the same direction as said hammer and being held firmly in its extreme forward position at the period when said hammer reaches the forward end of its stroke, in combination with means for actuating said hammer and valve in opposite directions.

13. The combination with a pneumatic tool, of a hammer having a reduced portion y, a valve having differential pressure areas and the reduced portion or neck $y^{\times}$, the interior of said valve being always open to fluid-pressure, ports and passages controlled by said valve in each of its extreme positions for permitting the motive fluid to act upon each end of said hammer the movement of the latter terminating exterior to said valve, a port n for admitting motive fluid to the passage o, port p and port q, when the two latter are thrown in communication by the neck y of said hammer, a passage r and port s for permitting live steam to act upon the larger area of the valve, whereby the latter is moved forwardly simultaneously with the forward movement of the hammer, a port v adapted to be uncovered by said hammer when the latter moves backwardly, a passage q and port x leading from said port v, said port x communicating with said neck $y^{\times}$ of said valve, whereby the latter is moved rearwardly simultaneously with the rearward movement of said hammer and suitable exhaust-passages for permitting the exhaust of the motive fluid during the rearward movement of said hammer.

14. A solid valve having a passage therethrough, a reduced portion $y^{\times}$, differential pressure areas, a concavity $9^{\times}$ in the larger of said pressure areas, and an extension $9^{\times\times}$ for controlling a steam-inlet port.

15. In a pneumatic tool, a valve-box having a valve therein, the interior of said valve being always open to fluid-pressure, a handle engaging the cylinder of said tool and having a port discharging substantially centrally from said handle into substantially the center of said valve and ports and passages lead-

ing to and from said cylinder controlled by said valve.

16. In a pneumatic tool, a cylinder, a solid hammer having a reduced portion, a valve moving in the same direction as said hammer, the movement of the latter terminating exterior to said valve, the latter consisting of a hollow shell having its interior surface always open to fluid-pressure, and inlet and exhaust ports common to said valve and hammer.

17. In a pneumatic tool, a handle, a valve-box having a cap secured thereto, a cylinder and a spring-pressed plunger, seated in said handle and adapted to engage teeth on said cap.

18. In a pneumatic tool, the combination of a valve and piston and a casing therefor, there being an inlet in the casing for the supply, the valve being hollow and the valve-chamber within the valve being in constant communication with the inlet, the casing having ports and passages in proximity to the upper and lower ends of the valve-chamber respectively, and connected directly with opposite ends of the piston-chamber and adapted to be brought alternately into communication with the valve-chamber by the reciprocating of the valve.

19. The combination with the valve-casing consisting of the main body thereof and the retaining-piece, the latter having a ratchet on its periphery and being movably secured to the main body of the casing, of a handle having a depending annular flange surrounding the retaining-piece, and a sliding pawl in said flange and engaging said ratchet.

20. The combination of a valve-box, a cap secured thereto, ratchet-teeth on said cap, a handle having a portion surrounding said cap and box, and a spring-pressed plunger or pawl seated in said handle and adapted to engage said teeth.

21. In a pneumatic tool, the combination of a valve and piston and a casing therefor, said valve having projections having differential pressure-surfaces, a chamber between the valve and the casing adapted to the reception of the projection having the pressure-surface of larger area, an exhaust-passage constantly connected with the chamber on one side of said projection, and passages leading from the opposite ends of the piston-cylinder arranged to be alternately connected with the chamber on the exhaust side of said projection by the shifting of the valve, whereby the exhaust from each end of said piston passes to that part of the chamber in constant communication with the exhaust and thence through said exhaust-passage.

22. In a pneumatic tool, the combination with the casing, of a valve having projections of differential areas, a chamber between the valve and the casing adapted to the reception of the projection of larger area, a piston having an annular groove, a main inlet-port, a passage communicating therewith adapted to register with said groove when the piston is at one end of its stroke, a second passage adapted to register with said groove at the same time and communicating with the said chamber on one side of said projection, an exhaust-passage constantly connected with the chamber on the other side of said piston, and passages leading from the ends of the piston-cylinder arranged to be alternately connected with the chamber on the exhaust side of said projection by the shifting of the valve, whereby the exhaust from each end of said piston passes to that part of the chamber in constant communication with the exhaust, and thence through said exhaust-passage.

23. In a pneumatic tool, the combination with the casing of a valve having projections of differential areas, a chamber between the valve and the casing adapted to the reception of the projection of larger area, a piston having an annular groove, a main inlet, a passage communicating therewith having a port adapted to register with said groove when the piston is at one end of its stroke, a second passage communicating with the exhaust and having a port leading to the piston-chamber adapted to be opened by said piston when at the other end of its stroke, a third passage communicating with said chamber at one side of said projection, said passage having two ports, one adapted to register with said groove when the piston is at one end of its stroke, the other leading to the piston-chamber adapted to be opened by said piston when at the other end of its stroke, whereby said chamber between valve and casing will be connected alternately with supply and exhaust by the shifting of the piston.

24. In a pneumatic tool, the combination, with the piston and casing, of a valve having projections of differential areas, a chamber between the valve and the casing adapted to the reception of the projection of larger area, a passage communicating with said chamber on one side of said projection and with the piston-chamber, and a supply-passage and an exhaust-passage also in communication with the piston-chamber and controlled by the piston in its reciprocation to alternately connect the first-named passage with the supply and exhaust.

25. In a pneumatic tool, the combination of a valve and piston and a casing therefor, there being an inlet in the casing for the supply, the valve being hollow and the valve-chamber within the valve being in constant communication with the inlet, the casing having ports and passages in proximity to the upper and lower ends of the valve-chamber respectively, and connected directly with opposite ends of the piston-chamber and adapted to be brought alternately into communication with the valve-chamber by the reciprocation of the valve, said valve also having projections of differential area, a chamber between the valve and the casing adapted to the reception of the projection of larger area,

a passage communicating with said chamber on one side of said projection, and ports and passages controlled by the piston in its reciprocation to alternately connect said passage to the chamber with the supply and exhaust, and a passage communicating with said chamber on the other side of said projection in connection with the exhaust, said passages communicating with said chamber on opposite sides of said projection being in proximity respectively to the upper and lower ends of the valve and connected with opposite ends of the piston-chamber.

26. The combination with the valve-casing consisting of the main body thereof and the retaining-piece, the latter having a ratchet on its periphery and being removably secured to the main body of the casing, of a handle having a depending annular flange surrounding the retaining-piece, and a sliding pawl in said flange and engaging said ratchet.

27. The combination with the valve-casing consisting of a main body thereof and the retaining-piece, the latter having a ratchet on its periphery and being removably secured to the main body of the casing, of a handle having a depending annular flange surrounding the retaining-piece, a pawl in a hollow portion of said handle-flange and engaging said ratchet, said pawl being spring-pressed against the ratchet and having an L-shaped extension-piece to permit the withdrawal by hand of the pawl from engagement with the ratchet.

28. The combination with the valve-casing consisting of the main body thereof and the retaining-piece, the latter having a ratchet on its periphery and being removably secured to the main body of the casing, of a handle having a depending annular flange surrounding the retaining-piece, a pawl in a hollow portion of said handle-flange and engaging said ratchet, said pawl being spring-pressed against the ratchet, and having an extension-piece projecting between the walls of said hollow portion of the handle-flange and adapted to be withdrawn to engage the exterior of the handle-flange, whereby the pawl is held out of engagement with said ratchet.

JULIUS KELLER.

Witnesses:
WM. C. WIEDERSHEIM,
E. HAYWARD FAIRBANKS.