O. O. APP.

FLUID PRESSURE OPERATED TOOL.

APPLICATION FILED OCT. 8, 1910. RENEWED JAN. 5, 1912.

1,205,140. Patented Nov. 21, 1916.

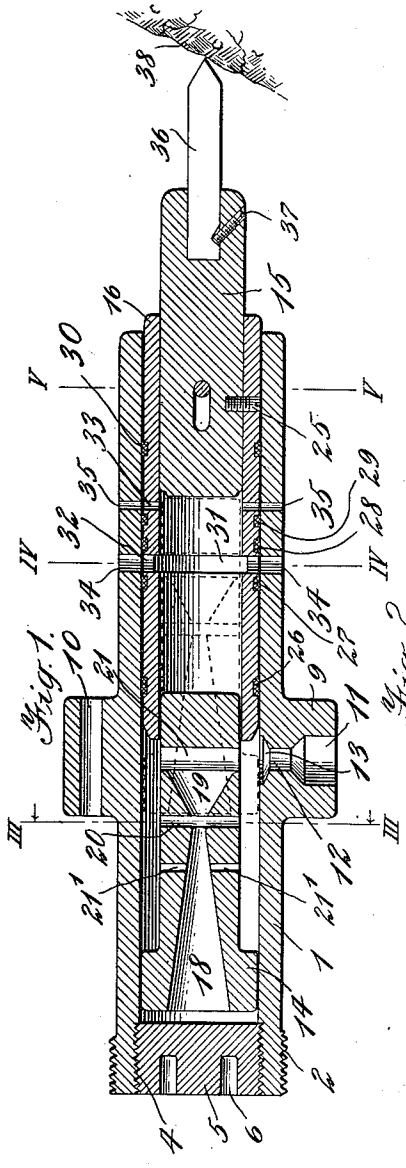


Fig. 1.

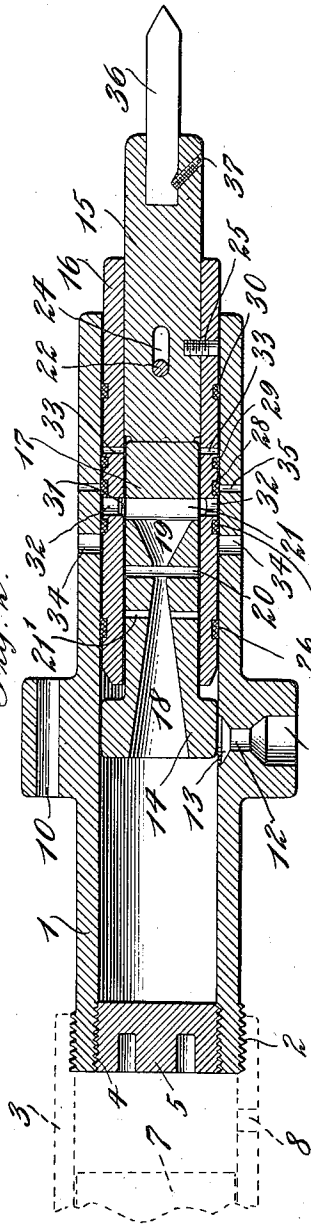


Fig. 2.

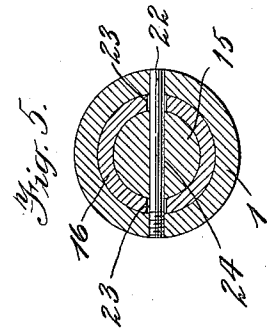


Fig. 5.

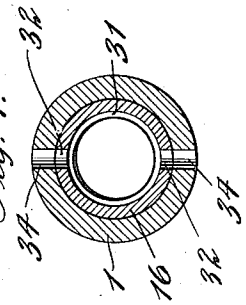


Fig. 4.

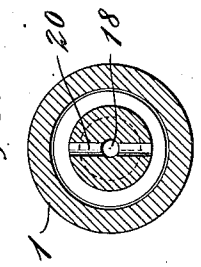


Fig. 3.

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FLUID-PRESSURE-OPERATED TOOL.

1,205,140. Specification of Letters Patent. Patented Nov. 21, 1916.

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To all whom it may concern:

Be it known that I, OLIVER O. APP, a citizen of the United States, residing at New York city, in the borough of Manhattan and State of New York, have invented certain new and useful Improvements in Fluid-Pressure-Operated Tools, of which the following is a full, clear, and exact description.

This invention relates to fluid pressure operated implements, and more particularly to a pneumatic tool holder, for chisels and the like, and is especially adapted for use in connection with the driving of tunnels, shafts and operations upon rock and like surfaces.

One object of my invention is to provide means whereby when a tool carried by said holder is not disposed against a hard surface, or is in fact not held against any surface whatsoever, the said holder will cease automatically to operate.

I further aim to secure a device which shall be of the simplest possible construction, and which shall have a minimum number of parts.

The implement is designed to stand hard and rough usage; is readily manipulatable; and comparatively inexpensive to manufacture, as compared with like devices.

I further aim to reduce the waste of the pressure-fluid to a minimum.

Other objects of my invention will be hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings which form a part hereof: Figure 1 is a longitudinal section of the implement, taken on the median line thereof, the parts of said implement being shown in operative position. Fig. 2 is a section similar to the first, but showing the parts in inoperative position. Fig. 3 is a transverse section taken on line III—III of Fig. 1. Fig. 4 is a similar section taken on line IV—IV of Fig. 1. Fig. 5 is a similar section correspondingly taken on line V—V of Fig. 1.

Referring to the drawings, in which like reference characters designate like parts throughout the several views; the casing or cylinder 1 is provided at its rear extremity with means for attaching thereto a suitable support. In this instance the rear extremity of the casing is threaded externally as shown at 2, for engagement with a sleeve 3, of the said support. The same end of the casing is also interiorly threaded at 4 for the reception of a plug 5 which may be screwed into position by means of the span-wrench holes 6. The rear extremity of the implement is hence substantially closed and is adapted to have fluid pressure exerted thereagainst to hold the tool to its work.

The support forms no part of this invention and hence has been indicated in dotted lines; but it may be here stated that one form of such device would comprise the sleeve 3 above mentioned which is disposed in engagement with a stationary plunger 7; fluid being introduced into the cavity provided between the face of this plunger and the rear face of the implement by means of a port 8 in the side of the sleeve 3. The outside of the casing 1 carries a preferably integrally formed collar 9 which has apertures 10 extending therethrough by means of which a suitable pipe or hose may be secured to the implement for delivering compressed air or the like thereto, such fluid entering through a port 11 in one side of the collar. This port is preferably reduced as at 12 adjacent its inner extremity and is flared out from such reduced portion at 13 to facilitate delivery of the fluid to the operative parts of the implement. These parts, in this embodiment of my invention, comprise respectively a reciprocable hammer or piston 14, a chisel or tool; a tool holder 15, and a port-controlling member or sleeve 16; the latter being disposed around the tool holder and also around the reduced portion 17 of the hammer. All of these parts are preferably circular in cross section, and fit each other as neatly as possible while allowing free movement of the respective parts or elements. The hammer has a conical recess 18 in its rear extremity; this recess tapering toward the center of the hammer and delivering into a somewhat similar recess 19 which, however, flares in an opposite direction to that first mentioned. Between these two recesses and respectively in communication with each is a cross port or opening 20, preferably consisting simply of a drilled hole; and a corresponding somewhat larger port 21 is disposed crosswise at the forward extremity of the recess 19, which delivers thereinto. A second set of cross ports 21′ is disposed between the cross port 20 and the rear end of the hammer. The forward extremity of the hammer is adapted to engage the tool holder 15; the

latter being held against rotation by means of a pin 22 which extends through the casing 1, slots 23 in the sleeve 16 and a corresponding slot 24 in the tool holder. The tool holder is hence adapted to be reciprocated through a predetermined travel. It is further, firmly secured to the port-controlling member or sleeve 16 so that these two parts move together, by means of a stud 25, which is shown in Figs. 1 and 2, as screwed into the body of the tool holder.

A plurality of rings respectively designated 26, 27, 28, 29 and 30, are carried by the sleeve 16, and by their engagement with the inner wall of the casing serve to prevent leakage of the fluid therebetween. The interior of the sleeve is provided with a groove 31 which extends entirely therearound; said groove opening respectively upon opposite sides thereof into the ports 32. Substantially midway of the length of the sleeve 16 is a pair of oppositely disposed ports 33; these latter being relatively quite small in diameter. The casing is ported at 34, preferably upon opposite sides thereof, with a pair of ports of substantially the same diameter as the ports 32 above referred to; and is further correspondingly ported at 35, these latter ports being spaced longituidnally from the ports 34 a distance substantially equal to the corresponding distance between ports 32 and 33. Ports 35 are preferably also of the same size as ports 33. The tool holder is recessed at its forward extremity for the reception of a tool 36. In this instance the tool shown is a chisel. The tool holder preferably is provided with means for retaining the tool in position therein, and a small screw 37 serves to accomplish this end.

The operation of the mechanism is as follows:—Considering the arrangement shown in Fig. 2, wherein, as aforesaid, the parts are shown in inoperative position; it will be observed that the hammer is forwardly disposed, in contact with the tool holder; said tool holder and its attached sleeve 16 also being driven as far forwardly as possible. The pressure-fluid, when turned on, enters the aperture 11 and holds the hammer under pressure in such forward position; there being no tendency to reciprocate any of the operative parts; while the ring 26 effectually prevents the escape of any pressure-fluid which may find its way around the enlarged end of the hammer. Assuming now that the tool is driven against a resisting surface, such for example as the rock 38 indicated in Fig. 1. This surface, being substantially unyielding, opposes the tool and thereby forces the tool holder and its sleeve back toward and into the casing. As a result of this action, the enlarged rear portion or head of the hammer closes the flared mouth 13 of the port 11; but as the pressure continues to be exerted upon the tool this port is again uncovered, this time, however, so as to admit the fluid to the forward side of the said head. The hammer will hence be urged rearwardly and will continue to travel toward the rear until the cross port 21′ reaches the rear extremity of the sleeve 16. A relatively small quantity of pressure-fluid will then rush through said port and will tend to counteract the rearward thrust of the hammer or plunger; but as the latter has considerable momentum, it will continue on its rearward course until the ports 20 and 21 are successively uncovered by passing the rear end of sleeve 16. Thereafter the full pressure of the fluid will be exerted upon the rear side of the hammer counteracting and overcoming in a very short time its momentum and urging it toward the forward end of the implement with considerable force. The rear stroke of the hammer is cushioned so that it normally never actually strikes the plug 5; but in practice will always be spaced therefrom even when in its rear-most position. Pressure in the meantime has been at all times exerted upon the rear end of the port-controlling member or sleeve 16 and hence has tended to thrust the same into its outermost position. This tendency, however, is resisted as long as the tool remains in contact with a resisting surface; so that the sleeve 16 and its tool holder are not outwardly or extendedly disposed. The hammer now strikes the inner extremity of the tool holder, momentarily driving it forward together with the sleeve 16. Owing to the fact, that the tool 36 is already in contact with a firmly resisting medium, the tool holder will not ordinarily be driven to its outermost position, and hence the tool will merely be driven into the rock a short distance as a result of the blow. The forward travel of the hammer or piston shuts off the admission of the pressure-fluid so that the same is no longer admitted to the rear of said hammer. It should be noted in this connection that this shutting off is gradual since the port 21 is closed immediately after the hammer begins its forward advance; the ports 20 and 21′ being thereafter successively closed and the air or other medium at the rear of the hammer then operating expansively to drive said hammer to its work. Actually the pressure is being exerted against the forward side of the enlarged head of the hammer while this forward advance of the hammer is being made; and the blow upon the tool holder will hence be slightly cushioned, as it should be, to prevent breakage of the operative parts; but this cushioning effect is not enough to interfere with the operation of such parts; an effective blow being delivered and immediately thereafter the hammer is returned to its rear-most position and the operation cycle repeated. The hammer will be recip-

rocated at a high rate of speed, a great number of blows being delivered upon the rear end of the tool holder proper, which action will continue as long as the tool meets with opposition.

I desire particularly to direct attention to the fact that the instant that the tool ceases to encounter a hard or resisting surface the implement will automatically cease to operate. This feature is of the utmost importance in a device of this character. Attention is also called to the particular disposition of the rings 26, 27, 28, 29, and 30. The cavity formed between the rear extremity of the tool holder and the forward end of the hammer is in communication with the air during almost the entire stroke of the hammer. As the latter moves forward to the position indicated in dotted lines in Fig. 1, the end thereof in passing groove 31 covers the same thereby forming a slight air cushion between the hammer and tool holder, air being allowed to escape relatively slowly out of the small ports 33 and 35 until the hammer has reached almost the end of its travel.

Assuming now that the sleeve which has a bias to exhaust port closing position is permitted to move to its outermost position, it is obvious that rings 27 and 28 serve to prevent leakage of the fluid from ports 32 either to ports 34 or 35. Were it not for rings 29 and 30, there might be some escapement of pressure-fluid through port 21, between the hammer and sleeve to port 33 and out from thence either forwardly to the extremity of the sleeve, or rearwardly back to ports 35. Ring 26 serves at all times to prevent leakage of air around the sleeve and out through the ports 34. The five rings shown are hence so disposed that escapement of the pressure-medium is substantially impossible.

In effect the sleeve 16 and tool holding part 15 act as one piece and constitute a shell which performs the dual function of holding the tool proper and of also serving as the means for shutting off the passage of the pressure-fluid through the mechanism. This arrangement is of the utmost importance, since in large measure the successful operation of the implement depends upon the fact that the hammer is not the means of shutting off the fluid flow. Should it be attempted to close the inlet port of the casing by the passage of the rear end or head of the hammer thereover, the cushion necessarily provided to prevent breakage of the parts, after the same have been in use for a comparatively short while, would urge the hammer rearwardly and hence reopen the admission; as a result of which the implement would not cease to operate in the manner described. This trouble has been encountered in all of the appliances of this description known to applicant. Indeed, applicant avers that, to the best of his knowledge, no practically operative implement adapted to stop when pressure upon the tool proper is removed has yet been produced.

The utilization of an operative part of the implement other than the hammer or plunger, to wit, the shell aforesaid as the means for shutting off the fluid flow affords a veritable solution of the problem, since the fluid pressure is at all times exerted upon the rear end of this shell and the cushioning effect above referred to merely serves to intensify the tendency to close the ports controlling the fluid flow.

As a matter of practical importance it should be noted that the construction herein set forth obviates a serious objection found in implements of this description as heretofore constructed, namely, the tendency for the casing to split after the device has been in use a comparatively short time. This is due to the necessarily close fit between the hammer and the casing wall adjacent the tool end of the casing. The shell in my construction coöperating as it does with both the hammer and the casing, practically eliminates this tendency and the life of the tool is materially lengthened.

What I claim, is:

1. A fluid-pressure operated tool actuating implement, comprising a casing having an inlet and at least one exhaust port, a hammer adapted to be reciprocated by pressure-fluid passing through said inlet port, and a movable port-controlling member which co-acts with said exhaust port to close the same when the tool is removed from the work, said inlet port being normally open when said parts are so disposed and the pressure-fluid thereby admitted through said inlet port tending to hold said member in its port closing position.

2. A fluid-pressure operated implement comprising a casing having an inlet and at least one exhaust port, a hammer adapted to be reciprocated by pressure-fluid passing through said inlet port, a tool adapted to be operated by said hammer, a movable port controlling member which co-acts with said exhaust port to close the same when the tool is removed from the work, said inlet port being normally open when said parts are so disposed and the pressure fluid thereby admitted through said inlet port tending to hold said member in its port closing position, said tool being connected to said member, pressure upon the working portion of the tool in excess of that exerted by the pressure fluid upon the said member moving the latter to open the said port covered thereby.

3. A fluid-pressure operated tool actuating implement comprising a cylinder having an inlet and at least one exhaust port, a hammer adapted to be operated by pressure-

fluid passing through said inlet port, a shell adapted to co-act with said cylinder to close said exhaust port when the tool is removed from the work, said inlet port being normally open when said parts are so disposed and the pressure fluid thereby admitted through said inlet port tending to hold said shell in its port closing position.

4. A fluid-pressure operated mechanism comprising a casing, a hammer relatively movable to said casing by fluid-pressure, a tool operable by one of said parts, and a port-closing member for shutting off the flow of pressure-fluid through the mechanism, said member being adapted to close the exhaust from the mechanism while leaving the inlet or admission open, said member further being normally held by said fluid-pressure in exhaust-port closing position when the tool is removed from the work.

5. A fluid-pressure operated mechanism comprising a casing, a hammer relatively movable to said casing by fluid-pressure, a tool operable by one of said parts, one of said parts having means for successively reducing the flow of the pressure-fluid through said mechanism at intervals during the operation of the same, and a port-closing member for shutting off the flow of pressure-fluid through the mechanism, said member being adapted to close the exhaust from the mechanism while leaving the inlet or admission open, said member further being normally held by said fluid-pressure in exhaust-port closing position when the tool is removed from the work.

6. A fluid pressure operated implement comprising a casing, a plunger therein, a shell normally surrounding a portion of said plunger, and means co-acting with said shell and casing for preventing leakage of pressure-fluid between said last mentioned parts.

7. A fluid-pressure operated mechanism comprising a casing having an inlet and at least one exhaust port, a shell therein having a port adapted to be moved into and out of alinement with the said exhaust port of said casing, a piston having a reduced forward portion and provided with a conduit from the side of said reduced portion to the rear face of said piston, said shell having a tendency to port closing position.

8. A fluid-pressure actuated implement having a casing provided with an inlet and an exhaust port, a shell adapted to carry the tool, means for operating the same, said means and said shell being moved and held in inoperative position by the fluid pressure when the tool is removed from the work, the exhaust port being closed by said shell in its inoperative position, the inlet port remaining open.

9. A fluid-pressure operated implement comprising a casing having an inlet and an exhaust port, a reciprocable piston therein, a shell and a tool operatively associated therewith for controlling said exhaust port, said piston having means for controlling said inlet port to admit fluid-pressure to one face only or to each of its faces alternately.

10. A fluid-pressure operated tool actuating mechanism comprising a casing having an inlet and an exhaust port, a reciprocating piston therein, said piston being fluid-pressure controlled and adapted to control the inlet to permit the passage of the fluid-pressure to one face thereof when in an inoperative position and to each face thereof alternately to reciprocate the same, a reciprocable shell within said casing and a tool operatively associated therewith, said shell being adapted to control said exhaust port.

11. A fluid-pressure operated mechanism comprising a casing having an inlet and exhaust port, a reciprocable hammer in said casing having a part co-acting with said inlet port to control the reciprocations of said hammer and an exhaust port controlling member separate from said hammer having a tool operatively associated therewith.

12. A fluid-pressure operated mechanism comprising a casing having a normally open inlet port and an exhaust port, a shell having a port adapted to coöperate with said exhaust port, a hammer in said casing having a plurality of ports therein connecting the opposite faces of said hammer and having a portion thereof adapted to control said inlet port to admit fluid-pressure to one face only of said hammer to hold the hammer in inoperative position and the shell in exhaust port closing position and also to permit the alternate passage of the fluid-pressure to both faces of the piston to reciprocate the hammer when the shell is moved to exhaust port opening position by the pressure of the tool against the work.

13. A fluid-pressure operated implement comprising a casing having an inlet port and an exhaust port, a ported shell for controlling said exhaust port and a piston disposed in said casing having a portion for controlling the admission of fluid-pressure to the opposite faces of said piston and a tool operatively associated with said shell.

14. A fluid-pressure operated implement comprising a casing having an inlet and exhaust port, a ported shell therein for controlling the exhaust port, a tool operatively associated with said shell, a reciprocable piston having conduits for admitting fluid-pressure from one face to another from said piston, said piston having a part adapted to permit the passage of fluid-pressure to one face only of said piston when the shell

is in exhaust port closing position and the tool is removed from the work and to permit the alternate passage of fluid-pressure to each face of the piston through said conduits when said shell is in exhaust port opening position and the tool is pressed against the work.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

OLIVER O. APP.

Witnesses:
JAMES D'ANTONIO,
WALDO M. CHAPIN.