No. 736,555. PATENTED AUG. 18, 1903.

# C. H. SHAW.

## PNEUMATIC TOOL.

APPLICATION FILED NOV. 11, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

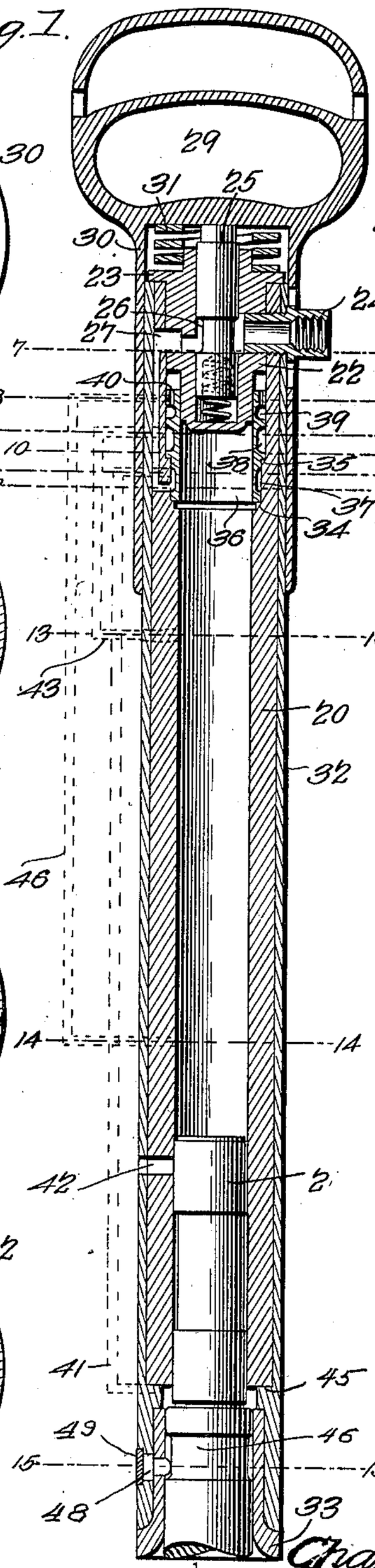



Fig. 7.

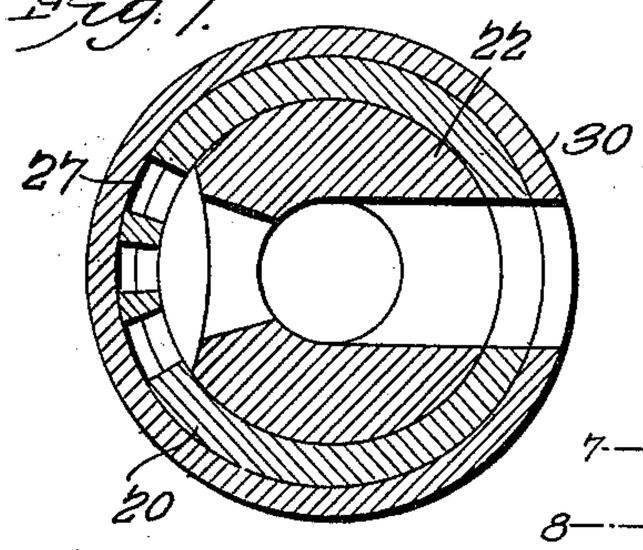



Fig. 11.

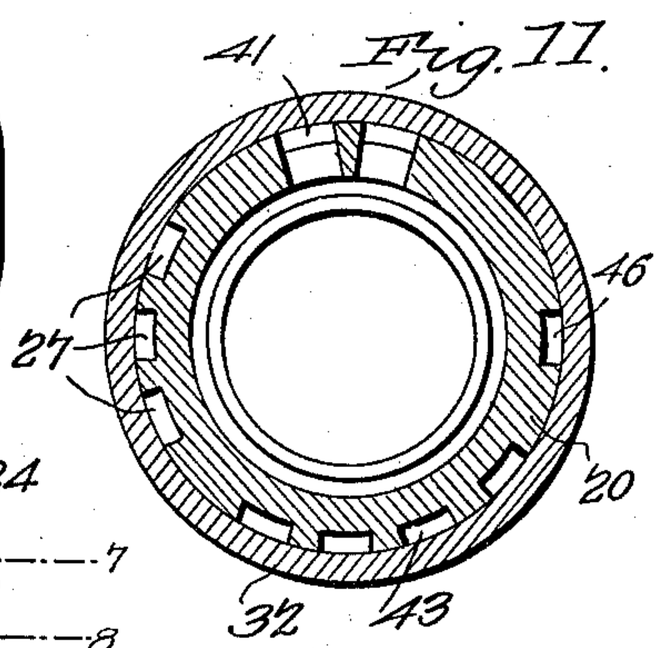



Fig. 8.

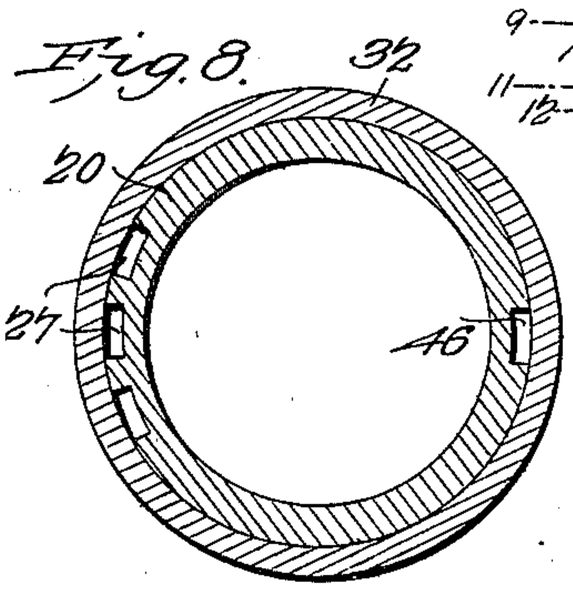



Fig. 12.

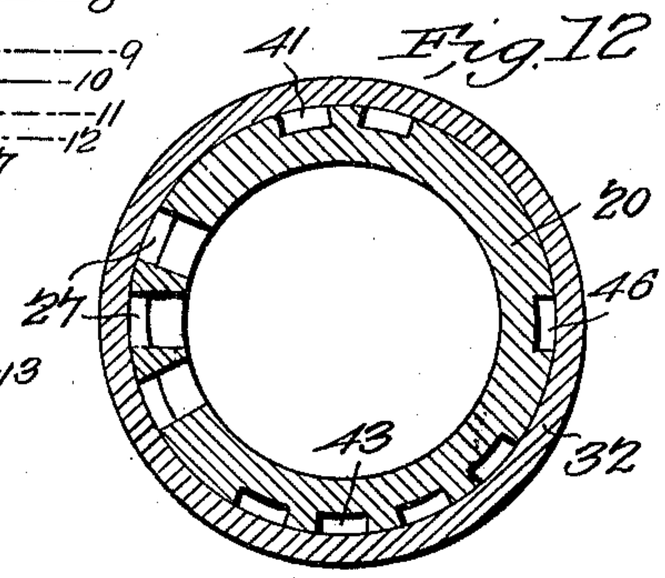



Fig. 9.

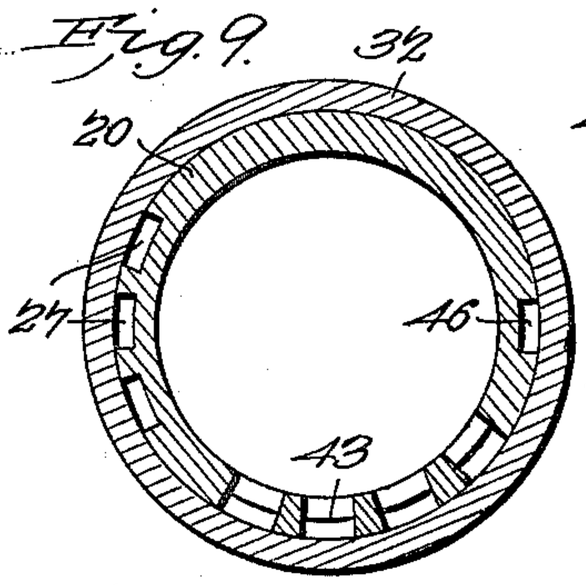



Fig. 13.

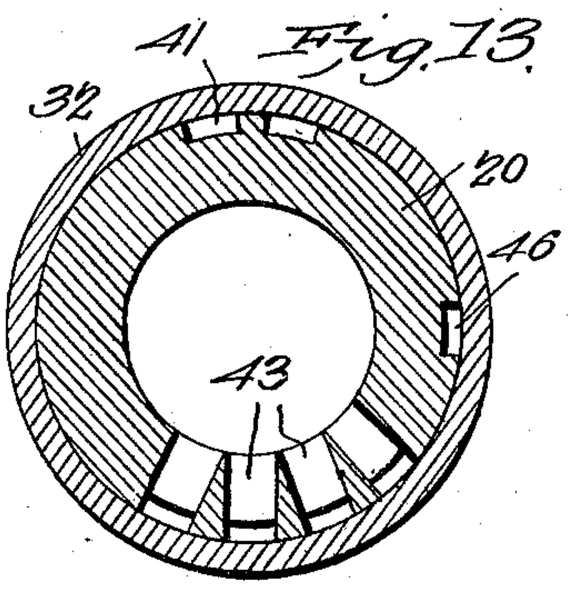



Fig. 10.

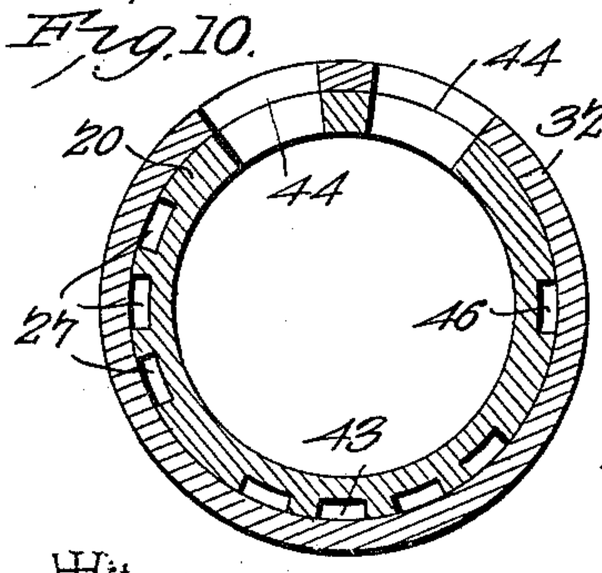
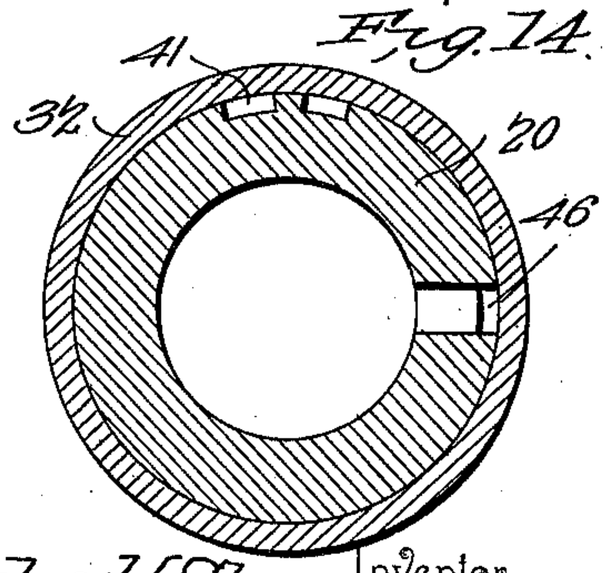



Fig. 14.

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No. 736,555. PATENTED AUG. 18, 1903.

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PNEUMATIC TOOL.

APPLICATION FILED NOV. 11, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

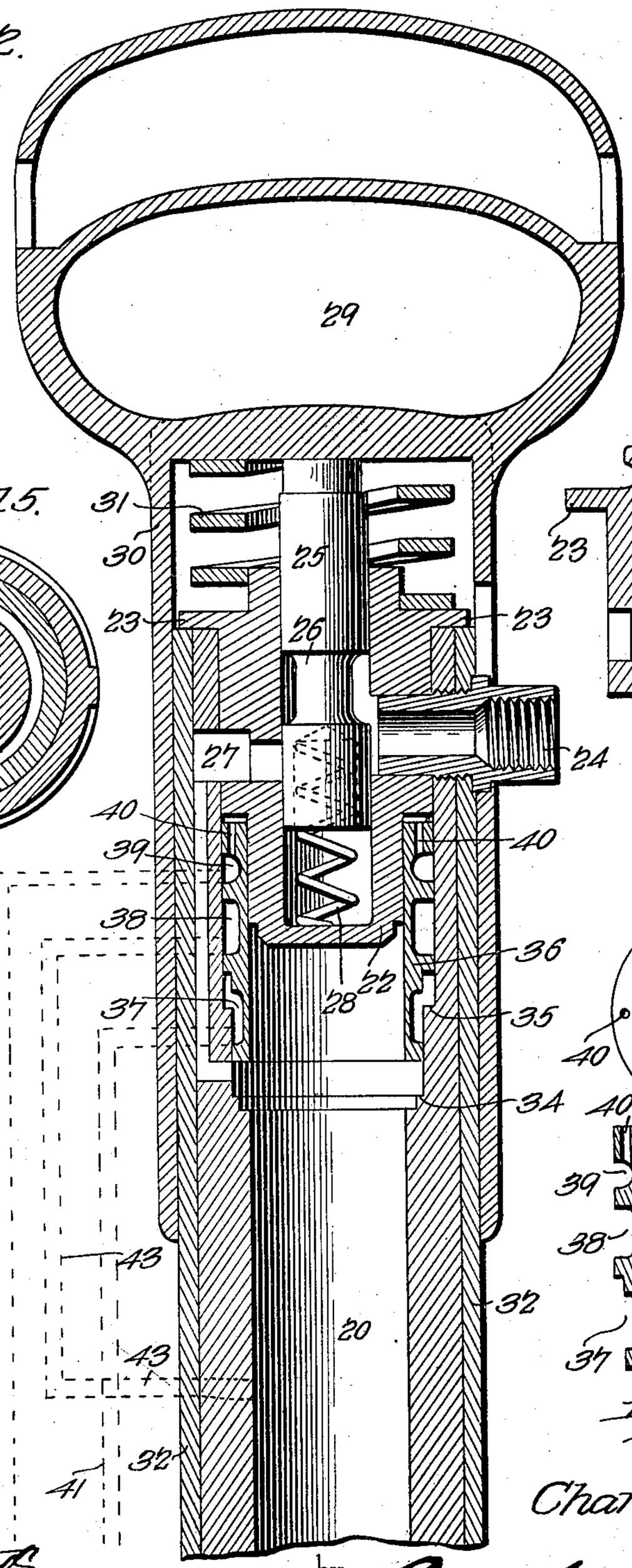



Fig. 15.

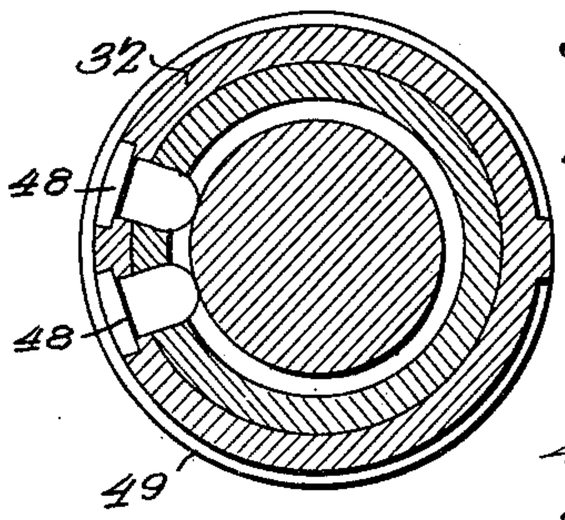



Fig. 4.

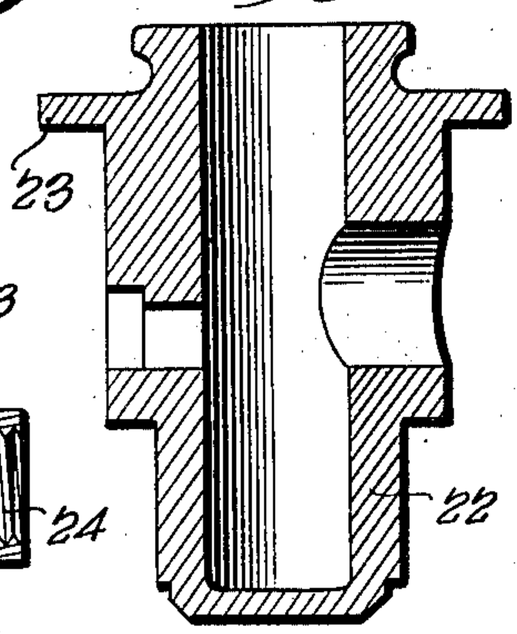
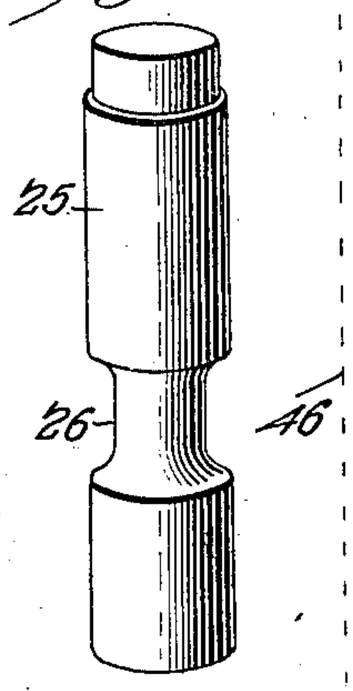



Fig. 5.


Fig. 3.



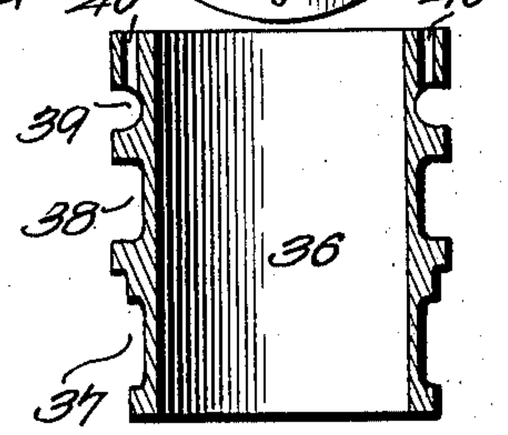




Fig. 6.

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No. 736,555. Patented August 18, 1903.

# UNITED STATES PATENT OFFICE.

CHARLES HENRY SHAW, OF DENVER, COLORADO.

## PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 736,555, dated August 18, 1903.

Application filed November 11, 1901. Serial No. 81,937. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES HENRY SHAW, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented a new and useful Pneumatic Tool, of which the following is a specification.

The invention relates to certain improvements in pneumatic tools of that class in which a reciprocating piston acts upon the shank of a chisel or other tool.

One object of the invention is to so construct the cylinder and piston as to obtain a long stroke of the piston with a correspondingly-increased impact upon the tool and to more fully control the movement of the piston without waste of the air or other fluid employed as an actuating medium.

A further object of the invention is to provide an effective cushioning of the piston on its rear stroke to overcome the momentum of the piston and prevent any direct contact between the latter and the end of the cylinder; and a still further object is to combine an improved form of valve adapted to be operated by the air or other fluid when compressed by the rear stroke of the piston.

With these and other objects in view the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the drawings, Figure 1 is a longitudinal sectional elevation of a pneumatic tool constructed in accordance with my invention. Fig. 2 is a similar view, on a somewhat larger scale, with the valves in different positions. Fig. 3 is a detached perspective view of the valve for governing the admission of the actuating fluid to the tool. Fig. 4 is a sectional elevation of the valve-casing detached. Figs. 5 and 6 represent, respectively, an end elevation and sectional view of the automatic valve for controlling the movements of the piston. Fig. 7 is a transverse sectional elevation, on an enlarged scale, on the line 7 7, Fig. 1. Figs. 8, 9, 10, 11, 12, 13, 14, and 15 are views similar to Fig. 7 on the sectional lines of Fig. 1, bearing their corresponding reference-numerals.

Similar numerals of reference are employed to designate corresponding parts throughout the various figures of the drawings.

The cylinder 20 is of a length corresponding to the desired length of stroke of the piston and is adapted to receive a solid cylindrical piston 21. One end of the cylinder is counterbored for the reception of a valve-containing box or casing 22, adapted to fit snugly within the cylinder and held from movement in one direction by an annular flange 23, fitting over the end of the cylinder, and in the opposite direction by the air-pipe nipple 24, which is screwed into a threaded opening in the side of the cylinder and enters an alining opening in the valve-casing. In a suitable chamber in the valve-casing is a cylindrical valve 25, having an annular port or passage 26, which when in alinement with the nipple-opening permits the air or other fluid to pass from the nipple to and through the main port 27, leading to the controlling-valve. The valve 25 is normally held in the closed position by helical compression-spring 28, partly seated in an opening in the lower end of the valve and having its lower end in contact with the lower wall of the valve-chamber. The valve 25 is of such length that its upper end projects beyond the valve-chamber for contact with a handle 29, carried by or forming part of a sleeve 30, mounted on the cylinder, the latter being confined in position by the nipple 26 and having sufficient play to permit its being moved against the valve to open the same. The handle is normally held from contact with the valve by a helical spring 31, and the valve being operated upon by the spring 28 is normally held in a crossed position. To place the tool in operation, all that is necessary is to depress the handle and open the preliminary valve. The compression-spring 31 acts while the tool is in use to take up the shock or jar resulting from the rapid impact of the piston on the shank of the tool, reducing the strain on the operator.

The cylinder 20 is made in two seetions or is provided with an outer jacket or casing 32, extending from end to end thereof and projecting slightly beyond the lower end of the tool for the reception and support of a tool-receiving socket 33 of a construction more fully described hereinafter. This construction of the cylinder permits of the formation

of more perfect ports than could be accomplished by coring, the ports being either cast or milled in the periphery of the main cylinder 20 and then inclosed and covered by the concentric jacket 32.

The upper portion of the cylinder is counterbored to form two annular valve-seats 34 and 35, against which fit the end and the shoulder portion of an annular valve 36. The valve is provided with a central opening of the same diameter as the cylinder and is guided to some extent by the lower end of the valve box or casing 22, there being between said valve box or casing and the adjacent inner walls of the cylinder an annular groove or space for the reception of the upper end of the valve and forming a cylinder into which fluid under pressure may be introduced to effect a downward movement of said valve at each downstroke of the piston. The lower end of the valve projects some distance beyond the valve-seat 34 to afford sufficient area for the air or other fluid compressed on the upstroke of the piston to move said valve in an upward direction, it being noted, however, that the entire area in the lower end of the valve is much smaller than the area of the upper end of the valve, so that when both are exposed to equal pressure the valve will be moved downwardly. In the periphery of the valve 36 are annular ports 37, 38, and 39 for directing the course of the actuating fluid, and from the latter port lead small passages 40 to the upper surface of the valve to admit air above the valve when the latter is to be moved.

The various ports and passages referred to in the following description are cut or otherwise formed in the cylinder-wall and are clearly illustrated in the transverse sectional views Figs. 7 to 14, inclusive. For the sake of clearness, however, the various ports have been omitted from Fig. 1, their course being indicated by dotted lines extending outside the figure.

The port 27 leads from the primary valve-chamber to a point near the lower end of the automatic valve 36 and when the valve is elevated, as shown in Fig. 2, permits the flow of air into the upper portion of the cylinder to move the piston downwardly. This port is divided into three or more sections in order not to weaken the cylinder-wall, as indicated in Figs. 7 to 12, inclusive. When the valve 36 is fully down, this port communicates with the annular port 37 of the valve and is placed by the latter in communication with a port 41, leading to the lower end of the cylinder and preferably formed in two sections, as indicated in Figs. 11 to 14.

When air has been admitted through the port 41 to the lower end of the cylinder, the piston 21 is raised by the air-pressure until it has passed an opening 42, formed directly through the wall of the cylinder and permitting the escape of air from the lower end of the cylinder. The pressure of the air will impart during its brief action sufficient momentum to the piston to carry the latter to the limit of the upstroke, the piston as it approaches the limit of its upward movement driving out the air from the upper portion of the cylinder through an escape-port 43, which leads to the valve-chamber, at a point in line with the annular port 38 of the valve and is placed by the latter in communication with openings or ports 44, leading to the outer air. To provide for the quick escape of the air, the port 43 is formed in four sections, giving a large area for the passage of the air from the cylinder.

When the piston reaches the lower end of the port 43, it acts as a valve to close said port. The air contained within the cylinder above the port is compressed by the upward movement of the piston until the pressure is sufficient to cause the upward movement of the valve 36, which again places the main pressure-port 27 in communication with the upper end of the cylinder. The upward movement of the piston, however, is so rapid that the piston will pass beyond the lower end of the port 27 and enter the chamber formed in the interior of the valve 36, the air within said chamber forming a dead-cushion which gradually stops the movement of the piston. The compressed air within this chamber will in expanding drive the piston downwardly, imparting to it an initial movement sufficient to carry it past the port 27, whereupon the air entering through said port will act upon the piston and effect the completion of its downward stroke. As the valve 36 is in the elevated position during the downward stroke of the piston, communication will be closed between the escape-port 43 and the outlet-openings 44, so that no air can escape from the cylinder through this port. As the piston nears its limit of the downward movement it passes a port 46, the upper end of which is at this time in communication with the annular port 39 of the valve 36, and a quantity of the compressed air flows from the cylinder through the port 46, thence through port 39 and openings 40 to the annular chamber in which the valve is situated, the air acting on the top of the valve and on the bottom of the valve with equal pressure; but, as before stated, the area at the top of the valve is greater than that of the bottom and a downward movement of the valve ensues, cutting off the flow of air through the port 27 to the upper end of the cylinder and opening communication between the exhaust-port 43 and the outer air, in readiness for the next upward movement of the piston. At the same time communication is opened between the port 27 and the port 41, permitting the flow of air to the lower end of the cylinder and starting the piston on its upward movement.

In order to further strengthen the connections between the cylinder and its jacket 32, the lower portion of the jacket is provided with an annular shoulder 45, on which the lower end of the cylinder rests, and the flange 23 of

the valve-chamber 22 is of a width sufficient to overlap both the cylinder and its jacket, while at the same time the nipple 24 also tends to prevent any longitudinal displacement.

In the lower portion of the jacket is secured a tool-receiving socket 33, into which the shank of the tool may be inserted in position to receive the impact of the piston. In order to hold the tool in position and at the same time to permit of its ready insertion or removal in the socket, the shank of the tool is provided with an annular groove 46, into which extend pins 47, having rounded inner ends, and the heads of such pins are acted upon by a curved spring 49, seated in the groove or recess milled or otherwise formed in the periphery of the jacket 32. This structure is such as to permit of the ready changing of tools, while at the same time the tool will be held from accidental displacement.

While the construction herein described, and illustrated in the accompanying drawings, presents the device in its prefered form, it is obvious that many changes in the form, proportions, size, and minor details of construction may be made within the scope of the claims without departing from the spirit or sacrificing any of the advantages of my invention.

Having thus described my invention, what I claim is—

1. In a pneumatic tool, the combination of the cylinder having at one end an annular valve-chamber of a diameter greater than the bore of the cylinder, said chamber having two concentrically-disposed shoulders arranged in different planes, a peripherally-ported annular valve guided within the chamber and adapted to fit against said shoulders, said valve having a central bore of a diameter equal to the bore of the cylinder and the area of the lower face of said valve being less than the area of the upper face thereof, means for closing the upper portion of the valve-bore to form a dead-cushion space within the valve, a piston adapted to enter the bore of the valve after leaving the cylinder and to effect an opening movement of said valve by the compression of air during the latter portion of the piston-stroke, the valve-opening movement being in the same direction as that in which the piston is traveling, a piston-controlled port leading to the valve-chamber, longitudinal ports or passages formed in the valve between one of the peripheral ports and the upper end of said valve to permit the entrance of air under working pressure to said valve-chamber, and ports or passages leading through the walls of the cylinder and controlled by said valve.

2. In a pneumatic tool, the combination of the cylinder having at one end an annular valve-chamber, an annular valve adapted to said chamber and having peripheral ports or passages, and longitudinal ports or passages extending from one of the peripheral ports to the upper end of the valve, and a piston adapted to reciprocate in said cylinder.

3. In a pneumatic tool, the combination of the cylinder having at one end two concentrically-disposed shoulders 34, 35 arranged in different planes, a pressure-operated valve having annular ports and adapted to fit against said shoulders, said valve being further provided with longitudinal ports or passages extending from one of the annular ports to the upper end of the valve, there being in the walls of the cylinder longitudinally-disposed feed and exhaust ports in communication with the annular ports of said valve, and a piston adapted to reciprocate in the cylinder, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CHARLES HENRY SHAW.

Witnesses:
C. F. SCHOFIELD,
M. T. GOSS.