C. B. RICHARDS.

IMPACT TOOL.

APPLICATION FILED MAR. 13, 1908.

904,726.

Patented Nov. 24, 1908.

Fig. I.

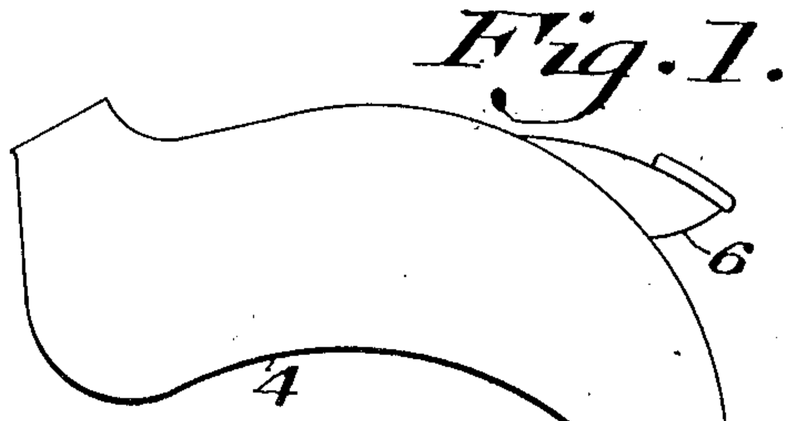
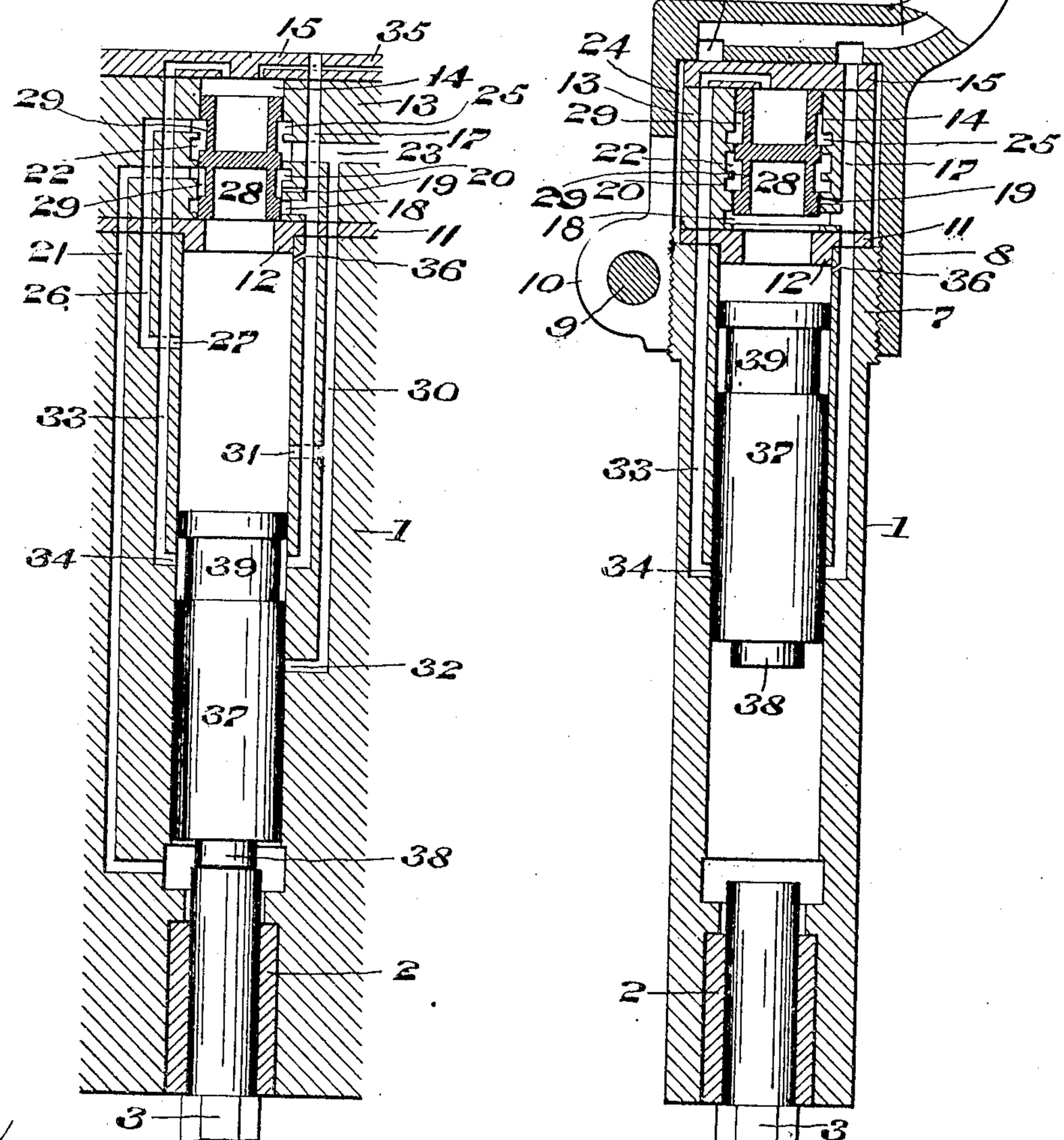


Fig. II.



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IMPACT-TOOL.

No. 904,726. Specification of Letters Patent. Patented Nov. 24, 1908.

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To all whom it may concern:

Be it known that I, CHARLES B. RICHARDS, a citizen of the United States, resident of Cleveland, county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Impact-Tools, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle so as to distinguish it from other inventions.

The annexed drawings and the following description set forth in detail, one mechanical form embodying the invention; such detail construction being but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings Figure I represents a longitudinal section of my improved pneumatic impact tool, and Fig. II, a diagrammatic longitudinal section of the tool, showing all ports and ducts in the tool.

The tool has a barrel, 1, the axial bore of which forms the working-cylinder or plunger-cylinder, and the forward or lower end of this barrel has a tool-nose or tool-socket, 2, into which the shank of the chisel, calking-tool, rivet-set or other working tool, 3, may be inserted. A grasping-handle, 4, has the supply-duct, 5, for the motive-fluid formed through it, and has suitable means for attaching a hose or other movable connection for the motive-fluid to it, and has a throttle-valve for controlling admission of motive-fluid to the tool and actuated by a suitable latch, 6. The rear or upper end of the barrel has an external screwthread, 7, and the inner end of the grasping-handle has an internally screw-threaded and longitudinally slitted socket, 8, which is screwed upon the upper end of the barrel and clamped upon the same by a nutted clamp-bolt, 9, passing through ears, 10, upon the edges of the slit in the socket. The details of these elements form no part of my present invention and may be substituted by other suitable parts.

An annular button or plate, 11, is placed against the rear or upper end of the barrel and has an annular projection, 12, projecting into the upper end of the plunger-cylinder. A cylindrical valve-block, 13, abuts against this button and has an axial bore of uniform diameter forming a valve-chamber 14. A plate or button, 15, closes the rear or upper end of the valve-chamber. All of these parts are contained within the handle-socket and are clamped between the bottom of the latter and the upper end of the barrel by the socket being screwed down upon the threaded upper end of the barrel. The bottom of the handle-socket is formed with an annular channel, 16, which communicates with a supply-duct in the handle, and a live-air duct, 17, through the upper button, the wall of the valve-block, the lower button, and the wall of the barrel has its upper end communicating with this channel. The live-air duct opens into the valve-chamber immediately above its lower end, and into the plunger-chamber at about the middle of the same.

The opening of the live-air duct into the valve-chamber is into an annular port-groove, 18, in the interior of the valve-chamber. A restricted passage, 19, extends from the live-air supply-duct 17 and into the interior of the valve-chamber a short distance above the annular inlet-port 18 in the same. An annular distributing port-groove, 20, is formed in the valve-chamber above the restricted supply-passage and communicates with a distributing bore or duct, 21, which extends through the wall of the valve-block, the lower button, and down through the wall of the barrel to the lower end of the plunger-cylinder. An annular exhaust-port, 22, is formed in the valve-chamber and communicates through a radial bore, 23, in the valve-block with an annular exhaust-space, 24, between the valve-block and handle-socket, which space has free outlet to the atmosphere. An annular port, 25, is formed in the valve-chamber above the exhaust-port and communicates through a duct, 26, in the wall of the valve-block, the lower button and the wall of the barrel with the rear exhaust-port, 27, of the plunger-cylinder, which port is some distance from the rear end of the cylinder. A valve, 28, slides in the valve-chamber and has three pistons separated by two circumferential grooves, 29, which connect the restricted supply-port with the distributing port for the lower end of the cylinder and the exhaust-port with the port connected to the rear cylinder exhaust, when the valve is down, and the lower one of which grooves connects the distributing port for the lower end of the cylinder to the exhaust-port when the valve is in its raised position. An exhaust-duct, 30, extends downward through the wall of the barrel from

the radial exhaust-bore 23, and has a relief-port, 31, into the plunger-cylinder which is uncovered by the plunger before the latter completes its downward stroke. The lower end of the permanent exhaust-duct 30, opens into the plunger-cylinder through a port, 32, at a point where it is uncovered by the ascending plunger before the latter reaches its uppermost or rearmost extreme. A duct, 33, in the wall of the barrel communicates at its lower end with the plunger-cylinder through a port, 34, directly opposite the lower port of the supply-duct, and said duct extends through the lower button, the wall of the valve-block, and radially through the upper button, opening through the under side of the latter into the upper end of the valve-chamber. A permanent exhaust-duct, 35, of less capacity than the radial duct in the button, is formed in the latter and extends radially from the upper end of the valve-chamber to the exhaust-space. A permanent live-air leak-port, 36, extends from the live-air duct into the upper end of the plunger-chamber to assist in providing an air-cushion for the returning plunger and for moving the valve rearward by piston-compressed air. A plunger, 37, fits to reciprocate in the piston-cylinder and has a nose, 38, at its lower end, which strikes the shank of the working-tool, and a circumferential groove, 39, near its upper end, which serves to connect the port at the lower end of the live-air supply-duct 17 with the port 34, leading to the upper end of the valve-chamber,—which port is usually termed in the trade the "kicker-port", so as to admit live-air to shift the valve downward when the piston arrives near the lower extremity of its stroke.

In practice, the inlet duct in the handle is connected to a hose conveying air under pressure and a suitable working-tool is inserted into the tool-socket. We will assume that the valve and plunger are in their upper or rearward positions as shown in Fig. I, and that the throttle-valve is opened to admit live-air into the hammer. The live-air passes through the live-air duct in the valve-block and enters the upper end of the plunger-cylinder through the rear-end live-air supply-port 18 and the opening in the lower button, driving the plunger downward. When the plunger arrives near the lower extremity of its down-stroke, it will uncover the permanent exhaust-port 31, relieving the pressure behind the plunger and in front of the valve and, at the same time, the port at the lower end of the inlet-duct is placed in communication with the kicker-port across the groove in the piston, so that live-air passes to the upper end of the valve-chamber. As the air-pressure below the valve is less than the live-air pressure above the valve, owing to the relief of pressure through the uncovered relief-port 31, the valve is shifted downward. While the plunger is on its down-stroke, air in front of the same will exhaust through the permanent front-exhaust 32 and also through the distributing-port at the lower end of the cylinder, up through the distributing-duct to the distributing-port in the valve-chamber, which is connected to the exhaust-port in the same by the lower groove in the valve. The plunger will thus meet with very slight resistance on its operative stroke, owing to the free exhaust in front of the descending plunger provided by the permanent exhaust-port and duct and the distributing duct for the lower end of the cylinder. When the plunger has delivered its blow upon the working-tool, the valve has been shifted downward so as to close the inlet-port to the rear or upper end of the cylinder and to open connection through the upper groove in the valve between the rear exhaust-port and passage and the exhaust-port and passage. At the same time, the distributing-port for the lower end of the cylinder is connected to the supply-duct by the lower groove in the valve, so as to cause live-air to enter the lower end of the cylinder to drive the plunger upward or rearward. As stated, the air behind the plunger exhausts through the rear exhaust. When the plunger arrives to near the upper end of the cylinder, it uncovers the lower permanent exhaust-port and, at the same time, closes the rear exhaust-port, trapping the air behind it and compressing this trapped air and the live-air admitted through the permanent live-air leak-port in the rear end of the cylinder. The air which forces the plunger upward, being relieved through the lower exhaust-port, will partly lose its force and prevent violent striking by the plunger of the rear end of the cylinder, while the plunger will have sufficient momentum to compress the air behind it sufficiently to shift the valve upward or rearward, as the air behind the valve may escape through the permanent exhaust-duct in the upper end of the valve-chamber.

Other modes of applying the principle of my invention may be employed for the mode herein explained. Change may therefore be made as regards the mechanism thus disclosed, provided the principle of construction set forth respectively in the following claims are employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In an impact tool, the combination with a plunger-cylinder and a plunger reciprocable therein, of a valve controlling inlet and exhaust of motive-fluid to and from the opposite ends of the cylinder and having two opposed pressure surfaces of the same area and one of said surfaces exposed to be acted upon by plunger-compressed air

and the opposed surface acted upon by plunger-controlled air under normal pressure, a permanently-open restricted exhaust-duct from the plunger-controlled surface, and a permanently-open relief and exhaust-port in the cylinder and located to be uncovered by the plunger as the latter approaches the end of its forward stroke.

2. In an impact tool, the combination of a plunger-cylinder having inlet and exhaust port at its forward end and an inlet port at its rear end and an exhaust port a distance from its rear end and a restricted live-air inlet-port at its rear end, a plunger reciprocable in said cylinder, a valve controlling admission and exhaust of motive-fluid to and from opposite ends of the plunger-cylinder and formed with opposed pressure-surfaces of equal areas and one of said surfaces exposed to the action of plunger-compressed air after the plunger has passed the rear exhaust-port and the opposite surface exposed to plunger-controlled air under normal pressure, and a permanent restricted exhaust-duct from said latter surface.

3. In an impact tool, the combination of a plunger-cylinder having a distributing-port at its forward end and a duct extending from the same and an exhaust-port and passage a distance from its rear end and permanent exhaust-ports opening from the cylinder at a point to be uncovered by the rear end of the plunger near the end of its forward stroke and at a point to be uncovered by the forward end of the plunger near the end of its rearward stroke and formed with a live-air supply-duct having a port opening into the cylinder near its middle and a "kicker-port" registering with said supply-port, a plunger reciprocating in said cylinder and formed with a circumferential groove which connects said last ports when the plunger is near the end of its forward stroke, a valve-block formed with a valve-chamber opening at its forward end into the rear end of the plunger-cylinder and formed with ports for the supply and exhaust-ducts of the cylinder and with a duct from the "kicker-port" into its upper end and a permanent restricted exhaust from said end, and a valve in said chamber and formed with grooves and pistons controlling the ports in the valve-chamber and having opposite end-surfaces of equal areas.

In testimony that I claim the foregoing to be my invention I have hereunto set my hand this 19 day of December A. D. 1907.

CHARLES B. RICHARDS.

Witnesses:
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F. J. CONNELLY.