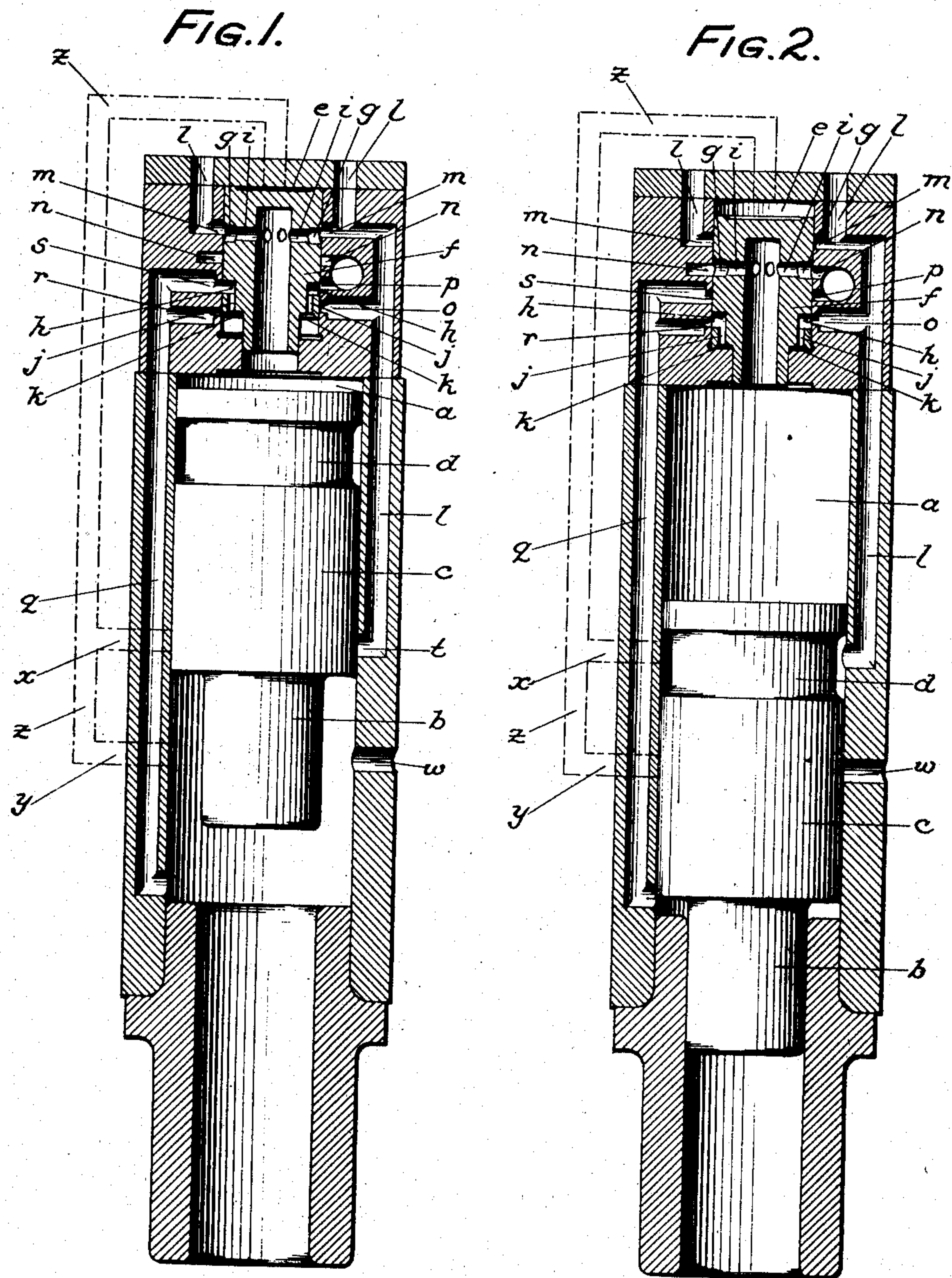


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PATENTED AUG. 27, 1907

W. H. VAN SICKEL.
PNEUMATIC TOOL.
APPLICATION FILED MAR. 23, 1906.



WITNESSES:

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PNEUMATIC TOOL.

No. 864,494

Specification of Letters Patent.

Patented Aug. 27, 1907.

Application filed March 23, 1906. Serial No. 307,567.

To all whom it may concern:

Be it known that I, WILBER H. VAN SICKEL, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Pneumatic Tools, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention comprises certain new and useful improvements in valve mechanism for pneumatic tools and the connection with the piston chamber.

I will first describe the embodiment of my invention as illustrated in the accompanying drawings and then point out the invention in the claims.

In the drawings: Figure 1 is a view showing my improved pneumatic tool with the parts in the position they assume with piston at one end, the upper, of its stroke. Fig. 2 is a similar view with the parts in the position they assume with the piston at the other end, the lower, of its stroke.

a is the piston chamber, with the piston therein having a striking portion *b*, the enlarged upper portion *c* having the groove *d*.

e is the valve chamber communicating with the upper end of the piston chamber. In this valve chamber *e* is the hollow valve *f*. This valve has on its exterior the circumferential grooves *g* and *h*. The groove *g* has orifices *i* connecting the exterior and interior of the valve at the groove. The groove *h* has leading from it the passages *j* leading to the pocket or opposite side of shoulder *k* on valve.

l are passages in constant connection with the air supply and have connecting therewith the passages *m*, which in one position of valve register with the groove *g*.

n is an exhaust passage which, in the other position of the valve, registers with the groove *g*.

o is a passage connected with one of passages *l* and which in one position of valve is connected with groove *h*, and *p* is a passage to the exhaust, registering with the groove *h* in the other position of the valve.

q is a passage leading from the lower end of piston chamber and having passages *r* and *s* communicating therewith at its upper end. One of the passages *l* extends downward and opens into the piston chamber through port *t*.

w is an exhaust port from piston chamber.

z is a passage communicating at one end with the valve chamber at end of valve and at the other end having two passages *x* and *y*, passage *x* entering piston chamber opposite port *t*, and passage *y* entering piston chamber opposite exhaust *w*.

The operation of the tool is as follows: The parts being in the position shown in Fig. 1, the groove *g* is in connection with air supply and air passes to top of pis-

ton chamber through orifices *i*. The lower end of piston chamber is exhausting through exhaust opening *w* and passage *q*, passage *s*, groove *h* to exhaust. The piston moves downward until the port *t* registers with the groove *d* in piston. When this occurs, air passes up through passage *z* to top of valve, shifting the valve to position shown in Fig. 2. This shift brings the groove *g* in line with the exhaust, and thus the pressure on top of piston is relieved. The groove *h* is brought in connection with air pressure supply, and air passes through passage *r* and *q* to bottom of piston chamber. Air is also admitted by groove *h* to passage *j*, bringing air to pocket on opposite side of shoulder *k*. The piston moves up. Until the piston has moved up far enough to connect exhaust port *w*, and passage *z*, the piston closes the outlet of passage *z*, and hence the valve is held down. When, however, the port *w* is uncovered, the pressure falls and the air pressure on top of valve is relieved and at once the air in pocket or opposite side of shoulder *k* acts, shifting the valve from the position of Fig. 2 toward that of Fig. 1. This continues until the air supply to groove *h* is cut off, cutting off air to bottom of piston. At this point air is just being admitted to groove *g* and the groove *h* is just opening into exhaust passage *p* allowing the air in pocket *k* to escape through holes *j*. The air entering groove *g* passes to the interior of the valve and the piston chamber and as the pressure rises therein causes the air to act against the lower surface of the valve to complete the stroke of the valve to the position of Fig. 1. By this arrangement I shift the pressure for moving the valve in one direction from one surface to another during its movement. By this arrangement I start the movement of the valve in this direction positively, and after partial movement of the valve sufficient to admit some air to top of the piston chamber, the pressure causing this valve movement is cut off and exhausted, and the movement of the valve temporarily stopped. This condition arises before the piston has reached the upper end of its stroke. The air entering the top of the piston chamber in this position of the valve enters gradually and slowly, retarding the upward movement of the piston and destroying its momentum and gradually bringing the piston to rest, thereby lessening the vibration of the tool as originally constructed where the valve is moved quickly and continuously throughout its entire stroke, and thus the piston is brought to rest and its direction of movement changed suddenly, producing considerable vibration. In my tool, as the air gradually brings the piston to rest, it reacts to move the valve the remainder of its stroke so that when the piston is thus gradually brought to rest at the end of its stroke full air pressure is ready to drive it in the opposite direction.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a valve in the valve chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply.
2. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a valve in the valve chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a pressure surface for said valve of greater area than the wall of the groove at the contracted portion of the valve, and means to relieve the pressure on said surface when the groove is in connection with the live air passage.
3. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a valve in the valve chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a pressure surface for said valve of greater area than the wall of the groove at the contracted portion of the valve, a passage from said pressure surface to the piston chamber, a passage to the exhaust from the piston chamber, the piston in its movement being adapted alternately to connect the pressure surface passage with the air pressure supply and exhaust.
4. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a valve in the valve chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston

chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a pressure surface for said valve of greater area than the wall of the groove at the contracted portion of the valve, a passage from said pressure surface to the piston chamber, a passage to the exhaust from the piston chamber, the piston in its movement being adapted alternately to connect the pressure surface passage with the air pressure supply and exhaust, and intermediate thereof to trap the air in said passage.

5. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a second circumferential groove in said valve, orifices through the wall of said groove to the interior of the valve, a passage, to the air supply, and a passage to the exhaust adapted alternately in the reciprocation of the valve, to register with the last mentioned groove.

6. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a second circumferential groove in said valve, orifices through the wall of said groove to the interior of the valve, a passage to the air supply, and a passage to the exhaust adapted, alternately in the reciprocation of the valve, to register with the last mentioned groove, the first mentioned groove, moving beyond its air supply before the last mentioned groove fully connects with its air supply.

7. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a pressure surface for said valve of greater area than the wall of the groove at the

contracted portion of the valve, and means to relieve the pressure on said surface when the groove is in connection with the live air passage, a second circumferential groove in said valve, orifices through the wall of said groove to the interior of the valve, a passage to the air supply, and a passage to the exhaust adapted alternately, in the reciprocation of the valve, to register with the last mentioned groove.

8. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply, a pressure surface for said valve of greater area than the wall of the groove at the contracted portion of the valve, a passage from said pressure surface to the piston chamber, a passage from the air supply to the piston chamber, a passage to the exhaust from the piston chamber, the piston in its movement being adapted, alternately to connect the pressure surface passage with the air pressure supply and exhaust, a second circumferential groove in said valve, orifices through the wall of said groove to the interior of the valve, a passage to the air supply, and a passage to the exhaust adapted, alternately in the reciprocation of the valve, to register with the last mentioned groove.

9. In a pneumatic tool, in combination, a valve chamber and a piston chamber, a piston in the piston chamber, and a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having a circumferential groove and a contracted portion beyond said groove, a passage or passages through the wall of said groove toward the contracted portion of the valve, a passage having openings into the valve chamber on one side thereof at different points, said passage extending to the piston chamber, passages from the other side of the valve chamber, one to the live air, the other to the exhaust, said

passages being at points in the valve chamber corresponding respectively to the piston chamber passage openings, the groove in the valve being adapted, in its movement in one direction, to connect one piston chamber passage opening with the exhaust and in its movement in the other direction, to connect the other piston chamber passage opening with the pressure supply; a pressure surface for said valve of greater area than the wall of the groove at the contracted portion of the valve, a passage from said pressure surface to the piston chamber, a passage from the air supply to the piston chamber, a passage to the exhaust from the piston chamber, the piston in its movement being adapted alternately to connect the pressure surface passage with the air pressure supply and exhaust, and, intermediate thereof, to trap the air in said passage, a second circumferential groove in said valve, orifices through the wall of said groove to the interior of the valve, a passage to the air supply, and a passage to the exhaust adapted, alternately in the reciprocation of the valve, to register with the last mentioned groove.

10. In combination, a piston chamber, and a valve chamber, a piston in the piston chamber, a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having two pressure surfaces, connection to one pressure surface on the exterior of the valve and a second connection to the other pressure surface independent of the first mentioned connection through the interior of the valve, means to admit pressure successively to said pressure surfaces to move and complete the movement of the valve in one direction.

11. In combination, a piston chamber, and a valve chamber, a piston in the piston chamber, a hollow valve in the valve chamber, the interior of which communicates with the piston chamber, said valve having two pressure surfaces, connection to one pressure surface on the exterior of the valve and to the other pressure surface through the interior of the valve, means to admit pressure successively to said pressure surfaces to move and complete the movement of the valve in one direction, and means to cut off the air pressure to the first mentioned pressure surface, when air is admitted to the second mentioned pressure surface.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this 19th day of March, 1906.

WILBER H. VAN SICKEL.

Witnesses:

M. M. HAMILTON,
FRANK S. BESSER.