S. OLDHAM.

JACK HAMMER DRILL.

APPLICATION FILED SEPT. 16, 1914.

1,141,650.

Patented June 1, 1915.

2 SHEETS—SHEET 1.

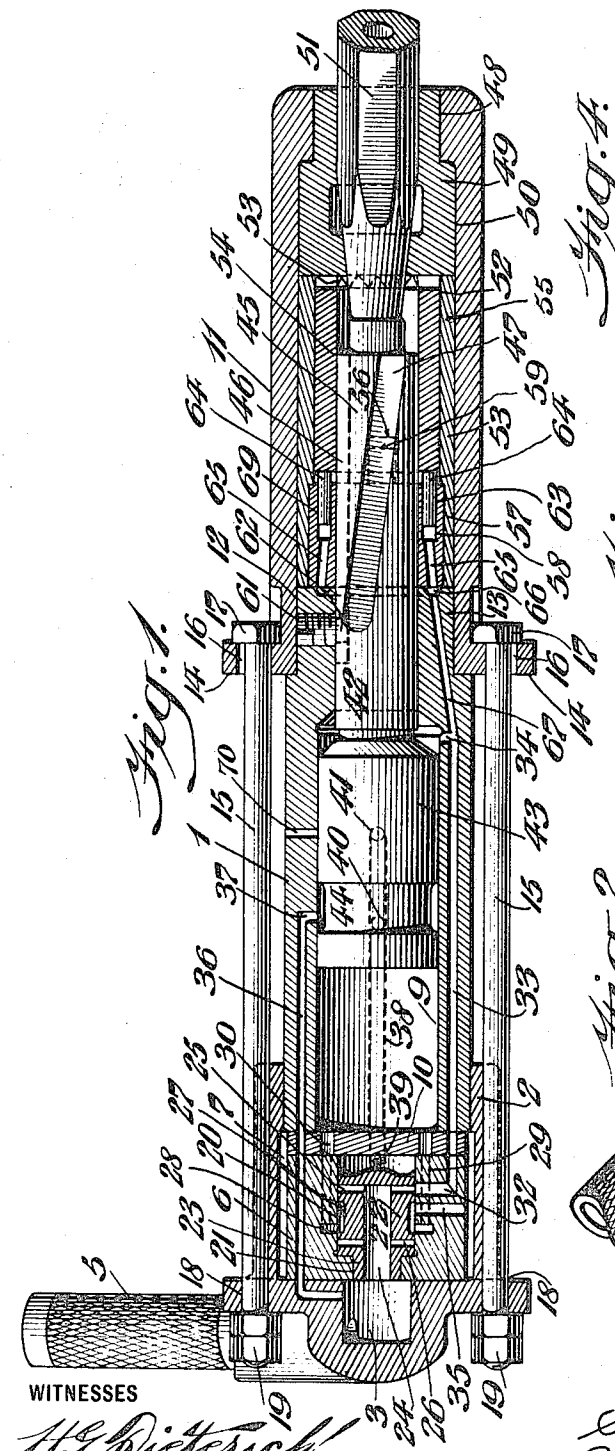


Fig. 1.

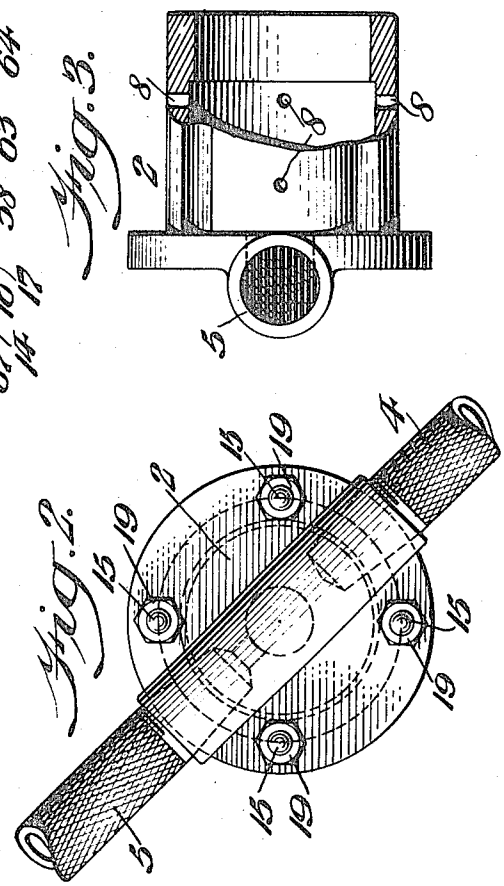


Fig. 2.

Fig. 3.



Fig. 4.

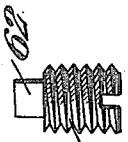


Fig. 5.

WITNESSES

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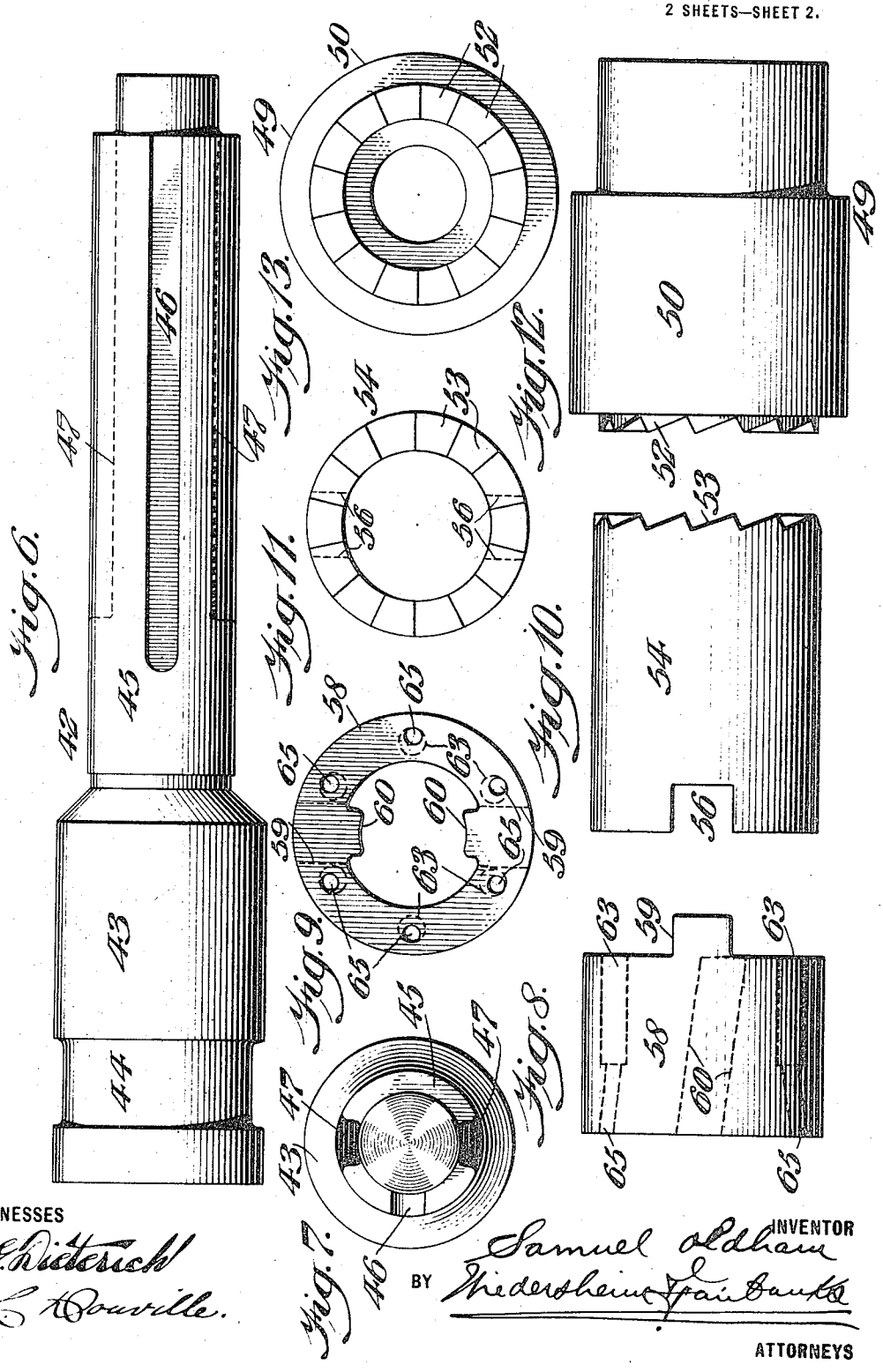
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JACK HAMMER-DRILL.

1,141,650. Specification of Letters Patent. Patented June 1, 1915.

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To all whom it may concern:

Be it known that I, SAMUEL OLDHAM, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Jack Hammer-Drill, of which the following is a specification.

In rock drills commonly in use, the same are incapable of being manually held, and it is generally necessary by reason of their great weight, to support the same on a tripod and to effect the rotation of the drilling or boring mechanism by means of ratchet and pawl mechanism and the like.

My present invention is designed to provide a jack hammer drill, which is light in weight and portable, so that it can be readily transported to any desired point, and can be manually held to the work without fatigue to the operator, and wherein the rotation of the drilling member is effected simultaneously with the reciprocations of the piston at the proper intervals without the interposition of complicated mechanism, which is likely to get out of order.

To the above ends my invention consists of a pneumatically actuated impact tool in which the boring or drilling implement or other working tool receives a partial rotation for each reciprocation of the piston to change the position of the cutting surface of the working tool.

It further consists of such rotating device in which the tool rotating elements are directly actuated from the reciprocated hammering element.

It further consists of means for directly controlling the tool-rotating means from the live motive fluid.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same will be found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents an axial section of an impact tool embodying my invention. Fig. 2 represents a view of the upper end of the tool. Fig. 3 represents a side view, with parts broken away and removed, of the handle-socket. Figs. 4 and 5 represent, respectively, an end view and a side view of a guide stud. Fig. 6 represents a side elevation of the reciprocating plunger. Fig. 7 represents an end view of such plunger. Fig. 8 represents a side elevation, and Fig. 9 an end view of a sleeve of the rotating mechanism. Fig. 10 represents a side elevation, and Fig. 11 an end view of a reciprocable sleeve in such mechanism. Fig. 12 represents a side elevation, and Fig. 13 an end view of the rotatable tool-socket.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—1 designates a main plunger cylinder or working cylinder forming a part of the barrel of the tool, and a handle-socket 2 is secured upon the upper end of such cylinder and has an axial inlet chamber 3 and radial handles 4 and 5, the latter of which is tubular and communicates with said chamber and can have its outer end connected to an air-hose or other connection (not illustrated) leading from an air-compressor or other source of motive fluid under pressure.

A cylindrical valve-block 6 is supported with its ends clamped between the bottom of the socket and the upper end of the plunger-cylinder, and is of less diameter than the interior diameter of the socket to form an annular exhaust-chamber 7, having exhaust ports 8, through the walls of the socket out of the atmosphere. The main plunger-cylinder has an axial bore 9 opening at its upper end and of the same diameter throughout, and a disk or button 10 is clamped between the upper end of the plunger-cylinder and the lower face of the valve-block, closing the upper end of the piston chamber formed by said bore. A guide-cylinder 11 is secured to the lower end of the plunger-cylinder, fitting with the upper end of an axial bore 12, upon the rabbeted lower end 13 of the plunger-cylinder and having an annular flange 14. Threaded rods 15 pass through openings 16 in the flange and have heads 17 at their ends bearing against said flange, and the upper ends of said rods pass through openings 18, in ears upon the handle-socket and have nuts

19 upon their threaded upper ends, by means of which rods and nuts the socket, valve-block, button, plunger-cylinder and guide-cylinder are axially connected. The valve-block has an axial valve-chamber 20 of the same diameter throughout, and a smaller diameter bore 21 at the upper end of said chamber opening into the inlet-chamber of the handle-socket. A valve having a cylindrical body 22 fitting in the valve-chamber and a neck 23 at the upper end sliding in the bore, is reciprocable in the valve-block and has an axial channel 24 opening at its upper end into the inlet-chamber and extending to near the lower end of the valve where it opens through the sides of the body through radial ports 25. Radial ports 26 extend through the sides of the body from the axial channel near the upper end of the valve-body, and an annular groove 27 is formed in the side of the valve-body between the two sets of radial ports, forming a port.

The valve-block has an annular port 28 near the upper end of the valve-chamber, with which the upper radial ports in the valve will register when the valve is in its lowermost position, and said port communicates by longitudinal passages 29 in the valve-block and passages 30, through the button with the upper end of the plunger chamber. The radial series of ports 25 formed in the valve from its axial channel and through the sides of the valve-body register, when the valve is at the upper end of its stroke, with a port 32, in the valve-block and communicating by a channel 33 in the valve-block, button and the wall of the plunger-cylinder, and through a port, 34, with the lower end of the plunger-chamber. A port 35 is formed in the valve-chamber between the ports communicating with the ends of the plunger-chamber, and extends to the annular exhaust-chamber surrounding the valve-block, and the annular groove in the valve-body alternately connects the channels from the ends of the plunger-chamber with the exhaust port and exhaust chamber, as the valve is reciprocated. A channel 36 extends from the inlet chamber in the handle-socket, and through the valve-block, button and the wall of the plunger-cylinder, and the lower end of said channel opens at about the middle of the plunger-chamber through a port, 37. A longitudinal passage 38 is formed in the wall of the plunger-cylinder and in the button and valve-block, and has a port 39 at its upper end and opening in the lower end of the valve-chamber, a port 40 peripherally alined with the live-air port 37 in the plunger-chamber, and a port 41 at its lower end adapted to be uncovered, when the plunger is in its uppermost position. A port, 70, is formed in the plunger chamber to communicate with the outer atmosphere and in or about in peripheral alinement with the port 41, to allow air in the lower portion of the plunger-chamber to escape when the plunger is at the end of its up-stroke and thus connect the lower end of the valve-chamber with the atmosphere through the passage 38 and port 41. A plunger 42 has a piston 43 reciprocable in the plunger-chamber and formed near its upper end with a peripheral recess 44, which connects the live-air port 37 and the upper port 40 when the plunger is at the lower end of its down-stroke. The plunger has a cylindrical striker 45 axially extending from its lower end, and said striker has a longitudinal groove 46 in its surface extending from near its upper end to its lower end, and two diametrically opposite oblique grooves 47, one at each side of such straight groove.

The guide-cylinder 11 has a flange 48 at the lower end of its axial bore 12, and a tool-socket 49 extends and is rotatable in the contracted bearing in said flange and has a cylindrical head 50 in the bore of the guide-cylinder and bearing against the flange. The socket has its bore shaped to receive and hold against turning the shank 51 of the working tool, which can be a bit, chisel or other tool which requires part rotation on its axis as it is driven into the work. The upper annular face of the head of the socket is formed with radiating ratchet-teeth 52, and corresponding teeth 53 upon the lower edge of a sleeve 54 engage such former teeth. Said sleeve fits to turn and slide within a cylindrical shell 55 in the bore of the guide-cylinder, and the rear edge of the sleeve has rectangular notches 56. The interior of said shell has the upper portion 57 of slightly greater diameter than the portion in which the ratchet-sleeve moves, and a sleeve 58 is rotatable in such enlargement and has tongues 59 upon its lower edge, which engage the rectangular notches in the upper edge of the ratchet sleeve, so that said sleeves will rotate together, but the ratchet-sleeve will have longitudinal movement in its relation to the upper sleeve. The bore of the upper sleeve has oblique tongues 60, which enter the oblique grooves of the cylindrical striker of the plunger to cause the reciprocations of the latter to rock the sleeves. A screw-plug 61 through the reduced lower end of the plunger-cylinder has a flat head 62, which projects into the straight groove of the striker and thus retains the latter and the plunger against rotation. The upper sleeve has a series of longitudinal bores 63 open at their lower ends, and plugs 64 are reciprocable in said bores to have their ends bear against the upper edge of the ratchet-sleeve, and the upper ends of said bores extend by diverging passages 65 out through the rear edge of the sleeve and register with an annular groove 66 in the end of the plunger-

cylinder, into which a passage 67 opens, extending from the forward end of the distributing channel 33.

In practice, the motive fluid, which is usually compressed air supplied from an air-compressor, is admitted through the tubular handle and enters the inlet chamber in the handle-socket. A controlling throttle-valve is usually employed on the inlet and is not here illustrated, as it can be of any suitable construction and forms no part of the present invention. The working tool, which may be a chisel, drill-bit, boring tool or any other percussion tool, has its shank inserted in the tool-socket to have such shank struck by the plunger and rotated by the rotatable socket. When the plunger is in the position illustrated in Fig. 1 of the drawing, said plunger has just struck the tool-shank and connects the port of the live-air distributing channel and the port of the distributing channel to the lower end of the valve-chamber by means of the peripheral groove on the plunger, so that the live-air is conveyed below the valve and moves the same upward. The live-air passes axially through the valve and through the radial ports in the lower end of the valve-body into the passage 33 and port 34 to the lower end of the working cylinder, forcing the plunger upward. The live-air passes from the returning channel 33 and its extension 67 to the bores 65 in the upper sleeve in the guide-cylinder, where it forces the plugs 64 downward to move the ratchet sleeve 54 downward to engage its teeth 53 with the teeth 52 of the head of the tool-socket 50.

As the plunger moves upward, the oblique grooves in the guide-plunger engaging the oblique tongues of the upper sleeve rotate the same, and, the ratchet teeth being engaged with those of the tool-socket, the latter and the tool are rotated and the working point of the latter will strike at a different position in the bottom of the drilled bore at each stroke. The air above the piston is exhausted through the openings in the button and passages in the valve-block, which the valve now connects with the exhaust port 35 through the annular groove 27. When the piston on its up-stroke uncovers the lower port 41 of the passage from the valve-chamber and the exhaust port 70 thus allowing the air below the valve to exhaust, the direct pressure of the live air against the upper end of the valve will overcome the pressure below the valve and move the same downward, when the plunger chamber will be connected at its lower end to the exhaust through the valve-groove and valve-chamber and at the upper end to the inlet through the upper radial ports in the valve-body and the passages in the valve-block and button. More than one exhaust port 70 can be provided to cause quick reduction of pressure below the valve when the plunger uncovers said ports at the end of its up-stroke. As the plunger descends and the lower end of the piston chamber is connected to the exhaust, the bores in the upper sleeve exhaust and allow the plugs to be released from contact with the lower sleeve and the sleeve free to slide upward to allow the ratchet teeth of the same to be moved over the ratchet-teeth upon the tool-socket to obtain a changed grip during the succeeding down-stroke of the plunger. The boring, drilling, cutting or other tool will thus be reciprocated to form an incision or bore in the stone, metal or whatever material it acts upon, by percussion of the piston upon the tool-shank, and such tool will receive a part of a revolution at each stroke of the plunger to change the relative positions of the engaging parts of the cutting and cut surfaces. The elements effecting the turning of the cutting tool are fully balanced around the axis of the actuating tool and are positive in their action.

It will be seen from the foregoing that I have produced a novel construction of boring or drilling implement which is readily portable, and can be easily manipulated without fatigue to the operator, and wherein I dispense with pawls and other complicated mechanism to effect the desired rotation of the drilling or boring tool at the proper periods during the reciprocations of the hammering piston.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a fluid-actuated impact tool, a tool socket, a sleeve adapted to be rotated and reciprocated and to engage said tool socket, and pneumatic means for actuating said sleeve alternately into and out of engagement with said tool socket.

2. In a fluid-actuated impact tool, a tool socket, a sleeve adapted to be rotated and reciprocated and to interlock with said tool socket, means for rotating said sleeve, and pneumatic means for actuating said sleeve alternately into and out of engagement with said tool socket to actuate the same.

3. In a fluid-actuated impact tool, a drilling or boring implement, a tool socket therefor, a sleeve adapted to be rotated and reciprocated and to engage said tool socket, and pneumatic means for actuating said sleeve alternately into and out of engagement with said tool socket to actuate the same.

4. In a fluid-actuated impact tool, a drilling or boring implement, a tool socket therefor having ratchet teeth thereon, a sleeve adapted to be rotated and reciprocated and provided with ratchet teeth in engagement with the teeth of said tool socket, and pneumatic means for actuating said sleeve alter-

nately into and out of engagement with said tool socket.

5. The combination of a cylinder, a plunger therein, a tool socket, a sleeve, interlocking devices common to said socket and sleeve, air actuated plugs bearing on said sleeve, means for effecting the rotation of said sleeve and socket, and means for admitting fluid pressure to said plugs.

6. In a fluid-actuated impact tool, a plunger, a plunger-cylinder, means for alternately admitting motive fluid to the opposite ends of said cylinder, a tool-socket, a sleeve rotative and reciprocative in said cylinder and adapted to be rotated by the reciprocations of the plunger, and pneumatic means constructed to longitudinally move said sleeve alternately into and out of engagement with the tool-socket.

7. In a fluid-actuated impact tool, a plunger, a plunger-cylinder, means for alternately admitting and exhausting motive fluid to and from the opposite ends of said cylinder, a tool-socket, a sleeve rotative and reciprocative in said cylinder and connected to be rotated by the reciprocations of the plunger and adapted to engage said tool-socket, and pneumatic means connected to one end of the plunger-cylinder to move said sleeve into engagement with said tool-socket by the motive fluid in such end.

8. In a fluid-actuated impact tool, a plunger-cylinder, a plunger reciprocable in said cylinder, means for alternately admitting and exhausting motive fluid to and from the opposite ends of said cylinder, a tool-socket having an annular series of ratchet-teeth, a sleeve rotative and reciprocative in said cylinder and connected to be rotated by the reciprocations of the plunger and provided with an annular series of ratchet-teeth engaging the teeth of the tool-socket, and pneumatic means connected to one end of the plunger-cylinder to be actuated by motive fluid from said end and to said sleeve to move the ratchet-teeth of the same into engagement with the teeth of the tool-socket.

9. In a fluid-actuated impact tool, a plunger-cylinder, a plunger reciprocable in said cylinder, means for controlling admission and exhaust of motive fluid into and from the ends of said cylinder, a tool-socket rotative in the end of said cylinder and having an annular series of ratchet-teeth, a sleeve reciprocable and rotatable in the cylinder and having ratchet-teeth at one end adapted to engage the teeth of the tool-socket, a sleeve rotatable in the cylinder and connected to be rotated by the reciprocating plunger, and pneumatic means in said latter sleeve adapted to longitudinally move the ratchet sleeve and pneumatically connected to one end of the plunger-cylinder.

10. In a fluid-actuated impact tool, a plunger-cylinder, a plunger reciprocable in said cylinder and comprising a piston and a striker formed with a longitudinal groove and an oblique groove, a rotatable tool-socket having an annular series of ratchet-teeth, a rotatable and reciprocable sleeve upon the striker and having an annular series of ratchet teeth adapted to engage the teeth of the socket, a rotatable sleeve having the striker movable in it and having an oblique tongue in its bore engaging the oblique groove in the striker and formed with a longitudinal bore in its wall connected with one end of the plunger-cylinder, a plug reciprocable in such bore and adapted to have its end engage the upper end of the ratchet-sleeve, and a plug in the cylinder and engaging the straight groove in the striker of the plunger.

11. In a fluid-actuated impact tool, a plunger-cylinder, a plunger reciprocable in said cylinder, means for controlling admission and exhaust of motive fluid into and from the ends of said cylinder, a tool-socket rotative in the end of said cylinder and having an annular series of ratchet-teeth, a sleeve reciprocable and rotatable in the cylinder and having ratchet-teeth at one end adapted to engage the teeth of the tool-socket, a sleeve rotatable in the cylinder, and connected to be rotated by the reciprocating plunger, and formed with a longitudinal bore communicating with the lower end of the plunger-cylinder, and a plug reciprocable in said bore to bear against the edge of the sliding ratchet sleeve.

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Witnesses:
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M. E. BYRNE.