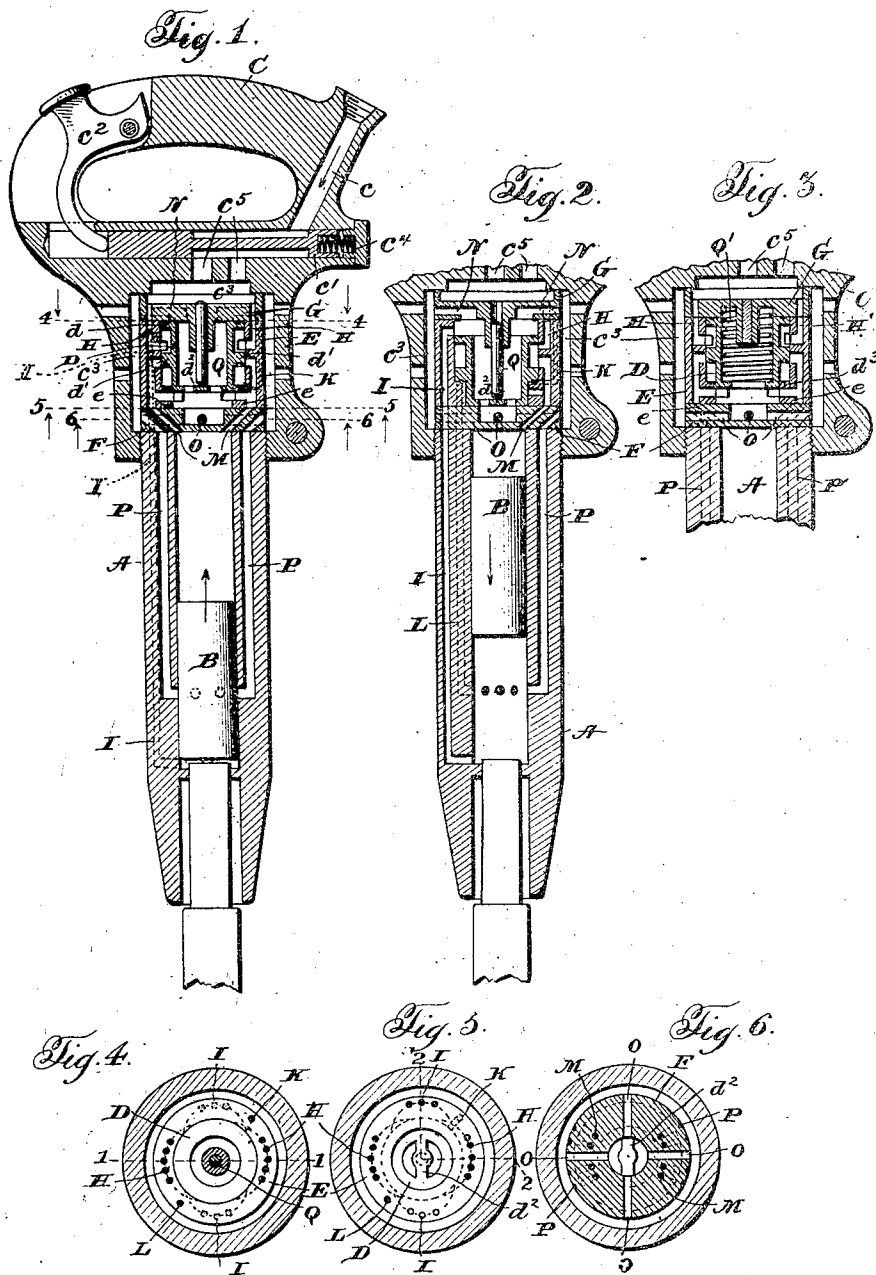


H. R. PRINDLE.
PNEUMATIC TOOL.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

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To all whom it may concern:

Be it known that I, HAROLD RITTENHOUSE PRINDLE, of Philadelphia, in the county of Philadelphia, and in the State of Pennsylvania, have invented a certain new and useful Improvement in Pneumatic Tools; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a pneumatic tool embodying my invention, the parts being shown in position when the piston has just delivered its blow, and is ready to return; Fig. 2 is a similar view showing the position of the parts just after the piston has commenced to move in the direction to strike the blow; Fig. 3 is a similar view to Fig. 1, but showing a portion only of the tool to illustrate a spring-actuated valve; Fig. 4 is a horizontal section on the line 4—4 of Fig. 1; Fig. 5 is a horizontal section on the line 5—5 of Fig. 1; and, Fig. 6 a horizontal section on the line 6—6 of Fig. 1.

The object of my invention is to provide a pneumatic tool which, among other advantages, will be economical in the consumption of air, will have an ample exhaust to avoid working against back-pressure, and have a valve mechanism reliable in its action, and of few parts, so that it may be easily assembled and taken to pieces, and to these ends, my invention consists in the pneumatic tool having the construction substantially as hereinafter specified and claimed.

The tool in which I have embodied my invention, and which has been selected for illustration, is a pneumatic hammer having a chambered body or cylinder A, of the usual form, a hammer B reciprocable therein and consisting of a simple cylindrical block and a grip form handle C, one end of the cylinder being threaded externally and the shank of the hammer being threaded internally for the coupling together of the cylinder and handle, as usual. The handle C has an air passage c that is controlled by a throttle valve c', controlled by a lever c'' adapted to be actuated, as is usual, by the hand gripping the handle. The valve c' consists of a simple cylindrical rod or bar reciprocable in a cylindrical cavity or chamber extending transversely of the handle with which the air inlet c communicates at one end, the rod intermediate its end being reduced in diameter to provide an annular space for the passage of air into the

valve chamber c³ which contains the valve D which, as usual, automatically controls the supply of air under pressure to opposite ends of the piston B to reciprocate the same. One of the ends of the rod coacts with an air inlet c, and constitutes the valve proper, and it is yieldingly held in closed position by means of a coil spring c⁴, one end of which is situated in a cavity in such end of the rod and the other bears against a screw plug which closes the transverse passage in the handle. The other end of the rod is engaged by the operating lever c². My throttle valve is extremely simple and inexpensive, and may be most readily placed in and removed from position.

The valve D is cylindrical in shape, and is hollowed or chambered longitudinally from end to end, and it is reciprocable in a cylindrical valve box E situated in the chamber or cavity c³ in the handle shank or stem and placed between a disk or cap F that closes the cylinder A at one end, and a disk or cap G at the end of the chamber or cavity in the handle stem or shank, into which air flows when the throttle valve is open. One or more ports c⁵ lead from the throttle valve chamber into said end of the chamber c³. The valve D at its end nearest the cap plate G has an annular flange d, and about its mid-length it has a similar flange d', the annular space between said flanges constituting an air passage, and said flanges are of the same diameter and slidingly fit the interior of the valve box. Contiguous to the other plate or disk F the valve box has an inwardly projecting shoulder or flange e whose internal diameter is the same as the external diameter of the valve, so that the latter is slidably fitted therein at its inner end. Between the mid-length valve flange d' and the valve box flange e a second air space around the valve is provided.

Ports or passages H lead from the end of the valve chamber c³ into which air enters to the annular space between the valve flanges d and d', and a port or passage I leads from said annular space to the end of the cylinder A reached by the hammer B in completing its travel in striking the blow. A port or passage K leads from one of the ports or passages H to the annular space between the valve mid-length flange d' and the valve box flange e to supply air under pressure to such space, and a port or passage L also leads to such annular space from the

cylinder A at a point near the end thereof reached by the hammer B in striking a blow, the hammer thus closing communication of the cylinder and such port L a short while before reaching its stroke in delivering a blow, and uncovering it a short while after commencing its travel in the opposite direction. Ports or passages M lead from the space between the mid-length valve flange d' and the valve box flange e to the outer end of the cylinder A or the end to which air is supplied to move the hammer in the direction to strike its blow. For the egress of exhaust to the atmosphere, there are a series of ports N which are in communication with and lead from the end of the valve chamber in which the valve flange d is located to the chamber c^3 , from which ports lead to the exterior of the tool, and there are a series of ports O that lead from the other end of the valve box to said chamber c^3 . There are also exhaust passages or ports P which lead from the cylinder A near the end thereof reached by the hammer B in striking its blow, and which are preferably carried to a point so that their outlets are in communication with said annular chamber c^3 to avoid a discharge of air on the hand of the workman holding the tool.

The valve is moved in one direction by pressure upon the mid-length annular flange d' supplied from the port K, and to move it in the opposite direction I may employ air pressure, using the construction illustrated in Fig. 1, or spring pressure, using the construction illustrated in Fig. 3. In the construction illustrated in Fig. 1, a rod or pin Q is used extending axially of the valve with one end exposed to live air pressure coming from the throttle valve chamber, and the opposite end engaging a bearing in the form of a cross-bar d^2 at the inner end of the valve, the pin being supported and guided by an opening in the cap plate or disk G which it slidably fits. The pressure-receiving end of the pin is small in comparison with the pressure-receiving area of the flange d' , so that when air acts upon said flange d' it will move the valve in opposition to the pressure on the pin. The point of engagement of the pin and the valve is advantageous, since the pin acts on the valve without any tendency to bind or twist the same.

When a spring Q' is employed to move the valve in one direction, it may be applied as illustrated in Fig. 3, where one end of it has a seat in the cap plate G and the other end bears against an inwardly turned annular flange d^3 at the inner end of the valve. The valve may be constructed so that it may be adapted for use either with the pin or the spring, so that in an emergency, or under any other conditions making it desirable, one may be substituted for the other. In this case, of course, the construction of cap

plate and valve G, shown in Fig. 1, would be employed, and for the substitution of the spring for the pin, it would be necessary merely to plug up the guiding opening in the cap G provided for the use of the pin.

The operation of my tool is as follows:—With the parts shown in Fig. 1, where the hammer has just delivered its blow and is about to return, live air from the handle passing into the valve box through the ports 8 will enter the annular space between the flanges d and d' of the valve D and pass thence into the ports I and enter therefrom the outer end of the cylinder. The hammer will thereby be moved on its return stroke to the opposite end of the cylinder under the pressure of the incoming air until its end uncovers the exhaust ports P and the port L which leads from the interior of the cylinder to the space between the valve flange d' and the valve box flange e , thus removing pressure from the valve flange d' , whereupon through the action of live air pressure upon the valve-operating pin Q, if it be used, or by the medium of the spring Q', if it be used, the valve will shift to the position shown in Fig. 2. Although the pressure of live air is removed from the hammer before the latter completes its return stroke, it will have acquired sufficient momentum to carry it the desired distance in the cylinder on its return stroke. During the return stroke of the hammer, as described, the air in advance of the same will be exhausted from the cylinder, passing therefrom through the ports M into the valve box, and some of it will escape therefrom through the ports O and some will pass through the valve and escape through the ports N. One of the features of my invention is the utilization of the chamber or passage through the valve for the outlet of exhaust air. It will be seen that the provision for the exhaust of air is most abundant, and is such that the hammer is not working against any pressure. The valve being shifted to the position shown in Fig. 2 places the inlet ports H and the ports M which communicate with the cylinder in communication by means of the annular space between the valve flanges d and d' , and the valve remains in such position, and live air acts upon the hammer to move it to strike the blow until the hammer, by its onward movement, covers the port L at the point where it opens into the cylinder, whereupon, by the access of air to the valve box between the valve flange d' and the valve box flange e through the port K, the air from said port K acting upon the valve flange d' will shift it to the position shown in Fig. 1, where it is maintained until, on the return stroke of the hammer, as has already been described, the port L where it opens into the cylinder is again uncovered, and pressure from air entering through the port K is removed from the valve flange d' .

Preferably, the opposing faces of the valve flange *d'* and the valve flange box *e* are provided with grooves for the admission of air between them when the valve is in the position shown in Fig. 2. During the movement of the hammer for striking a blow, as I have just described, air in advance of the hammer is exhausted from the cylinder through the ports *P* and also through the ports *I*, which, when the valve is in the position shown in Fig. 2, are uncovered where they open into the outer end of the valve box. It will be seen that an abundant provision for the exhaust of air is also made in my tool when the hammer is moving to strike its blow.

Some of the very desirable features of my tool have already been mentioned. Others are the small number of parts of the valve mechanism; the form of the hammer, which is a simple cylindrical block, which, among other advantages, possesses that of being reversible because of the absence of grooves or special formation of it; and its ability to dispose of particles of ice which, in out-door work in cold weather, forms in the valve mechanism, and which, in my tool, by the motion of the valve, are broken up, and because of the large exhaust ports which I am able to employ, readily pass out of the tool.

Having thus described my invention, what I claim is:—

1. In a pneumatic tool, the combination of a valve box, a chambered valve therein communicating at its ends with the interior of the valve box, an exhaust port leading from within the valve box at each end of the box, a piston-containing cylinder, and an exhaust port or ports leading therefrom to the valve box, and being in communication with the interior of the valve, air from said exhaust port passing to the atmosphere, in part directly through one of the exhaust ports at the end of the valve box, and in part through the valve to the exhaust port at the other end of the valve box.

2. In a pneumatic tool, the combination of a valve box, a valve having an internal passage, having at one end an annular flange, and intermediate its ends an annular flange fitting the valve box, and an annular flange in the valve box at the end of the valve oppo-

site that having the flange, a live air passage leading to the space between the two valve flanges when the valve is in one position, a live air passage leading from such space when the valve is in its other position, a piston-containing cylinder to which said last-named passage leads, and an exhaust port in communication with the interior of the valve.

3. In a pneumatic tool, the combination of a cylinder, a piston therein, a valve, passages controlled by the valve leading to opposite ends of the cylinder, a passage from the cylinder to the valve adapted to be closed by the piston before completing its travel in one direction, two exhaust passages from the cylinder at or near the same end thereof, but opening thereinto at different points along its length, and an exhaust passage from the other end of the cylinder.

4. In a pneumatic tool, the combination of a valve box, a hollow valve, the interior of the valve having a passage for exhaust, a pressure receiving surface on the exterior of the valve, a live air port leading to such surface to deliver fluid under pressure thereto, and means for applying power to the interior of the valve to move it in the opposite direction to that in which it is moved by pressure applied to said pressure-receiving surface.

5. In a pneumatic tool, the combination of a valve, a pressure-receiving surface for moving the valve in one direction, a port for delivering live air to such surface, and means for moving the valve in the opposite direction comprising a pin acting on the valve and having one end constantly exposed to air under pressure.

6. In a pneumatic tool, the combination of a hollow valve, a pressure-receiving surface on the exterior of the valve, a port for delivering live air to said surface, and a pin having one end in engagement with the valve on the inside thereof, and the other end exposed to air under pressure.

In testimony that I claim the foregoing I have hereunto set my hand.

HAROLD RITTENHOUSE PRINDLE.

Witnesses:

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HARRY REDEKER.