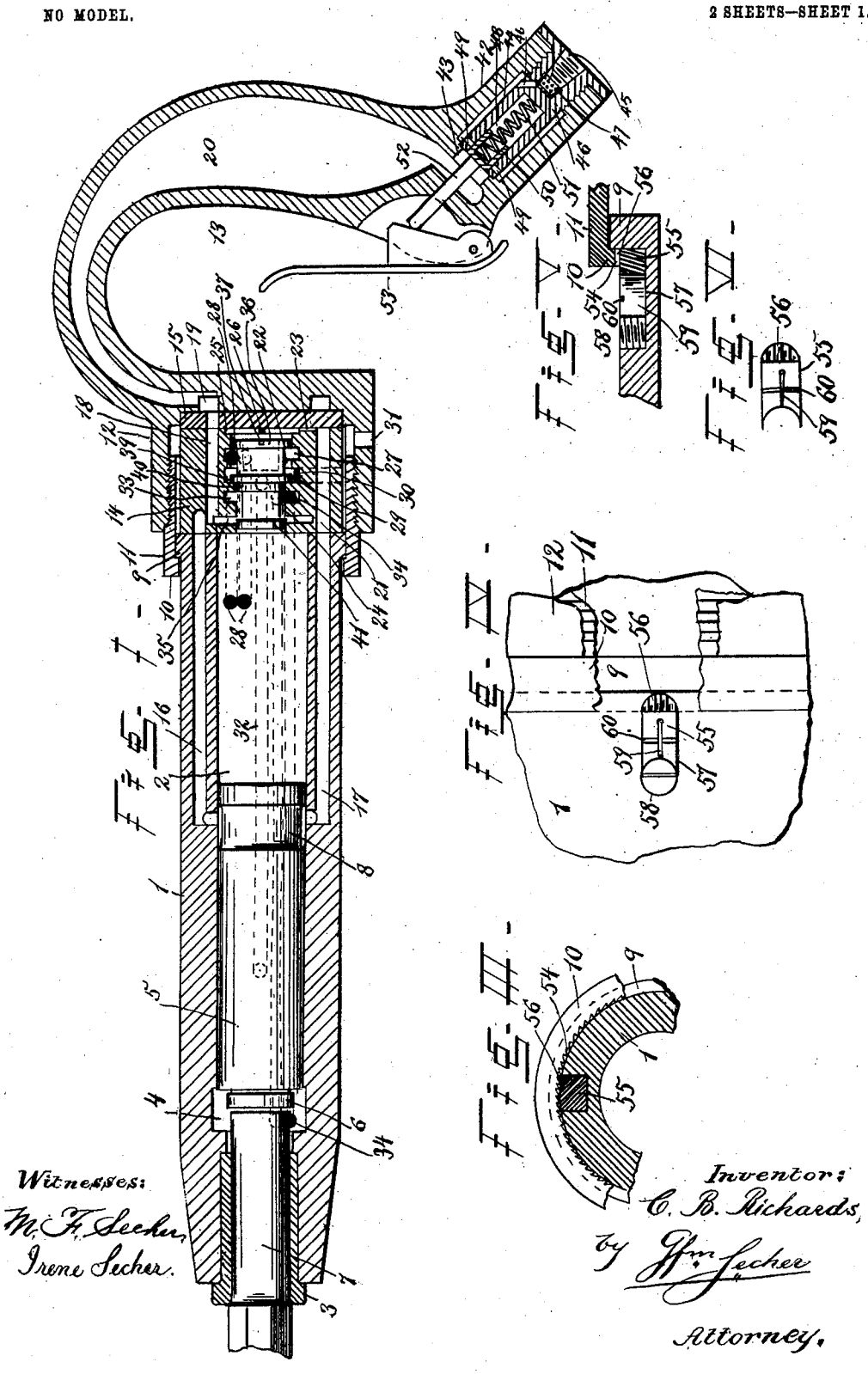
No. 745,239. PATENTED NOV. 24, 1903.

C. B. RICHARDS.

PNEUMATIC TOOL.

APPLICATION FILED FEB. 20, 1902.

NO MODEL. 2 SHEETS—SHEET 1.



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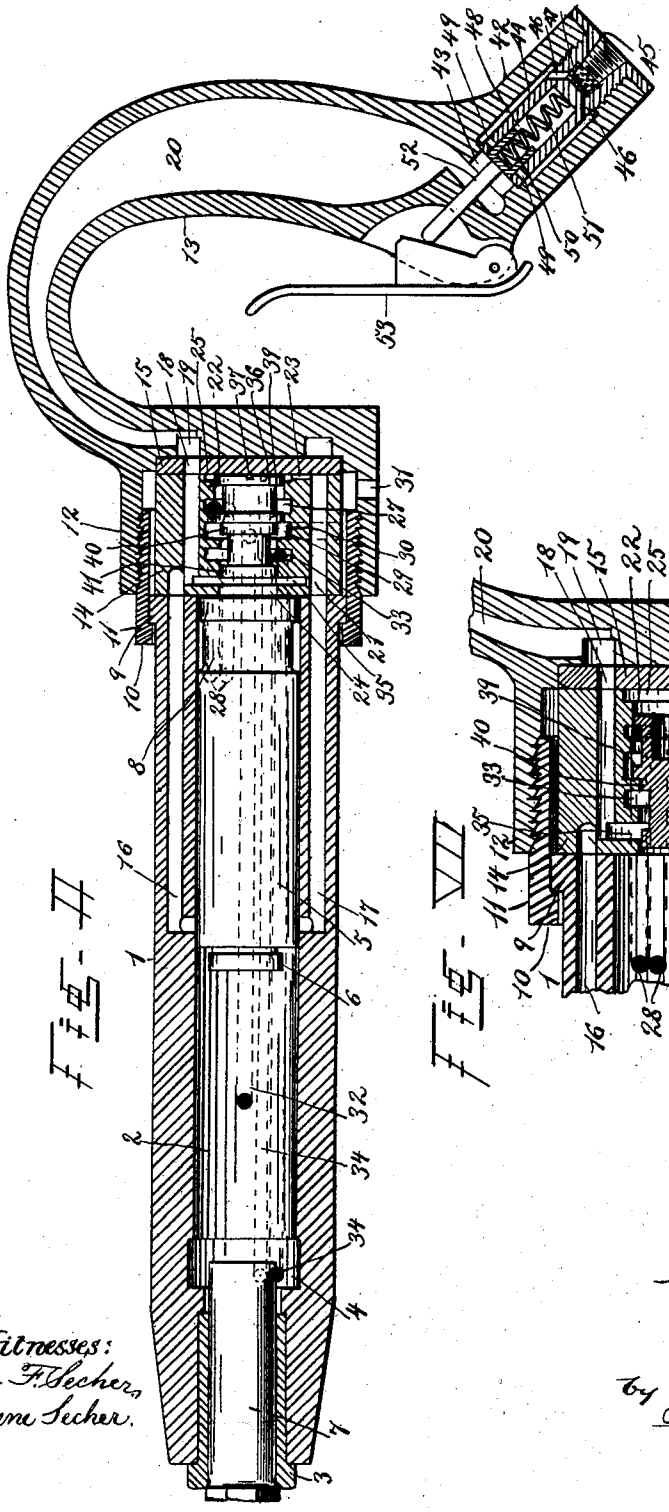

FIG. II

FIG. VII

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No. 745,239. Patented November 24, 1903.

UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 745,239, dated November 24, 1903.

Application filed February 20, 1902. Serial No. 94,922. (No model.)

To all whom it may concern:

Be it known that I, CHARLES B. RICHARDS, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented certain new and useful Improvements in Pneumatic 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 tool, showing the plunger at the extreme of its outward stroke and the valve shifted to cause the actuating-air to be admitted to the outer end and be exhausted from the inner end of the cylinder; Fig. II, a longitudinal section of the tool, showing the plunger at the inner extreme of its stroke and the valve correspondingly shifted; Fig. III, a transverse sectional detail view illustrating the dog securing the barrel and coupling-sleeve; Fig. IV, a plan view of said device; Fig. V, a longitudinal sectional detail view of the device; Fig. VI, a view of the detached dog, and Fig. VII an enlarged section of the valve mechanism.

The tool has a barrel 1, formed with an axial cylindrical bore 2, which forms the plunger-cylinder. The outer end of the bore is contracted and has a tool-socket 3 secured in it. An enlargement 4 is formed at the inner end of the tool-socket. A plunger 5 fits to slide in the cylinder and has preferably a nose 6 at its outer end, with which it may strike the end of the tool-shank 7, so as to prevent upsetting of or other injury to the end of the plunger. The plunger has a circumferential groove 8 near its inner end. The inner end of the barrel has an external circumferential flange 9, which is engaged by an internal flange 10 upon the end of the interior of a coupling-sleeve 11, which is screwed into a socket 12 of a pistol-grip handle 13. A cylindrical valve-block 14 and a cap-disk 15 are clamped between the bottom of the handle-socket and the inner end of the barrel by the coupling-sleeve, the disk closing the inner end of the valve-block, and said block and disk are preferably prevented from turning in their relation to each other and to the handle and barrel by suitable dowel-pins. (Not shown.) The sides of the plunger-cylinder have two longitudinal channels 16 and 17, which extend from ports at points registering with the circumferential groove in the plunger when the latter strikes the tool-shank. One, 16, of said channels communicates at its inner end with a longitudinal channel 18 in the valve-block, which channel communicates through a hole in the cap-disk with an annular inlet-channel 19 in the bottom of the handle-socket, which channel communicates with an inlet-channel 20 through the grip of the handle. The other, 17, of the channels in the barrel communicates with a longitudinal channel 21 in the valve-block, and the inner end of said channel abuts against the cap-disk and communicates with a large inner chamber 22 of the axial valve-chamber in the block through a port 23. Said large-diameter chamber 22 is closed at its inner end by the cap-disk and communicates with a forward small-diameter chamber 24, both chambers forming the axial cylindrical valve-chamber in the block. The inner chamber has an annular port-groove 25 communicating with the port 23 and having a small permanently-open exhaust-port 26 extending out through the side of the valve-block. A short distance from said annular port-groove is formed another annular port-groove, 27, which is a distributing-port for the exhaust from the inner end of the plunger-cylinder through one or more exhaust-channels 28, longitudinally extending through the side of the valve-block and barrel into the cylinder at a point a short distance from the inner end of the same. Another annular port-groove, 29, is formed in the large valve-chamber forward of the distributing port-groove, and said port-groove has an exhaust-port 30 through the side of the valve-block into an exhaust-space surrounding the

same and having exhaust to the outer air through a port 31 in the side of the handle-socket. A longitudinal channel 32 extends from the annular port-groove 29 to a point in the plunger-cylinder at a distance from the outer end of the same of about one-half of the length of the plunger, so that the outer port of said channel may be uncovered by the plunger when the latter arrives near the end of its back stroke. The port of said annular groove partly enters through the forward end wall of the large valve-chamber, and the position of the forward port of the channel 32 is such that the air entering said port and passing through said channel will pass out of its rear port and act into the large valve-chamber at the same time the plunger arrives at the extreme of its back stroke. An annular port-groove 33 is formed in the small valve-chamber near the rear or inner end of the same, and said groove communicates with one or more distributing-channels 34, which extend longitudinally through the sides of the valve-block and barrel to the forward or outer enlargement in the plunger-cylinder. An annular port-groove 35 is formed in the forward portion of the small valve-chamber and communicates with the inlet-channel 18 in the valve-block. A valve slides within the valve-chamber and has a large piston 36 at its rear or inner end, which piston is formed with a transverse groove 37 in the rear or inner face, forming communication with a recess 38 in the rear or inner end of the valve. A piston 39 is formed upon the valve to have play to alternately close the annular exhaust-port from communication with the forward or rear portion of the valve-chamber. A small-diameter piston 40 fits in the rear end of the smaller forward valve-chamber and is formed immediately upon the forward face of the last-mentioned piston. A piston 41 is formed upon the forward end of the valve to alternately fit within and close the small valve-chamber forward or to the rear of the forward live-air-port groove 35. A nipple 42 is formed at the end of the pistol-grip handle and has an axial bore through it, and the outer end of said bore is slightly contracted and internally threaded. A plug 44 is screwed into the threaded portion, forms a surrounding air-chamber within the large portion of the bore in the nipple, and fits against the contracted portion of said bore. Said plug has in its outer end an internally-threaded bore 45 for the attachment of the air-supply hose or other connection to the motive fluid, and ports 46 lead from the inner end of said bore to the air-space around the plug. A strainer 47 is preferably inserted in the bore to stop dust particles or other objects which may be carried by the air under pressure. The plug is formed with an axial bore 48, extending from the inner end to a partition at the ports 46, separating this bore from the screw-threaded bore, and ports 49 form a communication between the upper end of the surrounding air-chamber and the upper end of the bore 48. A thimble-shaped valve 50 slides in the bore to cover or uncover said ports and is forced outward by a spring 51, fitting with one end in the hollow of the valve and with its other end against the closed bottom of the bore. The valve has a stem 52 projecting through the air-duct in the handle-grip and out on the inner side of the same, and a latch 53 is pivoted upon that side of the handle to bear against the end of the stem and to be pressed against the grip to open the valve by the hand holding the grip.

A series of ratchet-teeth 54 are formed upon the internal face of the flange upon the coupling-sleeve, and a dog 55 has teeth 56 upon the outer face at one end and engages said ratchet-teeth. The dog slides in a groove 57 in the side of the barrel and has one end formed concave to receive a screw 58, which fits into this concave and into the end of the groove, so as to hold the dog in engagement with the teeth. The dog has a longitudinal slit 59 extending from the concave, and the portions at the sides of said slit are normally sprung together, as illustrated in Fig. VI, so that the screw may split them apart as it is screwed down and may then be held from turning by the two spring-jaws thus formed. A transverse notch 60 is formed in the outer face of the dog for the purpose of offering a purchase for the nib of a screw-driver in withdrawing the dog. This dog prevents turning of the coupling-sleeve in its relation to the barrel and handle and admits of said sleeve being turned to tighten it whenever necessary to draw the barrel and handle closer together, being easily withdrawn from its engagement.

In describing the operation of the tool we will assume that the tool is connected to a source of compressed air by a hose secured in the inlet-nipple, that the chisel or other tool is inserted in the tool-socket, that the throttle-valve is opened by pressing upon the latch, and that the plunger and valve are in the position shown in Fig. I, in which position the plunger has just struck its blow upon the tool-shank and the valve has been shifted to admit air in the outer end of the cylinder to return the plunger. The air passes now through the handle and inlet-channel to the forward live-air port 35, into the small valve-chamber, and around the valve into the forward distributing-port 33, whence it passes to the outer end of the plunger-cylinder through the channels 34, driving the plunger back. The air back of the plunger exhausts through the inner exhaust-channels 28 and ports 27 and 29 and out from the latter exhaust-port through the exhausts 30 and 31 to the outer air. When the plunger uncovers the kicker-port of the channel 32, the air will rush through said port and act against the forward face of the large piston 39 of the valve. At the same moment the plunger has

cut off the ports of the rear exhaust-channels 28 and compressed the thus-inclosed air to act against the small forward piston 41 of the valve, the joint action of the two bodies of air forcing the valve back and the location of the kicker-port being so adjusted that the two actions will be simultaneous. The air back of the valve has in the meantime been exhausting through the permanently-open exhaust in the inner end of the valve-chamber, and the back throw of the valve forces the remainder of the air out through said exhaust. When the plunger and valve are in these back positions, (illustrated in Fig. II,) the live air passes from the live-air-inlet port 35 in front of the valve and into the inner end of the cylinder, driving the plunger forward. The forward large piston 39 of the valve shuts off connection between the rear exhaust-channels and the exhaust-port of the valve-chamber, and the connection between the outer end of the cylinder through channels 34 and annular port 33 is open to the exhaust-port 29 30 between the forward small piston 41 and the pistons 40 39 of the valve, so that the air in the outer end of the plunger-cylinder may exhaust. When the plunger again arrives at the outer extreme of its stroke, the live-air channel 16 is placed in communication with the opposite channel 17 by the circumferential groove in the plunger, so that the live air passes to the rear end of the valve-chamber, where it passes through the transverse groove 37 in the end of the valve into the recess in the same and acts against the rear face of the valve, forcing the same forward. The air-distributing valve is thus thrown back by the concussion of the air from the returning plunger and is thrown forward by the direct action of the live air admitted behind it against its larger face against the pressure of the air against its smaller forward face. The kicker-port, channel, and port in the valve-chamber aid the concussive blow in throwing the valve back by balancing the pressure upon the forward and rear faces of the large valve-pistons, and thereby permitting the concussive blow upon the face of the small valve-piston to act whether the pressure behind the valve has been relieved through the permanently-open exhaust-port or not.

In an earlier application, Serial No. 41,005, filed December 24, 1900, for pneumatic tool I have made broad claims for a controlling-valve actuated by direct air-pressure at one stroke of the piston and by compression of the air between it and the piston at the return stroke and for such valve in a chamber at one end of the working cylinder and combined with the plunger and for such valve having differential-area faces and exposed to air-pressure on its larger face and compression at its smaller face, and I do not make such broad claims in this application.

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 principles of construction set forth respectively in the following claims are employed.

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

1. In a pneumatic tool, the combination with a plunger-cylinder having inlet and exhaust at the outer end and inlet at its inner end and exhaust a short distance from its inner end, and a plunger reciprocating within said cylinder and formed with an air-distributing groove, of a distributing-valve chamber having one end communicating with the inner end of the cylinder, a distributing-valve in said chamber, and registering ports and channels in the cylinder respectively communicating with the air-supply and with the other end of the valve-chamber to be connected by the groove in the plunger on its outward stroke to admit live air to the other end of the valve-chamber to throw the valve in one direction, the valve being thrown in the opposite direction by the compression of the air by the returning plunger at the inner end of the cylinder against the valve, substantially as set forth.

2. In a pneumatic tool, the combination with a plunger-cylinder having inlet and exhaust at the outer end and inlet at its inner end and exhaust a short distance from its inner end, and a plunger reciprocating within said cylinder, of a distributing-valve chamber having open communication at one end with the inner end of the cylinder and having a permanent exhaust at the other end, means controlled by the plunger for admitting live air to said end of the valve-chamber, and a distributing-valve in said chamber and adapted to be thrown in one direction by the admission of live air into the controlled end of the valve-chamber and to be thrown in the opposite direction by the compression of the air by the returning plunger at the inner end of the cylinder against the valve at the open end of the valve-chamber, substantially as set forth.

3. In a pneumatic tool, the combination with a plunger-cylinder having inlet and outlet at the outer end and inlet at the inner end and exhaust a short distance from the inner end, and a plunger reciprocating within said cylinder, of a distributing-valve chamber having a small-diameter chamber open to the inner end of the cylinder and a large-diameter chamber provided with a permanent exhaust and live-air inlet at its rear end and a live-air inlet at its forward end, a plunger-controlled live-air channel to the rear air-inlet of the large valve-chamber, a plunger-controlled live-air channel to the forward air-inlet of the large chamber and constructed to be opened at the back stroke of the plunger, and a distributing-valve in the valve-chamber and having a small piston exposed at the open end of the valve-chamber and large piston-surfaces exposed to the live-air inlets in

the large-diameter valve-chamber, substantially as set forth.

4. In a pneumatic tool, the combination of a plunger-cylinder having forward distributing ports and channels 34, kicker port and channel 32, exhaust port and channel 28, and valve-controlling live-air ports and channels 16 and 17; a plunger reciprocating in said cylinder and having a circumferential groove 8; a valve-block having channels 18 and 21 and formed with a valve-chamber open to the inner end of the cylinder and having a large-diameter bore 22 formed with permanent exhaust 26 and ports 25 and 27 and exhaust-port 29 30 and having a small-diameter bore formed with the distributing-port 33 and live-air-inlet port 35, and a valve in said chamber having large pistons 36 and 39 and small pistons 40 and 41, substantially as set forth.

5. In a pneumatic tool, the combination with the barrel having an external flange at its inner end, the handle having a socket, and the valve-block held between the end of the barrel and the bottom of the socket, of a coupling-sleeve screwed into the handle-socket and having an internal flange engaging over the flange of the barrel and formed with teeth upon its inner face, a dog sliding in a groove in the barrel and having teeth upon the end of its outer face engaging the teeth of the flange and means for holding said dog under the flange and against longitudinal movement in the groove, substantially as set forth.

6. In a pneumatic tool, the combination with the barrel having an external flange at its inner end, the handle having a socket, and the valve-block held between the end of the barrel and the bottom of the socket, of a coupling-sleeve screwed into the handle-socket and having an internal flange engaging over the flange of the barrel and formed with teeth upon its inner face, a dog sliding in a groove in the barrel and having teeth upon the end of its outer face engaging the teeth of the flange, and a screw in the end of the groove and abutting against the outer end of the dog, substantially as set forth.

7. In a pneumatic tool, the combination with the barrel having an external flange at its inner end, and a short longitudinal groove extending to said flange and formed with half-round ends, the handle having a socket, and the valve-block held between the end of the barrel and the bottom of the socket, of a coupling-sleeve screwed into the handle-socket and having an internal flange engaging over the flange of the barrel and formed with teeth upon its inner face, a dog sliding in said groove in the barrel and having teeth upon the end of its outer face engaging the teeth of the flange, and a screw fitted and threaded into the hole formed by the ends of the groove and of the dog, substantially as set forth.

8. In a pneumatic tool, the combination with a barrel having an external flange at its inner end, and a short longitudinal groove extending to said flange and formed with half-round ends, the handle having a socket, and the valve-block held between the end of the barrel and the bottom of the socket, of a coupling-sleeve screwed into the handle-socket and having an internal flange engaging over the flange of the barrel and formed with teeth upon its inner face, a dog formed with teeth upon the end of its outer face engaging the teeth of the flange and having a semicircular concave end and a longitudinal slit from said end to form spring-jaws, and a screw fitted and threaded into the hole formed by the ends of the groove and of the dog and thus spreading the spring-jaws apart to be clamped and held from turning by the same, substantially as set forth.

9. In a pneumatic tool, the combination with a plunger-cylinder having inlet and outlet at the outer end and inlet at the inner end and exhaust a short distance from the inner end, and a plunger reciprocating within said cylinder, of a distributing-valve having a small-area face at one end and exposed to the inner end of the cylinder and a large-area piston at the other end, and means controlled by the plunger for admitting live air against the two faces of the large-area piston, whereby the valve is thrown in one direction by the compression of the air by the returning plunger and by live air and in the opposite direction by live air.

In testimony that I claim the foregoing to be my invention I have hereunto set my hand this 20th day of October, A. D. 1900.

CHARLES B. RICHARDS.

Witnesses:
WM. SECHER,
M. F. SECHER.