No. 865,337. PATENTED SEPT. 3, 1907.

F. S. GRAHAM.

PNEUMATIC TOOL.

APPLICATION FILED NOV. 9, 1906.

Fig. 1.

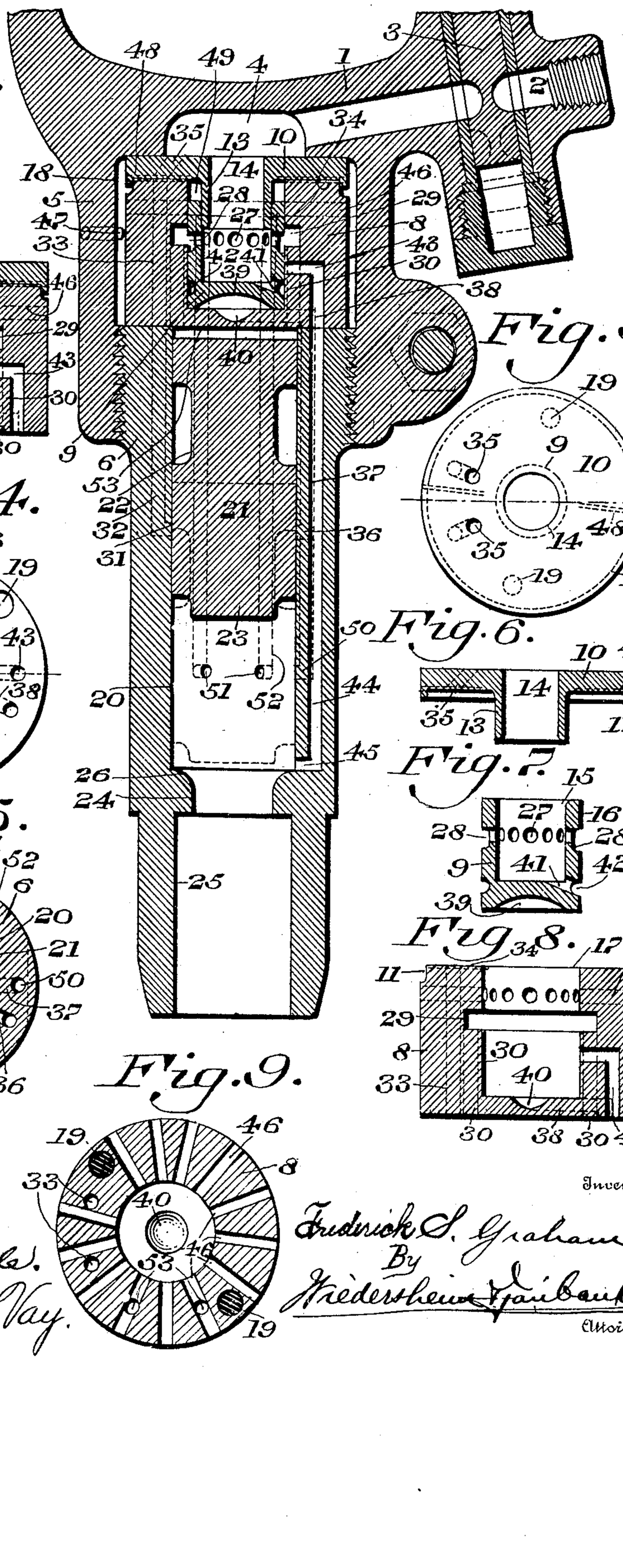


Fig. 2.

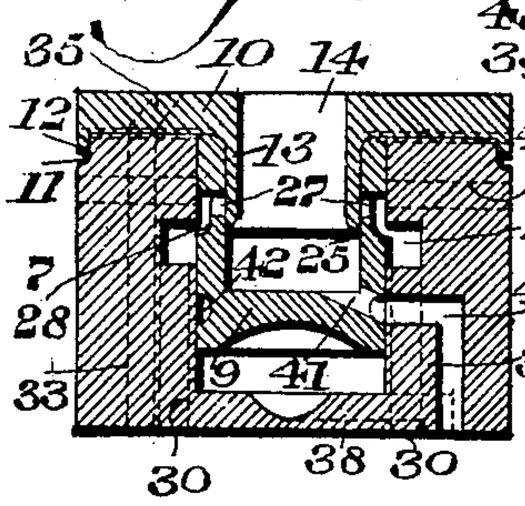


Fig. 3.




Fig. 4.

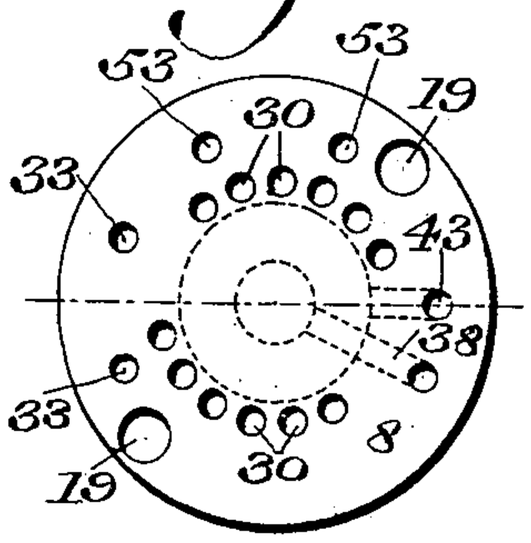


Fig. 5.

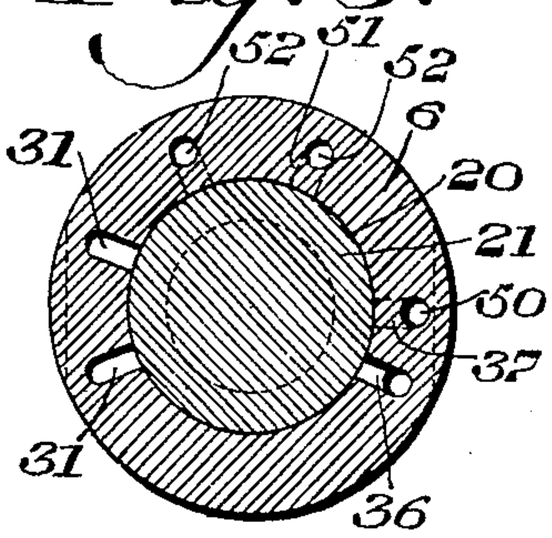


Fig. 6.




Fig. 7.




Fig. 8.




Fig. 9.




Witnesses

P. F. Nagle.

C. L. McVay.

Inventor

Frederick S. Graham.

By Wiederhein & Fairbanks.

Attorneys

# UNITED STATES PATENT OFFICE.

FREDERICK S. GRAHAM, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-THIRD TO RALPH M. SEAMAN AND ONE-THIRD TO CHARLES A. STRUNTZ.

## PNEUMATIC TOOL.

No. 865,337. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed November 9, 1906. Serial No. 342,715.

*To all whom it may concern:*

Be it known that I, FREDERICK S. GRAHAM, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Pneumatic Tool, of which the following is a specification.

My present invention relates to fluid actuated tools and consists of a novel and useful construction of a pneumatic tool and valve mechanism therefor in which the number of parts employed are reduced to a minimum, and in which the valve controlling the movements of the reciprocating piston is actuated in both directions by fluid pressure.

It further consists of a novel construction of valve mechanism in which a chambered valve having a uniform bearing surface is employed, said valve having provided therefor a suitable casing in which it is adapted to reciprocate and a valve cap or cover having a depending flange or sleeve with which the inner periphery of the valve engages.

It further consists of a novel construction of apertured valve, the bearing surface of which is of uniform diameter throughout and provided on its outer periphery with an annular groove which controls the exhaust ports in the valve casing.

It further consists of a novel construction and arrangement of ports and passages and a novel construction and arrangement of parts whereby a powerful and efficient tool is produced and the vibration, which is usually present in tools of this character, practically eliminated.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

In order to clearly illustrate my invention I have shown one embodiment thereof which has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists may be variously arranged and organized, and in the present instance I have shown the preferred embodiment thereof, although it is to be understood that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown.

Figure 1 represents a sectional view of a fluid actuated tool embodying my invention, the handle therefor being partly broken away. Fig. 2 represents a sectional view of the valve mechanism in detached position, the parts being shown in a different relation from that seen in Fig. 1. Fig. 3 represents a plan view of the valve cap or cover. Fig. 4 represents a plan view of the valve casing, the same being viewed from below. Fig. 5 represents a sectional view of Fig. 1. Fig. 6 represents a sectional view of the valve cap or cover in detached position. Fig. 7 represents a sectional view of the valve in detached position. Fig. 8 represents a sectional view of the valve casing. Fig. 9 represents a sectional view of the valve casing showing certain of the exhaust ports.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings. 1 designates a handle having an inlet passage 2 therethrough which is controlled by means of a suitable valve 3 located in the passage 2 which communicates with an inner chamber 4. The handle 1 is provided with a head block 5 which is adapted to be secured to a tool casing 6 in any suitable or conventional manner and in the present instance I have shown the same as having threaded connection therewith.

7 designates the valve mechanism which, in the present instance comprises a valve casing 8, a valve 9 and a valve top or cover 10. The casing 8 is provided on its outer periphery with an annular recess or groove 11 in which the flange 12 projecting downwardly from the periphery of the cover 10 is adapted to be seated when the parts are in assembled position. The valve cover 10 has a sleeve or flange 13 integral therewith and extending inwardly therefrom and 14 designates an aperture through the cover and flange. The valve 9 is provided with an internal chamber and an outer bearing surface 16, which latter is adapted to engage the inner bore 17 of the valve casing 8 when the parts are in assembled position. The outer portion of the valve 9, as is clearly seen in Figs. 1 and 2, engages the outer periphery of the depending flange 13 and the inner bore 17 of the valve casing 8, so that said valve 9 is always accurately guided in its movement.

As seen in Fig. 1, the head block 5 of the handle is chambered, as indicated at 18, so that when the parts are in assembled position, the bottom of the valve casing engages the tool cylinder 6 and the handle engages the top of the cover 10, so that the valve mechanism is maintained in proper position and alinement with respect to the handle and tool casing under all conditions. In order to prevent any improper movement of the valve mechanism when the handle is being secured to the tool casing, the valve casing is provided with dowel pins 19, as indicated in Fig. 4, which engage recesses in the tool casing, and as seen in Fig. 3, these dowel pins would preferably extend through the valve top or cover 10, although this would not be essential under all conditions, since the valve cover 10, owing to the provision of the flange 12, may have a close engagement with the valve casing 8. The dowel pins 19 may be of uniform diameter or the ends thereof may have a reduced or enlarged diameter. The tool casing 6 is provided with an inner bore 20 in which a plunger or piston 21 is adapted to reciprocate, said piston being provided intermediate its ends with an annular groove 22 and at its forward end it is provided with a reduced

diameter 23 in order that the same may pass through the reduced diameter 24 and engage with the working tool which is adapted to fit the bore 25 at the outer or forward end of the tool cylinder 6. In the present instance the inner wall of the casing 6 is rounded as seen at 26, in order that there will be no liability of the piston 21 contacting therewith on its forward stroke. In order to more clearly describe the construction and arrangement of the fluid ports and passages, I will now describe the manner in which the valve mechanism is actuated to control the motive fluid which actuates the reciprocating piston.

The live motive fluid enters through the inlet passage 2 and thence into the chamber 4 and owing to the provision of the aperture 13 the live motive fluid passes directly therethrough into the internal chamber 15 of the valve 9. Having the parts in the position seen in Fig. 1, the motive fluid passes through the ports 27 in the valve 9 and into the annular groove 28 into which said ports open and around the annular grooves 29 in the valve casing 8 which always communicates with said groove 28, thence through the motive fluid passages 30 into the piston chamber 20 of the tool casing 6 and acting upon the rear end of the piston 21 causes the same to move forwardly and impart a powerful and efficient blow to the working tool. As the piston travels forwardly the annular groove 22 therein will register with the port 31 in the tool casing and since this port communicates with a passage 32, registering with a passage 33 in the valve casing, which latter registers with a port 35 in the valve cover 10, communicating with the chamber 4 in the handle 1, the live motive fluid may now pass from the chamber 4 through the port 35, passage 33, passage 32 and port 31, around the annular groove 22 of the piston, through port 36, passage 37 in the tool casing and passage 38 in the valve casing which registers therewith beneath the valve 9 and this motive fluid acting upon the imperforate bottom of the valve 9 causes the latter to move rearwardly and assume the position indicated in Fig. 2. In the present instance the imperforate bottom of the valve 9 is recessed as seen at 39 and the bottom of the valve casing is recessed, as seen at 40, in order that the motive fluid may act the more readily against the bottom of the valve 9. The ports 27 are now closed by the depending flange 13 and a port 41 extending through the side of the valve 9 and communicating with an annular groove 42 in said valve will permit the live motive fluid to pass through the port 41 into the annular groove 42 thence through the passage 43 in the valve casing, since the groove 42 at this time registers therewith, and into passage 44 in the tool casing. The motive fluid may now pass through port 45 beneath the piston 21 and acting thereagainst cause the same to be moved rearwardly to the position seen in Fig. 1. The motive fluid in rear of the piston as the piston travels rearwardly may exhaust through passages 30 into annular groove 29 and owing to the provision of the groove 28 the exhaust motive fluid may pass through the exhaust ports 46 in the valve casing and thence through the exhaust ports 47, in the handle, to the atmosphere.

Owing to the provision of the groove or slot 48, the air or other fluid in the chamber 49 formed between the end of the valve and the valve cover, as clearly seen in Fig. 1, may escape therethrough on the rearward movement of said valve into the chamber 18 in the handle surrounding the valve casing and thence through the exhaust passages 47 through the handle, into the atmosphere. The motive fluid in the chamber formed between the imperforate bottom of the valve and the bottom of the valve casing may escape therefrom on the forward movement of said valve through the passage 38 in the valve casing, passage 37 registering therewith, port 50 into the piston cylinder 20 and thence through ports 51, passages 52, passages 53 in the valve casing 8 and thence into the exhaust ports 46 communicating therewith and thence into the chamber 18 and through the main exhaust ports 47 to the atmosphere. It will be noted that in the present instance the valve casing 8 has an annular groove 34 therein which registers with the groove or slot 48 which passes through the flange 12, although it is to be understood that this groove may be formed in either the valve cover or cap or the valve casing and still be within the scope of my invention.

It is to be noted that in my present invention a cup-shaped valve having an imperforate bottom and having a bearing of uniform diameter is employed and that the ports extending through the side of said valve are controlled by a flange or sleeve depending from the valve cover and that the inner periphery of the valve engages the outer periphery of said sleeve, so that the valve is accurately guided and the liability of the valve cracking or breaking at its upper or outer end, due to the excessive vibration which is present in tools of this character, is practically eliminated so that the side of the cup-shaped valve may be comparatively thin without any danger of the same breaking, as will be apparent to those skilled in this art.

It is further to be noted that owing to the provision of the annular groove 28 with which the ports 27 communicate that when the valve 9 is seated in its rearmost position, as indicated in Fig. 2, the exhaust motive fluid in the rear of the piston may readily pass therethrough ports 30 into the groove 29, thence, owing to the provision of the groove 28, through the exhaust ports 46 so that a free exhaust of the motive fluid in rear of the piston is permitted at the desired time.

It will be seen that there is always a pressure of the motive fluid on the valve 9 which tends to maintain the valve in seated position in the forward end of the casing and that when the piston moves forwardly, live motive fluid may pass therearound and cause the valve to be moved to its rear position, as is indicated in Fig. 2.

It will also be noted that the valve in all cases does not pass beyond the upper end of the valve casing and does not pass through the valve cover so that the bearing of the valve is protected at all times from any foreign material which may be carried into the tool by the motive fluid.

The valve mechanism may be cheaply and economically manufactured and since the inner bore of the valve casing is of uniform diameter the same may be readily ground if desired so that the valve may have an exact fit therein.

It will now be apparent from the foregoing that I have devised a novel and useful construction of pneumatic tool and valve mechanism therefor which embodies the features of advantage enumerated in the statement of invention and the above description and

while in the present instance I have shown and described the embodiment thereof which is at present preferred by me, it is to be understood that it is susceptible of modification in various particulars without departing from the spirit and scope of my invention or sacrificing any of its advantages.

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 of a casing, a reciprocating piston therein, and a valve mechanism comprising a valve casing, a cup-shaped valve of uniform diameter therein, a valve cover having a depending flange with the outer periphery of which the inner periphery of said valve engages, said valve having ports through the side thereof controlled by said flange and controlling the admission of motive fluid to advance the piston, and said valve having ports through the side thereof near its lower end for controlling the passage of motive fluid to return the piston.

2. In a pneumatic tool, the combination of a casing, a reciprocating piston therein and a valve mechanism comprising a valve casing, a cup-shaped valve of uniform diameter therein, a valve cover having a depending flange with the outer periphery of which the inner periphery of said valve engages, said valve having ports through the side thereof controlled by said flange and controlling the admission of motive fluid to advance the piston, said valve having ports through the side thereof near its lower end controlling the passage of motive fluid to return the piston, said valve casing having a series of exhaust ports therethrough, and an annular groove in proximity to said ports, and an annular groove on said valve adapted to permit exhaust fluid to pass from the groove in said valve casing into said series of exhaust ports.

3. In a valve mechanism for pneumatic tools, the combination of a casing having a bore of uniform diameter, a cup-shaped valve within said casing having an imperforate bottom, a series of ports through the side of said valve intermediate the ends thereof, a cover for said casing having a depending flange controlling said ports an annular groove on the outer periphery of said valve with which said ports communicate, an annular groove in said casing always in communication with the annular groove on said valve and passages for live and exhaust motive fluid leading from said casing and controlled by said valve.

4. In a valve mechanism for pneumatic tools, the combination of a casing having a bore of uniform diameter therein and an internal annular groove, a series of exhaust ports extending through said casing, passages communicating with said ports and extending through the bottom of the easing, a cup-shaped valve having an annular groove intermediate the end thereof and engaging said bore, a series of ports through said valve communicating with said groove, inlet ports through the side of said valve near the lower end thereof, ports extending through the forward end of said casing with which said ports communicate, a cover having a depending flange, the outer periphery of which engages the inner periphery of said valve, a passage extending through said cover and said casing, and a passage extending through the bottom of said casing beneath said valve.

5. In a valve mechanism for pneumatic tools, the combination of a casing having a uniform bore and an annular groove, a series of exhaust ports leading from said groove through the bottom of said casing, a cup-shaped valve within said bore and having an annular groove registering at all times with the annular groove in said casing, a cover having a depending flange the outer periphery of which the inner periphery of said valve engages, said valve controlling said inlet ports, a port through the side of said valve near the bottom thereof, a passage through the casing co-acting therewith, a passage through said cover and extending through the bottom of said casing, a passage through the bottom of said casing beneath said valve and exhaust passages through said casing.

6. In a pneumatic tool, the combination of a casing, a reciprocating piston and a valve mechanism comprising a valve casing, a cup-shaped valve of uniform diameter therein, a valve cover having a depending flange with the outer periphery of which the inner periphery of said valve engages, said valve having inlet ports through the side thereof controlled by said flange, there being an annular groove in said valve always registering with an annular groove in said casing, inlet passages leading from the groove in said casing through which motive fluid passes to advance the piston, said valve having ports through the side thereof for controlling the passage of motive fluid to return the piston, a live air inlet passage through said cover and casing and a passage through said casing and opening thereinto beneath said valve.

7. In a pneumatic tool, the combination of a casing, a reciprocating piston therein, and a valve mechanism comprising a valve casing, a cup-shaped valve of uniform diameter therein, a valve cover having a depending flange with the outer periphery of which the inner periphery of said valve engages, said valve having ports through the side thereof controlled by said flange and controlling the admission of motive fluid to advance the piston, said valve having ports through the side thereof near its lower end for controlling the passage of motive fluid to return the piston, and means for changing the valve.

8. In a pneumatic tool, the combination of a casing, a reciprocating piston therein, and a valve mechanism comprising a valve casing, a cup-shaped valve of uniform diameter therein, a valve cover having a depending flange with the outer periphery of which the inner periphery of said valve engages, said valve having ports through the side thereof controlled by said flange and controlling the admission of motive fluid to advance the piston, said valve having ports through the side thereof near its lower end for controlling the passage of motive fluid to return the piston, means for changing the valve, and means for permitting the exhaust of fluid pressure in the rear of said valve from the space between said flange and said casing.

FREDERICK S. GRAHAM.

Witnesses:
GEO. C. WESTON,
C. D. MCVAY.