W. E. COLWELL.

PNEUMATIC HAMMER FOR DRIVING NAILS.

APPLICATION FILED NOV. 26, 1910.

1,014,639.

Patented Jan. 16, 1912.

2 SHEETS—SHEET 1.

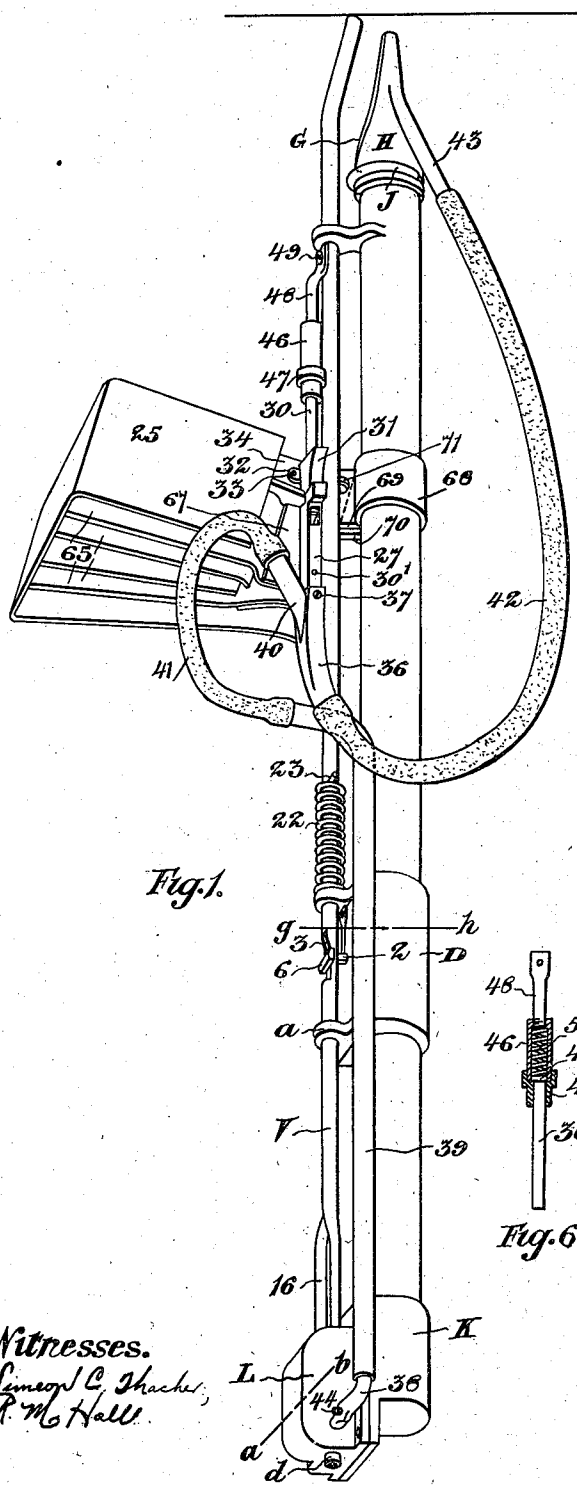


Fig. 1.

Fig. 6.

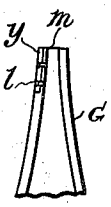


Fig. 7.

Fig. 2.

Witnesses.

Lemuel C. Thacher,

R. M. Hall.

Inventor.

W. E. Colwell,

by Egerton R. Case,

Atty.

W. E. COLWELL.

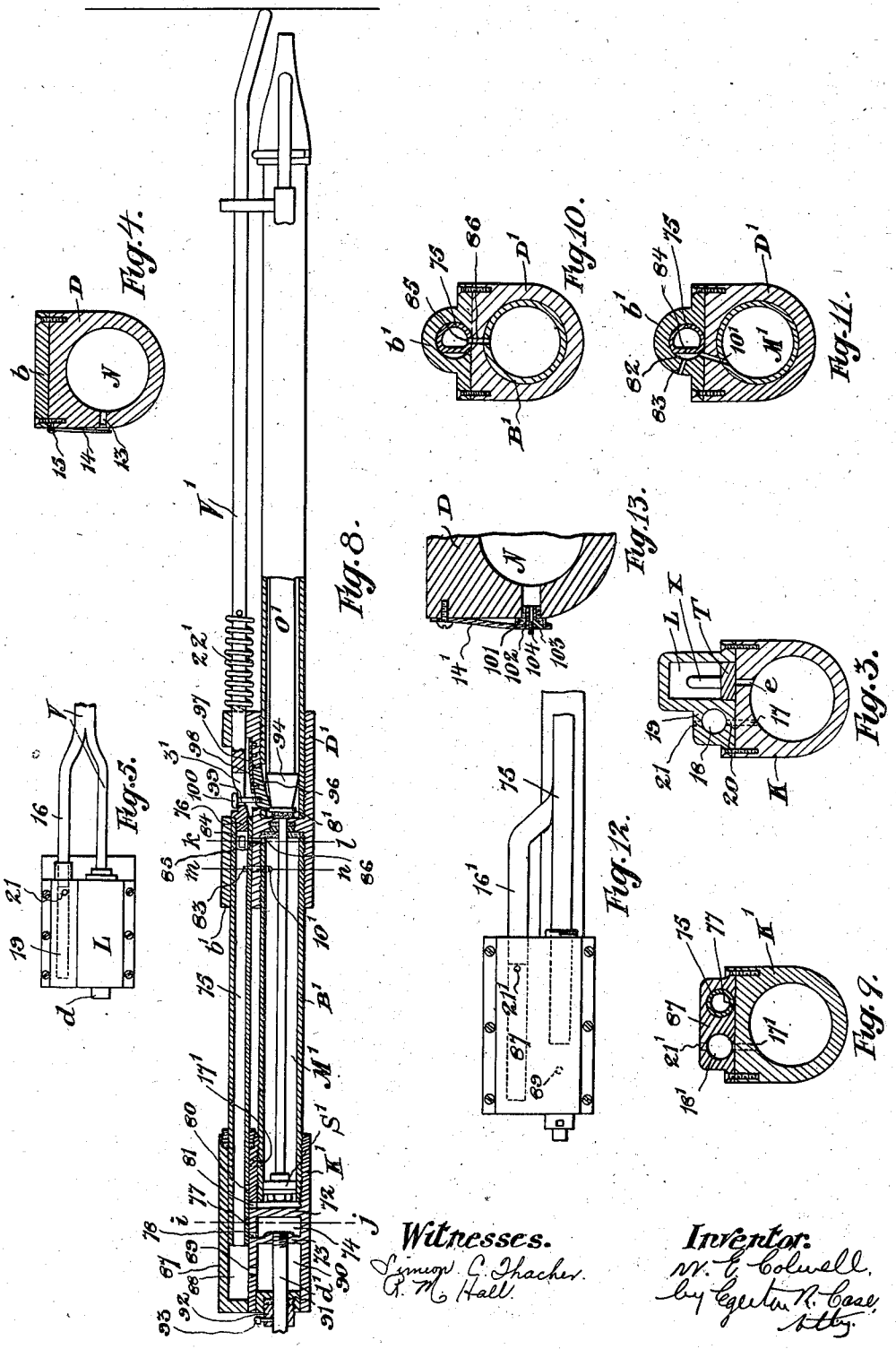
PNEUMATIC HAMMER FOR DRIVING NAILS.

APPLICATION FILED NOV. 26, 1910.

1,014,639.

Patented Jan. 16, 1912.

2 SHEETS—SHEET 2.



Witnesses.
Seymour C. Thacher.
R. M. Hall.

Inventor:
W. E. Colwell.
by Egerton R. Case.
Atty.

UNITED STATES PATENT OFFICE.

WILLIAM EVANS COLWELL, OF KINCARDINE, ONTARIO, CANADA.

PNEUMATIC HAMMER FOR DRIVING NAILS.

1,014,639. Specification of Letters Patent. Patented Jan. 16, 1912.

Application field November 26, 1910. Serial No. 594,410.

To all whom it may concern:

Be it known that I, WILLIAM EVANS COLWELL, a subject of the King of Great Britain, residing at Kincardine, in the county of Bruce, Province of Ontario, Canada, have invented certain new and useful Improvements in Pneumatic Hammers for Driving Nails, of which the following is a specification.

My invention relates to improvements in pneumatic hammers for driving nails, and one of the objects of my invention, in its broadest conception, is to combine with a hammer driven outward under the control of a motive fluid, preferably compressed air, pneumatic means for the purpose of positioning the nail in the point of the hammer so that at the next blow of the hammer, the nail will be driven.

In my preferred form of invention, my object is to economize in air as much as possible by utilizing the atmospheric pressure to return the hammer to normal position. In the alternative form of my invention illustrated, the hammer is returned to normal position by means of motive fluid under pressure.

Further objects of my invention will appear in the following specification wherein I describe my preferred form and an alternative form of my invention.

Figure 1 is a perspective view of my tool positioned to be used for vertical work. Fig. 2 is substantially a longitudinal central section through my tool, the hopper for the nails being removed. Fig. 3 is a cross section on the line *a—b*, Fig. 1, on an enlarged scale. Fig. 4 is a cross section on the line *g—h* (through the casting only), Fig. 1. Fig. 5 is a top view of the lower portion of my preferred form of tool when held in horizontal position. Fig. 6 is a longitudinal section through the means for releasing the nail supported in the mouth of the air tube or conduit, hereinafter particularly referred to. Fig. 7 is an enlarged view of portion of one section of the head of the hammer, looking at the inner side thereof, showing the magnet in place. Fig. 8 is, in part, a vertical longitudinal section through an alternative form of my tool. Fig. 9 is a vertical cross section on the line *i—j*, Fig. 8, on an enlarged scale. Fig. 10 is a cross section on the line *k—l*, Fig. 8, on an enlarged scale. Fig. 11 is a cross section on the line *m—n*, Fig. 8, on an enlarged scale. As will appear in the specification, the slide valve is shifted in position in this figure. Fig. 12 is a top view of the lower portion of the alternative form of my tool when held in horizontal position, and Fig. 13 is an enlarged cross section on the line *g—h*, to show the construction of an alternative form of valve illustrated in Fig. 4.

In the drawings, like characters of reference indicate corresponding parts in each figure.

The tool herein described, is particularly designed to be used by lathers, in nailing on laths, but it must be understood that certain parts of my invention are equally applicable in connection with various classes of pneumatic tools, such as rock-drills.

Broadly considered, my preferred form of invention consists of a cylinder divided into two chambers, one of the chambers is designed to receive the motive fluid in order to drive outward the hammer, and the chamber in which the hammer proper operates, is what I term a vacuum chamber as it does not receive any of the motive fluid. Means is associated with the cylinder so that when the tool is in use, this means will contact with the lath and so release the hammer and at the same time operate a valve to allow the motive fluid to drive the hammer outward. When the hammer is moved to the limit of its out-movement, the motive fluid exhausts from the power chamber, and as there is practically no air within the vacuum chamber behind the hammer proper, the atmospheric pressure is sufficient to return the hammer to normal position. After a nail is driven, the tool is withdrawn far enough so as to allow said releasing means to be moved into normal position and so permit the locking of the hammer and the cutting off of the supply of motive fluid into the power chamber. When the tool is first used, the initial out-movement of the hammer will not drive a nail, because no nail will be held in the head. When the said releasing means is moved as stated, a nail is discharged into the conduit or air-chamber and will lie in the side of the air tube so that immediately the point of the hammer is withdrawn, the nail will be driven into the point and so positioned as to be driven into the wood at the next blow of the hammer. It is to be remembered that the air current for the air-feed is always operating, and therefore a nail is in the po-

sition indicated at the time the tool is used so that it will be positioned in the head of the tool as the hammer is moved back to normal position. The head of the hammer is constructed so as to permit the free entry of air into the forward portion of the vacuum chamber in order to return the hammer to normal position.

The cylinder A is composed of two sections B and C which screw into the bored casting D, which is provided with the dividing wall E. Preferably screwed over the outer end of the section C of the cylinder is the head F. The section B screws into the casting K which carries the air-chest L suitably attached thereto. The dividing wall E separates the cylinder A into a power chamber M and a vacuum chamber N.

O is the hammer which operates within the vacuum chamber N, and the inner end of this hammer is provided with a piston head P.

Screwing into the extension Q of the piston head, is a piston-rod R which is provided at its end operating in the power chamber M, with a piston head S.

Operating in the air-chest L (see Figs. 2 and 3) is a slide valve T provided with a port U.

V is a trip-rod having bearing in the ears *a* forming part of the top plate *b* of the casting D. This trip rod has also bearing in its front end in the ear *c* carried by the section C. The trip-rod V passes through the stuffing box W held in the air chest L, and the housed end X thereof is bent to engage with a pocket Y formed in the slide valve T. The motive fluid is fed through the coupling *d*, and when the said trip-rod is moved inward in using the tool, the port U is brought into alinement with the port *e* leading into the power chamber M, thus introducing the motive fluid into this chamber behind the piston head S.

2 is a dog operating in the longitudinal slot 3 formed in the trip-rod V.

4 is a leaf-spring secured by the means shown, to the top plate *b*, the free end of which extends into a pocket formed in the side of the dog 2. This spring 4 retains the dog 2 in the position illustrated in Fig. 2.

The trip-rod V is cut away as illustrated in Figs. 1 and 2 in the vicinity of the slot 3 so as to form cam surfaces 5 against which operates the head 6 of the dog 2. This dog operates through a hole formed in the top plate *b* and also through the casting D and extends through a hole in the section C down into the vacuum chamber N so that the annular flange 8 of the extension Q will be held by this dog and so lock the hammer O in normal position. When the trip-rod V is moved inward to move the slide valve T, as before stated, the cam surfaces 5 operate to withdraw the dog 2 from the path of movement of the annular flange 8. The movements of the parts just described are so adjusted that full pressure of the motive fluid is being exerted against the piston head S just before the dog 2 releases the hammer, and it will be understood that when the said dog is withdrawn sufficiently, the said hammer is shot forward and so drives the nail 9 held in the head.

10 is a port opening through the section B and casting D, and the position of this port is such that when the piston head S is moved to the limit of its out-movement, it moves beyond the said port, and allows the motive fluid to exhaust from the power chamber M. So soon as the nail is driven, the tool is withdrawn from the lath or wall and by spring power, the trip-rod V is returned to normal position thus allowing the dog 2 to be returned to normal position, and cutting off the motive fluid from the air chest L. Now as my tool is constructed to practically provide a vacuum in the chamber N between the piston head P and the dividing wall E, it will be understood that so soon as the said hammer has driven the nail, the atmospheric pressure within the chamber N between the head of the tool and the piston head P will shoot the hammer back to normal position when it will be locked by the dog 2. One side of the dog 2 is beveled as shown to permit the flange 8 to escape thereby.

11 is any suitable shock-absorbing material carried by the piston-rod R, and 12 is a stuffing box through which this piston rod operates.

13 is a port (see Fig. 4 particularly) which is normally closed by the spring valve 14 secured by the screw 15 or other suitable means to the casting D. This spring valve 14 will prevent any air escaping into the vacuum chamber N, and the function of the same, together with the port 13, is to allow the ready escape of any air that may leak into the vacuum chamber so as to reduce to a minimum any resistance offered to the inmovement of the hammer O. In order that this alternative form of my device may work, it will of course be understood that it must be constructed so as to absolutely prevent, if possible, any escape of air into the vacuum chamber N between the wall E and the piston-head P. Should any air leak into this chamber, during the in-movement of the hammer O, the air will be compressed by the piston-head P and forced out of the port 13.

16 is a slide valve carried by the trip-rod V.

In order to prevent any back pressure caused by the compression of fluid remaining in the power chamber M after the first exhaust therefrom, I provide a casting K (see Figs. 2 and 3) with a port 17 which

communicates with a chamber 18 formed in the air chest casting 19 by means of the port 20 formed in said casting. In the normal position of the parts (see Figs. 1, 2, 3, and 5) the ports 17 and 20 as well as the port 21 opening from the chamber 18, are open. The tool is supposed to have been withdrawn from the wall in Figs. 1, 2, 3, and 5, and therefore as the said ports are open, any air remaining in the power chamber M is forced therefrom by the return to normal of the hammer O without causing any appreciable back pressure. When the trip rod V is moved by contact with the wall, the valve 16 closes the ports 20 and 21 and so prevents the escape of the motive fluid therethrough.

22 is a coil spring mounted on the trip rod V. When this trip rod is moved inward, the pin 23 thereof compresses this spring against the plate *b* so that the stored-up energy of this spring will return the said trip rod to normal position at the proper time.

24 is the end of the hammer, and the same is screwed into the hammer proper so that in case of breakage it may be readily replaced.

I shall now describe the construction and operation of an alternative form of my invention. Whereas in the preferred form, I utilize the atmospheric pressure to return the hammer proper to normal position, in this alternative form I utilize the motive fluid for this purpose. It is one of the objects of my invention as embodied in the alternative form illustrated, to utilize the full pressure of the motive fluid in returning the hammer to normal position without having to take air from the live pipe directly for this purpose. In order to utilize the full pressure of the motive fluid, I must store sufficient of this motive fluid in the tool when the motive fluid from the live pipe is passing thereinto.

The casting K′ is provided with walls 72 and 73 spaced apart so as to form the air chamber 74. The pipe or coupling *d′* is held in the wall 73 and conducts the motive fluid to the chamber 74. When the trip rod V′ is shoved inward, the cylinder valve 75 coupled thereto as shown at 76, is moved so as to bring the port 77 into alinement with the port 78 and thus allow the motive fluid under pressure to escape from the air chamber 74 into said cylinder valve. This movement of the said valve also brings the port 80 into alinement with the port 81 and allows motive fluid to rush into the power chamber M′ and so drive outward the hammer. Of course at the same time the said ports are moving, means is operated to unlock the hammer, as hereinafter described. When the piston head S′ moves beyond the port 10′, the motive fluid exhausts from the power chamber M′ into the cavity 82 and escapes through the port 83, formed in the top plate *b′*, through which the cylinder valve 75 operates. The cylinder valve 75 is flattened as shown at 84 so that when the trip rod V′ is moved as described, the flattened portion 84 will be moved into the position shown in Fig. 11 to allow for the exhaust. The spring 22′ returns the trip rod V′ and cylinder valve 75 to normal position when a nail has been driven, and as the port 77 communicates with the port 78 after the port 80 has been moved out of communication with the port 81, a full supply of motive fluid will be stored in the cylinder valve 75 so that when the said spring 22′ returns the parts to normal position, the port 85 formed in the cylinder valve 75 will be in alinement with the port 86 opening through the casting D′ and the section B′, and will allow the motive fluid from said cylinder valve and connected chambers to rush into the power chamber M′ and drive the piston head S′ and connected parts back to normal position.

The top plate 87 of the casting K′ is provided with a chamber 88 in which the cylinder valve 75 operates, and this chamber communicates by a port 89 formed in the casting K′ with an air chest 90. This air chest 90 is added to increase the capacity of the tool for storing the motive fluid under pressure, and the capacity of this air chest can be regulated at will, by the following means: 91 is a sliding end for the said air chest mounted to move on the supply pipe *d′*. 92 is a plug mounted on said pipe and screwing into the said sliding end. 93 is a set screw by means of which the plug 92 can be held in adjusted position on the pipe *d′*. By adjusting inward or outward the position of the sliding end 91 the capacity of the air chest 90 can be regulated.

17′ is a port formed in the casting K′ which opens into the chamber 18′ formed in the top plate 87. 16′ is a valve which operates in this chamber 18′. When the piston head S′ is being forced inward under the action of the stored motive fluid from the cylinder valve 75, the valve 16′ has opened the port 17′ so that the motive fluid in the power chamber M′ that did not exhaust through the port 10′, will escape through this valve into the chamber 18′ and out of this chamber through the exhaust port 21′. Of course when the trip rod V′ is shoved inward, the port 17′ is closed.

The head 94 of the hammer O′ is provided with an annular flange 8′ with which engages the dog 96 having a rounded inner end, which has bearing against the rounded corner 97 of the casting D′.

98 is a leaf-spring suitably secured to the casting D′ and to the dog 96, which keeps this dog in the position illustrated in Fig. 8.

The triprod V′ is provided with a slot 3′, but in this form of my invention the dog 2 is a pin 99 which screws into the dog 96. The head 100 of the pin 99 rests against the cam surfaces of the sides of the slot 3′, as before described in connection with my preferred form of invention.

While I have described what I consider to be the best embodiments of my invention, I desire it to be understood that the principles can be embodied in different forms, and I desire not to be limited beyond the requirements of the prior art, and the terms of my claims.

y is a magnet secured by the screws 1 to one of the sections of the head F, for instance the section G.

m is a tongue of metal which remains after portion of the end of the section G has been removed to provide space for the magnet *y*, thus forming a wall between the nail and said magnet. I do not confine myself to using this magnet, although from practice I have found that when the tool is used in a vertical position, the magnet is some times useful; *e. g.*, if there is any diminution in the pressure of the motive fluid for the nail conduits. Should the pressure of the motive fluid fall too low, or the fluid be entirely cut off, the magnet will prevent the nail from dropping back into the section C. By providing the tongue of metal *m*, I prevent the point 24 of the hammer from coming in contact with the magnet so that it will not be magnetized.

In my experiments I have found that I can operate my hammer with the minimum pressure of motive fluid when the same is suddenly unlocked and shot forward under the full pressure of the motive fluid. If the atmospheric pressure should be so great as to cause the hammer O to strike too great a blow against the wall E, I provide an alternative form of construction for the valve 14. The head 101 of the valve 14′ is provided with a short conduit 102 with which communicates a pipe 103 to allow atmospheric air to rush into the vacuum chamber when the hammer O is driven outward. The plug 104 screwing into the conduit 102 can be used to regulate the supply of air into the pipe 103. The supply of air through the parts just described will be quite small but will be sufficient to provide a cushion of compressed air within the vacuum chamber to largely absorb the shock developed by the return to normal of the hammer O. So as to absolutely insure the free action of the pressure of the atmosphere in returning the hammer O to normal position, I provide the section C with a hole *x*. The constant stream of compressed air passing through the coupling 43 into the head F will not interfere with the passage of air under atmospheric pressure through this hole.

What I claim as my invention is:

1. A tool operated by motive fluid comprising the combination of a cylinder divided into a first and second chamber; a hammer operating in said second chamber, the outer end of which is open; a piston-rod attached to said hammer and operating in said first chamber; valve means for controlling the supply and exhaust of motive fluid into and out of said first chamber; means for locking said hammer in normal position, and means whereby when the tool is pressed against a wall, said hammer is unlocked and said valve means operated to permit a supply of motive fluid to drive said hammer outward.

2. A tool operated by motive fluid comprising the combination of a cylinder divided into a first and second chamber; a hammer operating in said second chamber, the outer end of which is open; a piston-rod attached to said hammer and operating in the said second chamber; valve means for controlling the supply and exhaust of motive fluid into and out of said first chamber; means for locking said hammer in normal position, and a trip-rod supported by said cylinder and normally extending beyond the front end thereof, and which, when pressed against a wall, will unlock said hammer and operate said valve means to permit a supply of motive fluid to drive said hammer outward.

3. A tool initially operated by motive fluid under pressure, comprising the combination of a cylinder divided by a wall into a power chamber provided with intake and exhaust ports, and another chamber, the front end of which is open; a member operating in said other chamber and provided with means to fit said chamber; a piston-rod attached to said member and operating through said wall and in the said power chamber; valve means for controlling the supply and exhaust of motive fluid into and out of said power chamber, and means whereby when the tool is pressed against a wall, said valve means will be operated to permit a supply of motive fluid to drive said member outward, and to open said exhaust port, the out-movement of said member causing a partial vacuum in said other chamber between said wall and said member so that atmospheric pressure will return said member back to normal postion.

4. A tool initially operated by motive fluid under pressure, comprising the combination of a cylinder divided by a wall into a power chamber provided with intake and exhaust ports; and another chamber, the front end of which is open; a member operating in said other chamber and provided with means to fit said chamber; a piston-rod attached to said member and operating through said wall and in said power chamber; valve means for controlling the supply and ex-

haust of motive fluid into and out of said power chamber; means whereby when the tool is pressed against a wall said valve means will be operated to permit a supply of motive fluid to drive said member outward, and to open said exhaust port, the out-movement of said member causing a partial vacuum in said other chamber between said wall and said member so that atmospheric pressure will return said member back to normal position, and a valve leading into said other chamber to control passage of air thereinto and therefrom, as and for the purpose specified.

5. A tool initially operated by motive fluid under pressure, comprising the combination of a cylinder divided by a wall into a power chamber provided with intake and exhaust ports, and another chamber, the front end of which is open; a member operating in said other chamber and provided with means to fit said chamber; a piston-rod attached to said member and operating through said wall and in said power chamber; valve means for controlling the supply and exhaust of motive fluid into and out of said power chamber; means for locking said member in normal position; means whereby when the tool is pressed against a wall, said member will be unlocked, and said valve means operated to permit a supply of motive fluid to drive said member outward, and to open said exhaust port, the out-movement of said member causing a partial vacuum in said other chamber between said wall and said member so that atmospheric pressure will return said member back to normal position.

6. A tool initially operated by motive fluid under pressure, comprising the combination of a cylinder divided by a wall into a power chamber provided with intake and exhaust ports, and another chamber, the front end of which is open; a member operating in said other chamber and provided with means to fit said chamber; a piston-rod attached to said member and operating through said wall and in the power chamber; valve means for controlling the supply and exhaust of motive fluid into and out of said power chamber; means for locking said member in normal position; means whereby when the tool is pressed against a wall, said member will be unlocked, and said valve means operated to permit a supply of motive fluid to drive said member outward, and to open said exhaust port, the out-movement of said member causing a partial vacuum in said other chamber between said wall and said member so that atmospheric pressure will return said member back to normal position, and a valve leading into said other chamber to control passage of air thereinto and therefrom, as and for the purpose specified.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM EVANS COLWELL.

Witnesses:
R. M. HALL,
S. C. THACHER.