

(No Model.)

3 Sheets—Sheet 1.

D. DRAWBAUGH.
PNEUMATIC TOOL FOR ROCK CUTTING.

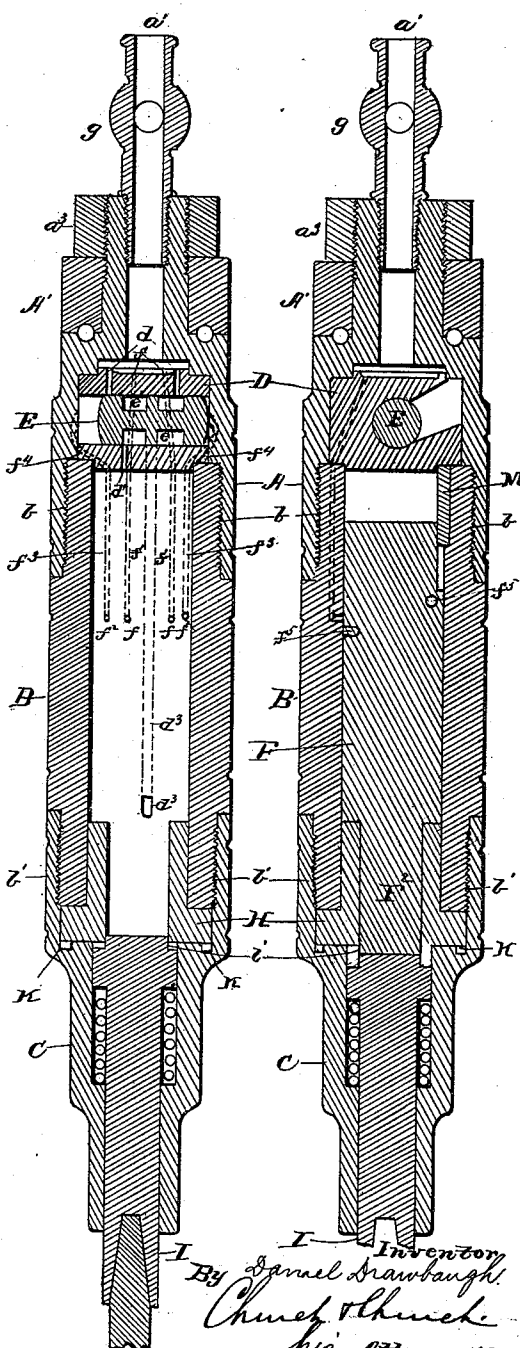
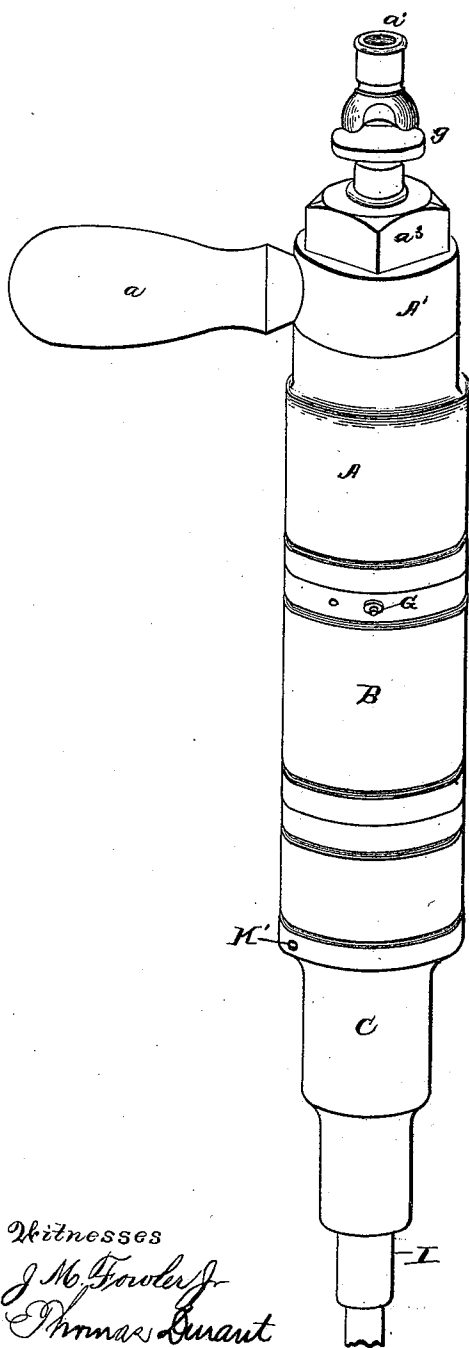
No. 464,820.

Patented Dec. 8, 1891.

Fig. 1

Fig. 2

Fig. 3



Witnesses

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By Daniel Drawbaugh
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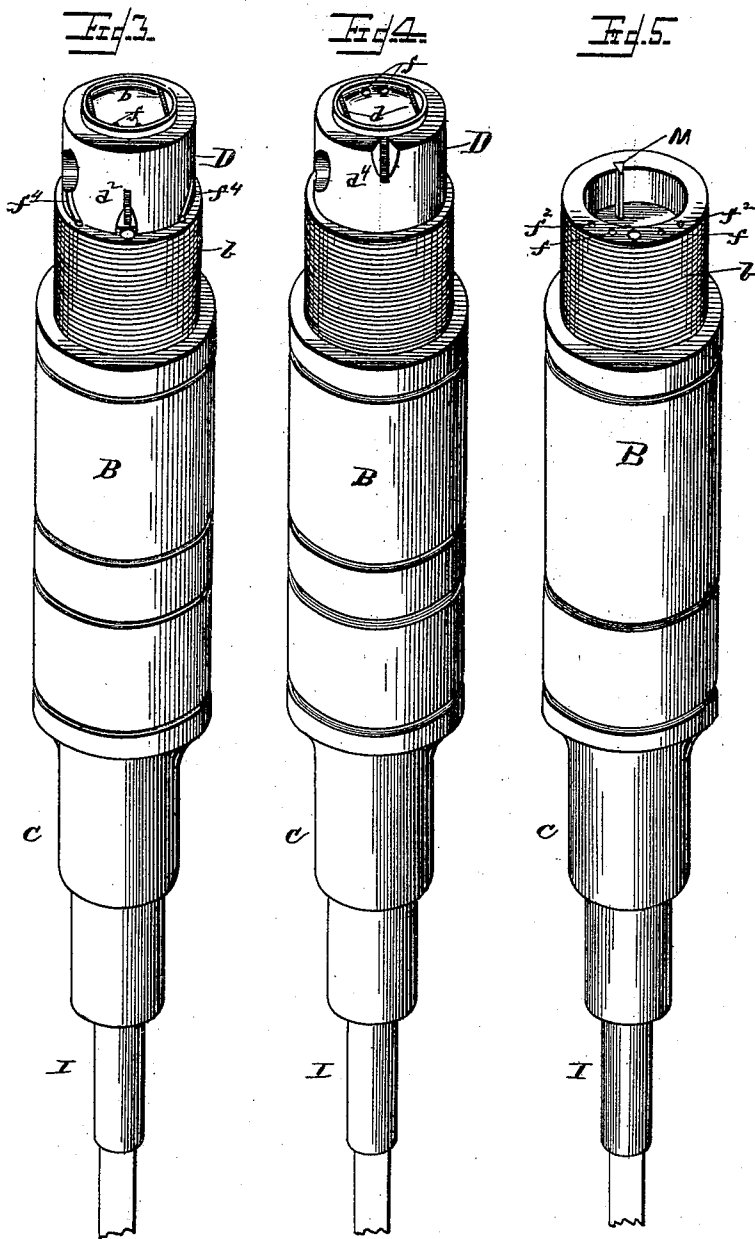
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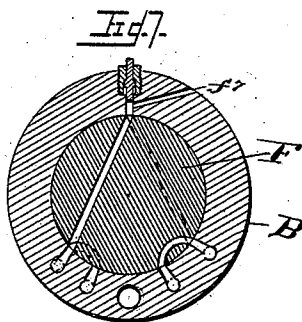
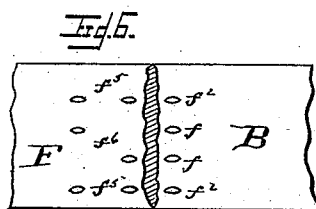
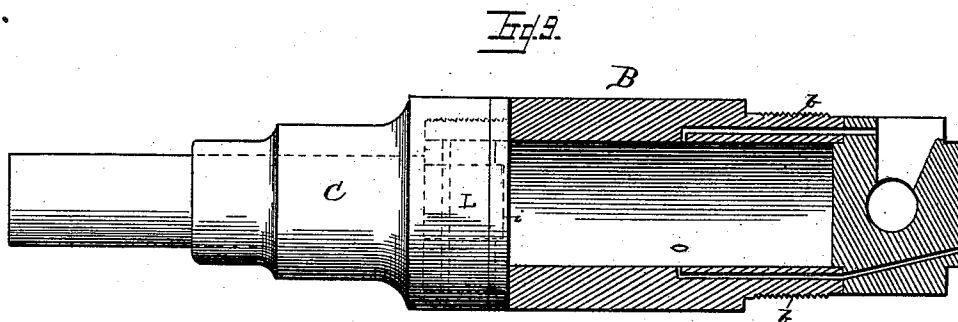
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Witnesses:

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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL FOR ROCK-CUTTING.

SPECIFICATION forming part of Letters Patent No. 464,820, dated December 8, 1891.

Application filed August 27, 1891. Serial No. 403,876. (No model.)

To all whom it may concern:

Be it known that I, DANIEL DRAWBAUGH, of Eberly's Mill, in the county of Cumberland and State of Pennsylvania, have invented certain new and useful Improvements in Pneumatic Tools for Rock-Cutting; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates, particularly, to that class of devices in which the work is performed by a hammer or piston driven by compressed air or similar elastic fluid and adapted to strike a series of sharp blows upon a tool-stock or member connected therewith, whereby the substance to be operated upon is cut, indented, or otherwise acted on, according to its nature and the character of the tool employed.

The objects of the invention are, first, to provide an exceedingly simple and effective tool in which the valve is separate from the hammer or piston and located in an independent valve-box, said valve being operated itself by compressed air, the admission of which is controlled by the piston; second, to provide a means for controlling the rapidity of the stroke delivered by the piston, and, finally, to provide a tool which, when desired, may be set to operate automatically when brought into contact with the work and to automatically discontinue its operation when removed from the work.

The invention consists in certain novel details of construction and combinations and arrangements of parts to be hereinafter described, and pointed out particularly in the appended claims.

In the accompanying drawings, Figure 1 is a perspective view of the preferred form of tool. Fig. 2 is a longitudinal vertical section of the same, taken in a plane longitudinally of the valve. Fig. 3 is a perspective view with the top section or portion of the casing removed, and Fig. 4 is a similar view from the opposite side. Fig. 5 is a similar view with the valve-block removed. Fig. 6 is a diagrammatic view of the ports in the cylinder or piston and hammer controlling the

passage of air to and from the valve. Fig. 7 is a cross-sectional view through the piston or hammer and cylinder, showing the exhaust-port for the valve. Fig. 8 is a longitudinal vertical section showing the hammer at the forward extreme of its movement, with the valve-controlling ports past the corresponding ports in the cylinder, leaving the hammer at rest in the position shown. Fig. 9 is a detail longitudinal section showing the exhaust-passage from the valve opening into the main exhaust.

Similar letters of reference in the several figures indicate the same parts.

In constructing the present tool the casing is preferably made in three pieces, the top section A being adapted for the application of a handle, such as *a*, and constitutes a chamber for the reception of the valve-block, the middle section B, which constitutes the cylinder proper and is provided with screw-threaded extensions *b b'*, respectively adapted to screw into the top and bottom sections, as shown, and the point-section C, which constitutes the holder for the tool-stock, and in some instances forms a closure for the lower end of the cylinder. The upper section is provided with the usual air-entrance port *a'* at the center, and in the present instance is also provided with the main exhaust-port, which is located at one side of the circular section A' of the handle, which surrounds the extension forming the air-port, this exhaust-port being located on the side away from the operator when the tool is properly grasped, and thus always free from obstruction by the operator's hand or body, and in order that the same may always be in proper connection with the passage leading up from the cylinder an annular recess is formed in the two contacting faces of the upper section of the casing and piece A' of the handle, respectively, which passage thus always forms a free connection through which the exhaust can pass, no matter what the adjustment of the handle is with relation to the tool. The handle, it will be understood, may be held in place by any securing means, preferably, however, a nut *a''*, which screws down on the

threaded portion of the extension forming the air-port.

A portion of the device, which I have and shall herein term the "valve-block," is adapted to fit accurately within the upper section 5 A, while the block itself is preferably secured firmly in the upper end of the cylinder in such manner as to cause the passage formed therein to register with the passages in the 10 walls of said cylinder or casing. This block is lettered D and is provided with a transverse cylindrical valve-chamber, in which works a valve E, controlling the passage of air to and from the piston or hammer F, located in the cylinder below. The valve, as 15 will be seen by reference to Fig. 2, is cylindrical and provided with two annular chambers *e*, separated by a relatively narrow annular ring or wall at the center of the valve, and in order to make the valve light to facilitate its easy and instantaneous movement 20 the walls of the end abutments, as well as of the central ring, are undercut, permitting a full effective surface to be secured with the employment of exceedingly light valves.

Leading in from the top of the valve-block are two main air-passages *d*, located just far enough apart to prevent them both being open to their respective chambers in the valve 30 at the same time, and leading from the bottom of the valve-chamber are two corresponding ports located somewhat closer together, the one *d'* opening directly into the upper end of the cylinder and the other *d''* leading out to one 35 side and registering with a passage *d'''*, terminating in a port opening into the cylinder at the opposite end, with which construction, it will be seen, that when the valve is moved longitudinally to one extreme of its movement air will be admitted to one end of the 40 cylinder and when at the opposite extreme of its movement air will be admitted to the opposite end of the cylinder, the exhaust taking place simultaneously from the side opposite that receiving air through a centrally- 45 arranged exhaust-passage *d''''*, which communicates with the annular passage between the handle and upper section before mentioned.

The hammer F is constructed of a solid 50 piece of metal not weakened nor scarred by large passages, valve-operating devices, or other complications which have heretofore been found detrimental by causing the cylinder to wear rapidly, to say nothing of the necessary retardation of the movement of the 55 hammer and the consequent decrease in its effective stroke due to such arrangements. In order, however, to cause the proper throw of the valve when the piston has reached the 60 extremes of its movement, two small air-passages *f* lead down through the valve-block and register with two corresponding passages *f'*, passing down into the walls of the cylinder to a convenient point, where they open inwardly. A short distance on one side of each 65 of the ports *f'* is located a port *f''*, from which passages *f'''* lead up parallel to passage *f'* and

communicate at the top of the cylinder with passages *f''''*, opening out at the ends of the valve, respectively, and thus it is only necessary to establish communication between the 70 ports *f'* and *f''* at the proper moment to cause the valve to be thrown from one extreme to the other. To accomplish this, as well as to effect the necessary exhaust from the ends of 75 the valve, the piston or hammer is provided with ports *f''''*, located a distance apart longitudinally of the hammer approximately equal to the length of the stroke, which ports *f''''* open communication between the ports *f'* *f''* 80 for one end or the other of the valve when the piston or hammer is at the corresponding extreme of its stroke. The exhaust is effected by means of ports *f''''*, located in the piston or hammer and adapted to register with the 85 ports *f''* at the same moment that the ports *f'* *f''* for the opposite end of the valve are put in communication. The ports *f''''* in the preferred arrangement register at the proper moment with an exhaust-port *f''''''* in the wall of 90 the cylinder.

When it is desired to regulate the speed at which the hammer shall repeat its stroke without materially affecting the force of the blow delivered, it is accomplished by throttling one of the air-passages for the valve, 95 thus making the valve repeat its stroke more slowly. I prefer to throttle the exhaust-passage leading from the side of the cylinder, and to do this a simple pin-valve G is located in the side of the cylinder and adapted to partially but never entirely close said passage. (See Fig. 5.) When the pin is pressed in by the operator's fingers, it partially closes the 100 passage-way, and the speed at which the tool operates may be thus effectually controlled without effort on his part and without materially affecting the force of the blow delivered.

When it is desired to decrease the speed of 110 the hammer and also the effectiveness or strength of the blow delivered, it is accomplished by throttling the air-supply for the whole machine by means of the stop-cock *g* in the supply-pipe.

It will be understood, of course, that the exhaust for the valve may lead into the main exhaust-passage, as shown in Fig. 9, where the throttling device is omitted for the sake of clearness. 115

In the preferred construction the lower end of the cylinder is closed by a plug H, having a relatively small central opening, through which a prolongation F² of the hammer projects and into which, also, the upwardly-extending end *i* of the tool-stock I projects, said 120 projections being hardened to resist the wearing effects due to the constant striking together, and the block H serving to effectually limit the movements of the two parts. 125

The tool-stock is surrounded by a spiral spring, which may be strong enough to hold it up against the block; but in the preferred construction the weight of the tool-stock and 130

tool, supplemented by the pressure of the air on the upper end of the piston or hammer, is just sufficient to allow the piston or hammer to rest against the block H, in which position the ports f^5 for moving the valve are just below the ports f' and no air can pass from one to the other, the result of which arrangement is that the hammer remains at rest in this position until the tool, coming in contact with the surface to be operated upon, raises the piston or hammer a very slight distance, causing the ports $f' f^5$ to register and the piston or hammer to immediately begin its reciprocations. This result, it will be seen, is accomplished by giving the piston having the ports therein controlling the throw of the valve a throw greater than normal, or giving it a movement in one direction far enough to cause the co-operating port for the valve air-supply to pass each other without throwing the valve and causing a return movement of the piston or hammer. Practice has demonstrated this to be an accomplished fact, and it is found especially useful where the tools are used in gangs carried by mechanical appliances for dressing off projections or uneven surfaces.

The ports in the piston or hammer and the corresponding ports in the walls of the cylinder are preferably formed somewhat elongated or tapering down to points in both directions for the purpose of facilitating the movement of the valve and preventing the same from being moved too suddenly, the shape of the ports being such, as will be seen from an inspection of Fig. 6, that the air is let in and cut off gradually—that is to say, in a relatively gradual manner, inasmuch as the hammer and valve may under some circumstances be caused to make thirty thousand reciprocations a minute.

To prevent air-cushions forming at the bottom of the tool below the block H and enlargement on the tool-stock, annular ring k is formed in the point-section with an aperture or apertures k' , leading to the exterior of the tool.

In Fig. 9 the construction of the point-section is somewhat modified, being particularly adapted for use in small tools. In this instance the tool-stock is provided with a relatively long projection z , which passes through a removable ring L and is adapted to be struck by the lower end of the piston or hammer, which is made straight or substantially straight. The piston, it will be understood, may be prevented from rotation by any desired means; but I prefer a spline and groove M, as shown.

The wear first apparent in tools of this character usually occurs at the ends of the valves, where the same strike the walls of casing and in many devices render the same inoperative; but with the present construction of valves wear at this point is practically harmless, as the throw of the valve would not be changed to a sensible degree, no matter how

much wear takes place, and it does not diminish the efficiency of the air-cushion, which under ordinary circumstances relieves the shock of the valve against the casing at each end of its stroke.

A tool constructed as herein described will not only be found highly efficient when worked by means of compressed air, but it may be operated equally as well up to a certain pressure by suction, an advantage of the last method of operation being that the size of the vacuum-chamber need never be as large as the air-receiver when using compressed air.

Having thus described my invention, what I claim as new is—

1. In a pneumatic tool, the combination, with a casing having the cylinder therein, the tool-stock, and the piston or hammer co-operating therewith, as described, of the valve-block independent of the cylinder, the cylindrical valve working transversely therein, passages leading from the air-port to the cylinder, controlled by the valve, and passages leading from the air-port to the valve for moving the same, controlled by the piston or hammer, substantially as described.

2. In a pneumatic tool, the combination, with the casing having the central section with the cylinder therein, the tool-stock, and the piston or hammer working in the casing and co-operating with said tool-stock, of the separate valve-block fitting the upper end of the cylinder, the cylindrical valve operating transversely in the said block, and passages leading from the air-port to opposite ends of the cylinder through the valve and passages leading from the air-port to opposite ends of the valve through the piston, substantially as described.

3. In a pneumatic tool, the combination, with the casing having the cylinder therein, the piston or hammer working in said cylinder, and the valve, of air-passages leading from the air-port to opposite ends of the cylinder through the valve and air-passages leading to opposite ends of the valve, controlled by the piston, and a throttle located in one of the air-passages for the valve, whereby the speed at which said valve operates may be controlled, substantially as described.

4. In a pneumatic tool, the combination, with the casing having the cylinder therein, a piston or hammer working in said cylinder, the valve, and air-passages leading from the air-ports to opposite ends of the cylinder through the valve, of air-passages leading from the air-ports to opposite ends of the valve, controlled by the piston or hammer, exhaust-passages from said valve, also controlled by the hammer, and a throttle controlling the passage of air to said exhaust-passages, substantially as described.

5. In a pneumatic tool, the combination, with the casing having a cylinder therein, the piston or hammer working in said cylinder, the valve, and air-passages leading from

the air-ports to opposite ends of the cylinder through the valve, of the exhaust-ports for the cylinder, air-passages leading to opposite ends of the valve through the piston or hammer and from said valve through the hammer to exhaust, and a pin throttle-valve controlling one of the passages for the valve, the end of said pin throttle-valve projecting outside of the casing, substantially as described.

6. In a pneumatic tool, the combination, with the casing having the cylinder therein, with air-passages opening into said cylinder, and the valve to which said air-passages lead, of the piston or hammer having air-passages therein registering with the air-passages in the cylinder when at substantially the extreme of its normal stroke, and a stop for arresting the movement of the piston or hammer at a point beyond its effective stroke, whereby the ports before mentioned are caused to pass and the hammer remain at rest until the ports are again caused to register, substantially as described.

7. In a pneumatic tool, the combination, with the piston or hammer having air-passages therein, substantially as described, of the casing having the cylinder therein, with air-passages registering with the air-passages in the piston or hammer before the same reaches the extreme of its stroke in one direction, and the valve and complementary parts, substantially as described.

8. In a pneumatic tool, the combination, with the piston having air-passages therein, and the valve, of the casing having the cylinder therein and also having air-passages leading from the air-port through the valve to opposite ends of the cylinder and from the air-ports through the piston or hammer to the opposite ends of the valve, one of said last-mentioned air-passages registering with its air-passages in the piston or hammer before the same reaches the extreme of its movement in one direction, substantially as described.

9. In a pneumatic tool, the combination, with the casing having the cylinder therein, with air-passages opening into said cylinder at the end and intermediate points, the valve to which said intermediate air-passages lead, and the piston or hammer working in the cylinder and having air-passages for connecting said intermediate air-passages, of the tool-stock having the relatively light spring for elevating the same, said tool-stock having a movement beyond the reach of the piston or

hammer when operated at its normal stroke, whereby when said stock is so moved the piston or hammer is caused to make an abnormal stroke, substantially as described.

10. In a pneumatic tool, the combination, with the casing having the cylinder therein, with air-passages from the air-port to each end of the cylinder and from the air-port to the cylinder at an intermediate point and from an intermediate point to each end of the valve-box, of the valve controlling the passages leading to each end of the cylinder, the piston or hammer having the relatively small passages for connecting the intermediate passages leading to the valve when at different portions of its stroke, and the tool-stock co-operating with said piston or hammer at one extreme of its stroke, substantially as described.

11. In a pneumatic tool, the combination, with the casing having the cylinder therein, with air-passages leading from the air-ports to each end of the cylinder and from the air-ports to the cylinder at an intermediate point and from an intermediate point to the valve-box, of the valve-box, the valve working therein and controlling the passages leading to the ends of the cylinder, and the piston or hammer working in the cylinder and having air-passages for connecting the intermediate air-passages leading to the valve, the mouths of the air-passages in the piston and co-operating passages in the cylinder being elongated and narrowed toward each end, whereby the valve is started and arrested gradually.

12. In a pneumatic tool, the combination, with the casing having the cylinder with air-passages, substantially as described, the piston, and the valve, of the handle adjustably secured to the casing and having the air-exhaust port therein, substantially as described.

13. In a pneumatic tool, the combination, with the casing having the elongated end forming the air-ports, the cylinder having air-passages, substantially as described, the piston or hammer, and the valve, of the handle having the end surrounding the elongation forming the air-port, with the air-exhaust port formed therein, the annular recess registering with the air-exhaust passage in the casing irrespective of the adjustment of the handle, and the set-nut for holding the handle in place, substantially as described.

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