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H. A. R. PRINDLE & J. U. ADOLPH.

PNEUMATIC TOOL.

APPLICATION FILED JUNE 19, 1902.

NO MODEL.

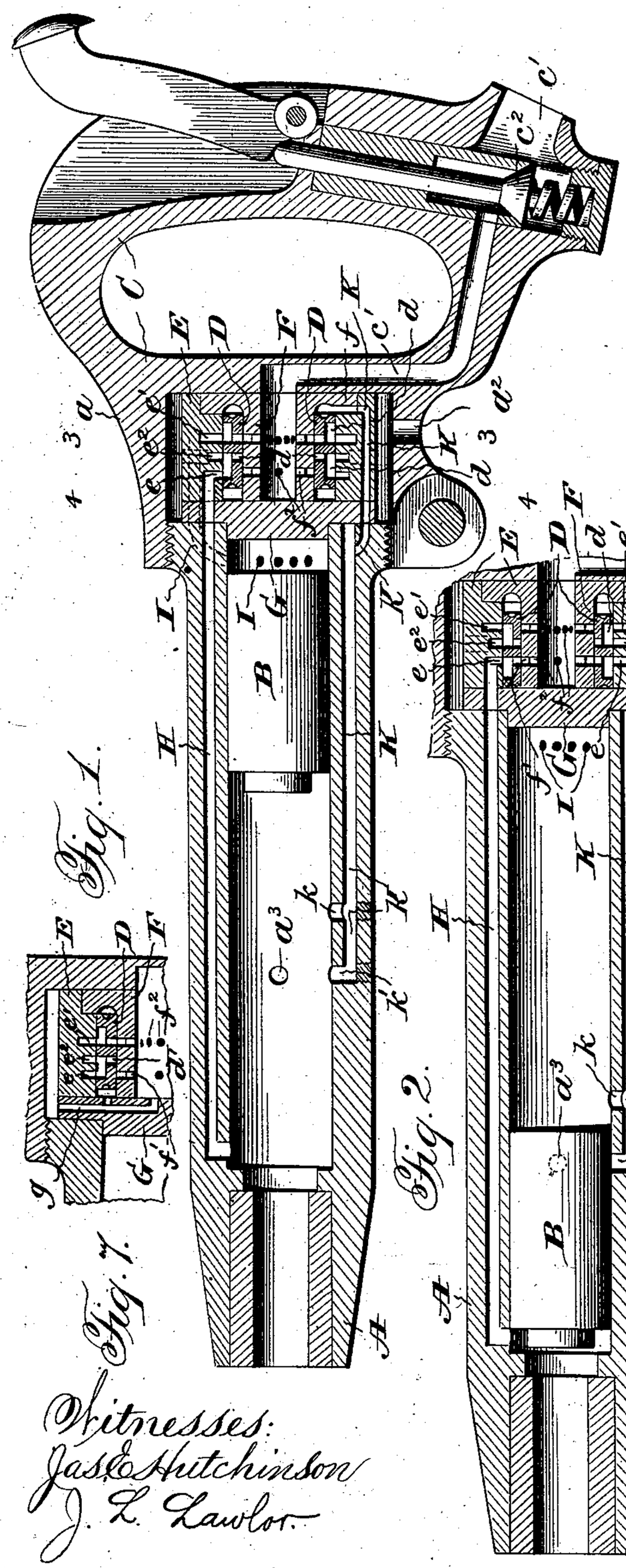

Fig. 1.

Fig. 2.

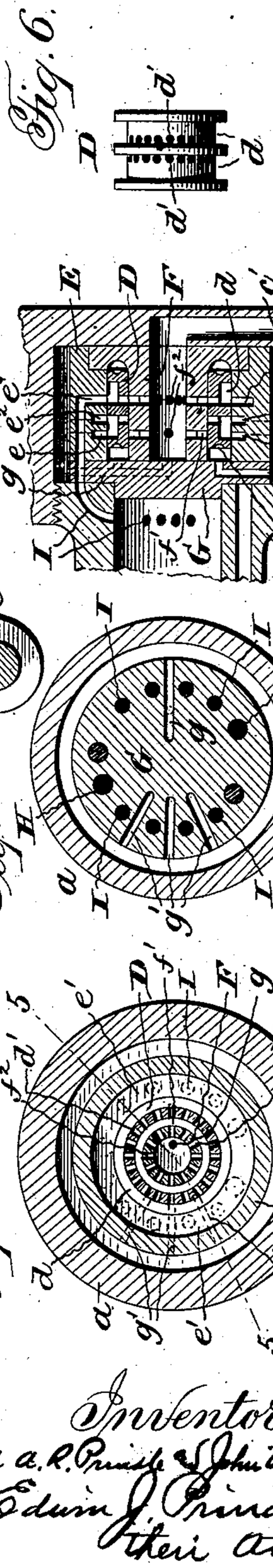

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

HAROLD A. R. PRINDLE AND JOHN U. ADOLPH, OF PHILADELPHIA, PENNSYLVANIA.

PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 724,736, dated April 7, 1903.

Application filed June 19, 1902. Serial No. 112,380. (No model.)

To all whom it may concern:

Be it known that we, HAROLD A. R. PRINDLE and JOHN U. ADOLPH, 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 we 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 hammer embodying our invention. Fig. 2 is a similar view with the parts shown in the position they occupy when the hammer has given its blow. Fig. 3 is a cross-section on the line 3 3 of Fig. 1. Fig. 4 is a cross-section on the line 4 4 of Fig. 1. Fig. 5 is a detail view, in longitudinal section, on the line 5 5 of Fig. 3. Fig. 6 is a detail view, in side elevation, of our valve; and Fig. 7 is a partial sectional view in a different plane from Fig. 5 to show in full lines a certain passage that appears in dotted lines in said figure.

The object of our invention is to provide a pneumatic tool of such construction that its cost of manufacture will be low, liability to derangement and wear reduced to a minimum, and be of high efficiency in work; and to these ends our invention consists in the pneumatic tool having the features of construction substantially as hereinafter specified and claimed.

The tool in which we have embodied our invention and which has been selected for illustration is a pneumatic hammer having a cylinder A, a piston-form hammer B, reciprocable in the cylinder, and a grip-form handle C, the cylinder and handle being screwed together, the cylinder having at one end an externally-threaded portion that engages internal thread in a chambered extension c on the handle. The handle C, as usual, has an air-passage c', that is controlled by a throttle-valve c^2, which passage at one end is adapted to be placed in communication with a source of supply of compressed air and at the other end is in communication with the valve mechanism of the tool, which mechanism is situated in the chambered extension c of the handle.

The valve D consists simply of a hollow cylinder having two circumferential or annular grooves d and radial openings or holes d', placing the interior of the valve in communication with the respective circumferential grooves. The valve is located and is longitudinally movable in a valve-box comprising a shell E, that encircles the valve, a tube F, that the valve encircles, that has at one end a flange f, fitting an annular seat or groove in one end of the shell E, and a disk G, situated between the valve, the shell, and the tube, and the end of the cylinder A. The interior of the tube is open from end to end, and it is in constant communication with the air-passage c' in the handle C. In the exterior of the tube there are two annular grooves f', each of which by radial holes f^2 is in communication with the interior of the tube. The grooves f' are given such position that they are alternately in communication with the respective grooves d of the valve D, one groove f' being in communication with a groove d when the valve is at one limit of its travel, and the other groove f' being in communication with the other groove d when the valve is at the other limit of its travel. In the inner wall of the shell E there are three annular grooves that are equidistant from each other, two adjacent ones of which at a time are adapted to coincide with one of the valve-grooves d, and the outer ones e and e' of the three being ports for the supply of compressed air to the respective ends of the hammer, while the middle one e^2 is an exhaust-port in communication with the external air by means of radial openings that lead therefrom to the outside of the shell and a hole or passage a^2 through the wall of the handle extension a. One or more passages H extend from the supply-port e through the shell, the disk G, and the wall of the cylinder A to the end of the cylinder on the striking side of the hammer B, while to the other end of the cylinder one or more passages I lead from the other supply-port e', said passage or passages

I also, of course, extending through the shell E, the disk G, and the cylinder-wall. As is usual, the shifting of the valve is automatically effected by air-pressure on opposite ends of the valve. We subject the valve at one end to a constant pressure, for this purpose forming a passage *g* in the disk G, that is in constant communication with the interior of the tube F and with a space at the end of the valve next said disk, preferably formed by an annular groove f^3 in the end of the valve, the passage *g* being carried through the disk to the exterior thereof and thence to the atmosphere, so that the pressure of the air to which the valve is subjected will be reduced. In addition to that portion of the passage *g* which leads from the end of the valve to reduce the effective pressure of the air thereon there are one or more passages *g'*, that establish communication between the groove f^3 and the atmosphere, which additional passages are preferably provided at points substantially diametrically opposite the point of communication of the passage *g* with said groove, so as to insure an even distribution of pressure upon the end of the valve, and thereby obviate any tendency to bind or chatter which might result from an unequal pressure. Air is supplied to the other end of the valve through a passage K, that extends through the tube-flange *f*, the shell E, the disk G, and the wall of the cylinder A, being in communication with the cylinder through an opening *k* at a point that is uncovered by the hammer a short distance before the latter completes its travel in the direction to strike its blow upon the tool. It will be seen that when compressed air can pass from the cylinder through the opening *k* and the passage K to the end of the valve there will be a greater pressure on such end than on the opposite end, owing to the reduction of the pressure on the latter, and therefore the valve will be moved under the force of the superior pressure. To enable the valve to be moved in the opposite direction by reduced pressure upon one of its ends, pressure upon its other end is wholly removed, and for the purpose of removing the pressure the passage K is extended a short distance beyond the opening *k* and is placed in communication with the cylinder by an opening *k'*. Situated at a corresponding point to the opening *k'* lengthwise of the cylinder is an opening a^3 through the wall of the cylinder in communication with the atmosphere, so that when the opening *k'* is uncovered by the piston B the air will exhaust from that end of the valve to which it is supplied by the passage K. For convenience in assembling the valve D has in each end a groove *d*, so that the valve may be placed either end to. The presence of the groove in the end to which higher pressure is to be subjected is sufficient to give access of air to such end from the passage K; but to insure ample space for this purpose a larger groove or depression is provided in the flange *f*.

The operation of the hammer illustrated is as follows: With the parts in the position shown in Fig. 1 and the throttle-valve open the valve D will be subjected to the reduced pressure at one end only and thereby held in position to establish communication from the interior of the tube F and the supply-port *e'*, from which leads the passage or passages I. Thereby air will be supplied to the cylinder to move the hammer outward therein to strike the tool, air in advance of the hammer being exhausted through the cylinder-opening a^3 and the passage or passages H, that lead from the outer end of the cylinder to the supply-port *e*, from which said passage or passages run, and the exhaust-port e^2, said two ports being in communication through one of the grooves *d* and *d* of the valve D. When the hammer has nearly completed its travel, it will uncover the opening *k*, placing the passage K in communication with the cylinder in rear of the hammer, and having previously covered the opening *k'* of the extension of the passage K, as well as the exhaust-opening a^3, air from the cylinder will pass through the opening *k* into the passage K and thence to the end of the valve, to which air is supplied from said passage K, and the pressure on such end being superior to that on the other end the valve will be moved, covering the annular groove *f*, through which communication between the interior of the tube and the supply-port *e'* is established and placing the other annular groove *f* in communication with the other supply-port *e*, as well as placing the supply-port *e* from which leads the passage or passages I in communication with the exhaust-port e^2. Air will now pass through the passage or passages H into the cylinder at the striking end of the hammer, and thus return the hammer to the inner end of the cylinder, the air in the latter being exhausted through the passage or passages I to the supply-port *e* in communication therewith, and thence through one of the annular valve-grooves *d* and *d* into the exhaust-port e^2. As the hammer on its return stroke covers the opening *k* before the pressure at the high-pressure end of the valve is lowered sufficiently to permit the valve to be moved by the pressure on its low-pressure end, the escape of air from the passage K will be prevented and the valve thus mantained in the position for the supply of air to the cylinder through the passage or passages H. When, however, the piston has moved far enough to uncover the opening *k'*, that leads from the extension of the passage K, all pressure will be taken from the high-pressure end of the valve, and the valve will consequently be moved under the pressure at its low-pressure end to the position to change the port connections. The

point where the passage or passages I open into the cylinder is such that the piston covers the same before reaching the inner end of the cylinder, and thus a small volume of air is imprisoned that cushions the piston. After the piston passes the exhaust-port a^3 its momentum carries it through the remainder of its travel. It will be observed that the air in exhausting by its rush through the port into contact with the annular shoulder on the valve between the two grooves d and d supplements the pressure on the valve end by which it is shifted and held in position.

Our valve by reason of its being merely a hollow cylinder whose casing-engaging surfaces are of the same diameter is cheap to make, as only such surfaces and its interior have to be finished. Having a long bearing on the tube and the air acting on it evenly there is no tendency to tilt and bind, and thus wear is obviated, and it slides easily and freely, so that it has a very quick action, enabling the tool to run at high speed, with the result that the hammer strikes powerful blows and works rapidly. To avoid retarding effect on the hammer, the air is exhausted very rapidly from the cylinder, the relative size of the exhaust and supply ports being such as to accomplish this.

It will be noted that our hammer is a simple cylindrical block having no grooves or other special configuration.

Having thus described our invention, what we claim is—

1. The combination with a cylinder and a piston, of a valve having pressure-receiving surfaces to move it in opposite directions, means for intermittently applying pressure to one of such surfaces, and means for constantly applying a lower pressure to the other of such surfaces.

2. The combination with a cylinder and a piston, of a valve having pressure-receiving surfaces to move it in opposite directions, a source of supply of fluid to both of such surfaces, an open passage leading from one of such surfaces to an exhaust to reduce the pressure thereon, and means for constantly supplying fluid to such surface.

3. The combination with a cylinder and a piston, of a valve consisting of a cylinder having two surfaces of similar area for the application of fluid under pressure to move the valve in opposite directions, means for constantly applying fluid under pressure to one of such surfaces, means for supplying it intermittently to the other surface, and means whereby the pressure is less on the surface to which it is constantly supplied than on the surface to which it is intermittently supplied.

4. The combination with a cylinder, and a piston, of a valve consisting of a cylinder having opposite ends of similar area, a passage for constantly supplying fluid under pressure to one end of the valve, means for supplying it intermittently to the other end of the valve, and a constantly-open passage leading from the end of the valve to which fluid is constantly supplied.

5. The combination with a cylinder and a piston, of a valve having ends of similar area, a hollow part on which it is slidingly mounted, a passage leading from said hollow part to one end of the valve, a passage leading therefrom to an exhaust, and a passage leading to a closed space at the other end of the valve.

6. The combination with a cylinder and a piston, of a valve having ends of similar area, a hollow part on which it is slidingly mounted, a passage leading from said hollow part to one end of the valve, a passage leading to a closed space at the other end of the valve, and passages leading from said hollow part that are controlled by the valve.

7. The combination with a cylinder and a piston, of a valve consisting of a cylinder having opposing surfaces of similar area having two annular grooves, adapted to be alternately placed in communication with a source of supply of fluid under pressure, a valve-box having supply and exhaust ports, and means to subject said opposing surfaces of the valve to different pressures, one of which is constant.

8. The combination with a cylinder and a piston, of a valve consisting of a cylinder of uniform diameter from end to end and having two annular grooves, a tubular part on which the valve is slidingly mounted, having passages through its walls, a shell encircling the valve having supply and exhaust ports, and means to automatically move the valve.

9. The combination with a cylinder and a piston, of a valve having two surfaces adapted to be subjected to pressure to move the valve in opposite directions, a tubular part on which the valve is slidingly mounted, in communication with a source of supply of fluid under pressure, a wall interposed between said tubular part and the valve and the cylinder and forming one end of the cylinder, and a passage in said wall leading from the interior of the tubular part to one of the valve-surfaces, and leading from the latter to an exhaust.

10. The combination with a cylinder and a piston, of a valve having two surfaces adapted to be subjected to pressure to move the valve in opposite directions, a tubular part on which the valve is slidingly mounted, in communication with a source of supply of fluid under pressure, a wall interposed between said tubular part and the valve and the cylinder and forming one end of the cylinder, a passage in said wall leading from the interior of the tubular part to one of the valve-surfaces, and leading from the latter to an exhaust, and a passage leading from the interior of the cylinder to the other valve-

surface, said last-mentioned passage being controlled by the piston.

11. The combination with a cylinder and a piston, of a cylindrical valve having two annular grooves, and a valve-box comprising a tube encircled by the valve, a shell encircling the valve, said tube and shell having passages, and the tube having a flange at one end of the shell, and a disk at the other end of the shell having a passage leading from the tube to one end of the valve, and a passage or passages leading from the valve.

In testimony that we claim the foregoing we have hereunto set our hands.

HAROLD A. R. PRINDLE.
JOHN U. ADOLPH.

Witnesses:
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LAURA A. BORING.