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W. E. BADGER.

PNEUMATIC TOOL.

APPLICATION FILED JULY 20, 1904.

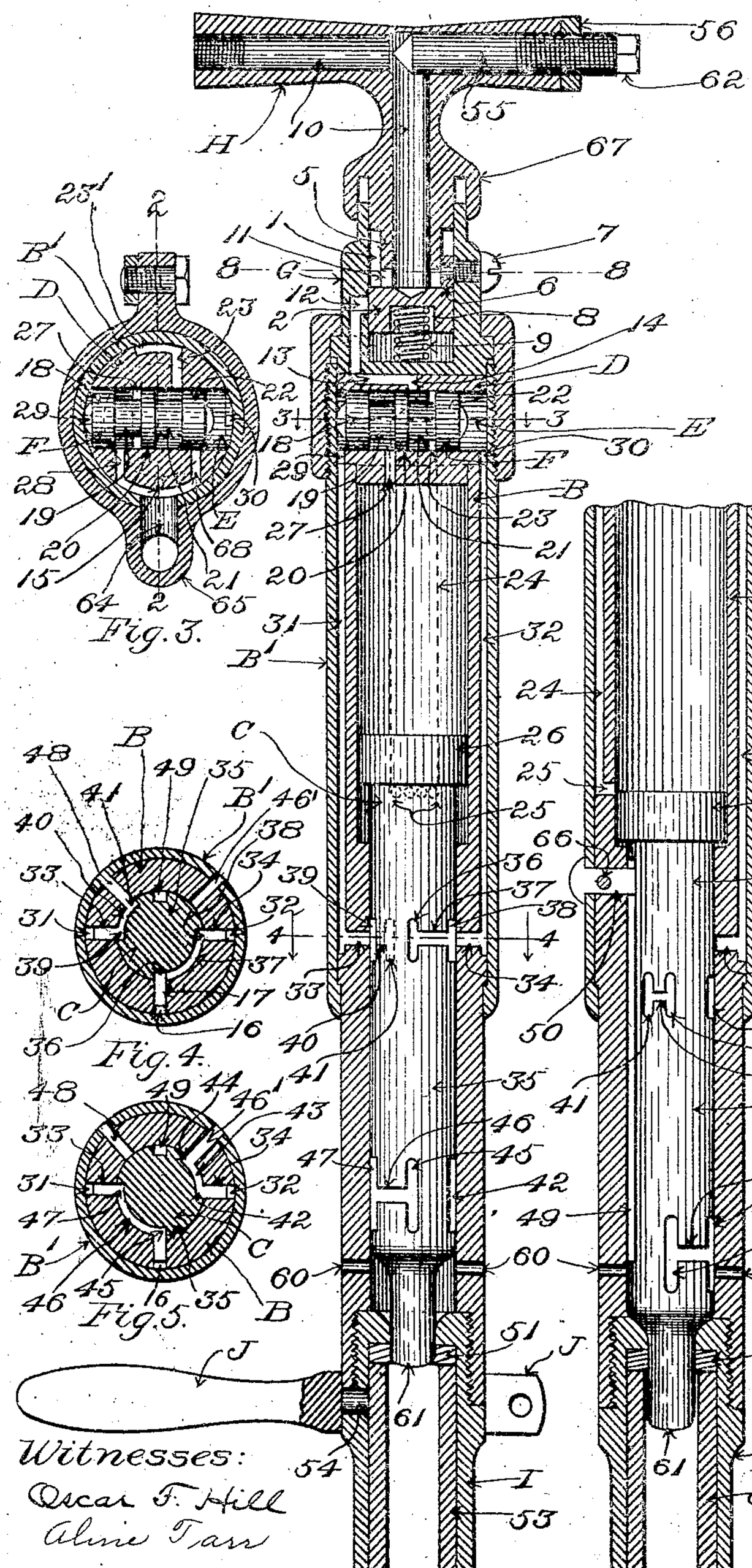

Fig. 1.

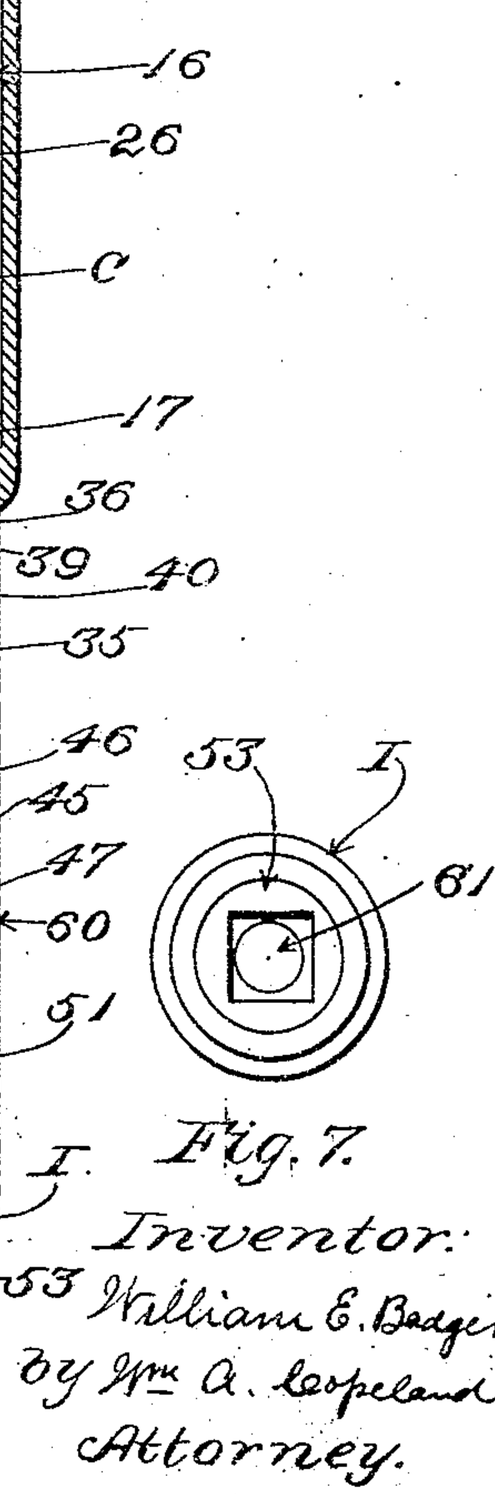

Fig. 2.

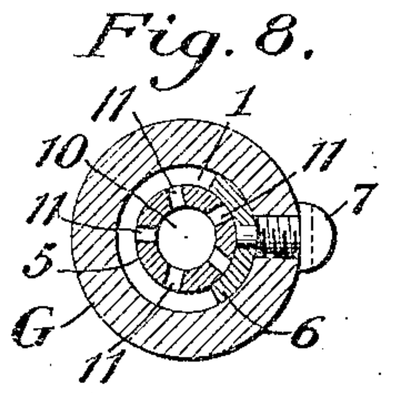

Fig. 8.

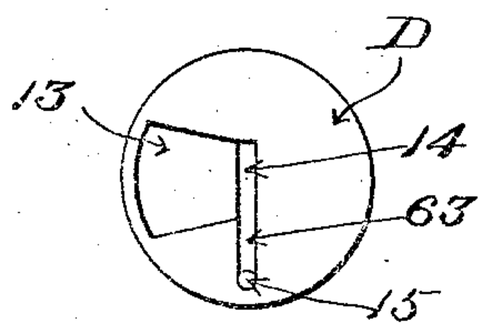

Fig. 6.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 7.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC TOOL.

No. 810,603. Specification of Letters Patent. Patented Jan. 23, 1906.

Application filed July 20, 1904. Serial No. 217,364.

To all whom it may concern:

Be it known that I, WILLIAM E. BADGER, of Quincy, in the c unty of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Pneumatic Tools, of which the following is a specification.

The main object of the invention is to produce a tool of greater efficiency than those at present in use.

One feature of the invention consists in providing the tool with a grasping-handle having an air-passage adapted to be connected with the compressed-air supply and movably mounted in the cylinder-head, through which there is a passage to the valve-chamber, the handle being movable to bring the air-passage therein into registration with the air-passage in the head.

Another feature of the invention consists in making the grasping-handle rotatable with relation to the cylinder and head, as well as movable longitudinally with relation thereto. The turning handle is fastened securely to the cylinder and to the forward head, the latter engaging the non-circular shank of the working tool, which is in practically fixed relation therewith when the tool is in operation. There are no working parts with sliding joints or working fits exposed to the dust and grit raised by the working tool, as is the case where the working tool is rotatable with relation to the body of the tool. The forward head is provided with a bushing having a perforation the cross-section of which corresponds with the cross-section of the standard drill-steel from which the working tools are made, so that the latter do not require any special fitting, as is the case when the shanks of the working tools must be of circular cross-section to turn in the tool-holding socket, and the latter is in a fixed position with relation to the grasping-handle for holding the tool to the work.

Other features of the invention will be set forth hereinafter.

The invention will now be fully described, and the novel features thereof will be particularly set forth in the claims at the close of the specification.

In the drawings, Figure 1 is a longitudinal central section of a pneumatic tool embodying the invention, taken when the piston is in the position it will occupy when a work-tool is inserted. Fig. 2 is a longitudinal section on line 2 2 of Fig. 3, taken at right angles to Fig. 1, but the piston being in the position it will occupy when the work-tool is removed. Fig. 3 is a cross-section through the valve-casing on line 3 3 of Fig. 1. Fig. 4 is a cross-section taken on line 4 4 of Fig. 1, showing the upper set of grooves in the piston. Fig. 5 is a cross-section on line 4 4 of Fig. 1, taken when the piston is at the upper or backward end of its stroke, and therefore passing through the lower set of grooves instead of through the upper set. Fig. 6 is a plan of the top of the valve-casing. Fig. 7 is an end view of the lower head. Fig. 8 is a cross-section on line 8 8 of Fig. 1.

The tool comprises a cylinder B, an outer casing B′, a piston (or hammer) C, which moves in said cylinder, a valve-casing D in the upper or rear end of the cylinder and formed with a chamber E, a valve F, located and moving in said chamber E, an upper head G for the cylinder, a grasping-handle H, connected with the upper head and having a passage connecting with the source of fluid-pressure which operates the tool, a lower head I, which receives the drill or working tool, and a turning handle J, secured to the lower head for the purpose of rotating the working tool. The grasping-handle H is mounted in the head G in such manner as to be movable both longitudinally and rotatably. The stem of the handle is formed with a neck 5, thus forming a chamber 1, within which is inserted a segment of collar 6. A screw 7 passes through the side of head G and into the segment-collar 6, thus securing the grasping-handle to the head, but allowing a longitudinal movement of the handle as permitted by the length of the chamber and also a turning movement of the handle with relation to the head. The shoulder at each end of the chamber limits the longitudinal movement and prevents entire withdrawal of the handle. The collar 6 forms a bearing for the portion of the screw 7 which enters the chamber. The grasping-handle H is preferably formed with an annular flange 67, thus forming an annular-grooved bearing for the annular rear end of the head G. A recess 8 is formed in the lower part of the stem, and a spring 9, seated in said recess and bearing against the head G, normally retains the handle H in its uppermost position with relation to the head, as shown in Fig. 1. A hole 10 is formed in the handle H, extending longitudinally through the cross-arm and a branch extend-

ing down into the lower part of the stem. The outer portion of the hole at one end of the arm is screw-threaded or otherwise adapted for connection with a compressed-air pipe. (Not shown.) A regulating-stem 55, having a check-nut 56, is inserted in the other arm of the handle opposite to the compressed-air connection and extends inward past the junction of the passage in the stem with the passage in the arm, whereby the amount of air admitted to the tool may be regulated. A head 62 serves as a means for operating the regulating-stem. A series of holes 11 are formed through the wall of the neck 5 in the lower part of the stem of handle, through which the compressed air will pass into the chamber 1 when the air is admitted to the handle. A passage 12 leads from the inside of the socket in the head G, in which the grasping-handle H moves, and extends down inside of the side wall of the head and through the lower end and registers with a channel 13, cut in the top of the valve-casing. The entrance to the passage 12 is normally closed by the base 2 of the handle, as shown in Fig. 1. When the grasping-handle H is pushed down, the base 2 will be moved down below the entrance to the passage 12, thus leaving a free passage for the compressed air from the socket 10 in the handle through the holes 11, chamber 1, and passage 12 to the channel 13 in the top of the valve-casing.

The valve F is a double spool formed with heads 18 and 22 at opposite ends, a central annular flange or partition 20, and neck portions 19 and 21 between the said central flange and the two heads, thus forming two chambers within the valve. Channel 13 extends along the upper part of the valve-casing to a port 14, which opens into the valve-chamber E. A channel 63 (shown in Fig. 6) and at right angles to channel 13 is cut on the top of the valve-casing from port 14, Fig. 1, to connect with a hole 15, (see Fig. 3,) which extends down through the valve-casing and registers with a passage 16, Fig. 2, extending down in the wall of the cylinder B and leading through hole 17 into the interior of the piston-chamber of the cylinder at some distance below the enlarged portion of the piston-chamber in which the head 26 of the piston moves, Figs 2 and 4. When the valve is in the position shown in Figs. 1 and 3, the port 14 also opens into the valve-chamber around the neck 21 of the valve between the head 22 and the partition 20. A port 23 leads from said chamber through the side of the valve-casing, and a channel 23′ leads from said port 23 down in the outside of the valve-casing and registers with a passage 24, which extends down in the wall of the cylinder B and opens into the piston-chamber through holes 25. (See Figs. 1 and 2.) When the piston is in its lowest working position with a tool inserted, the piston-head 26 is above the ports 25, and in its reciprocating movements it does not go below the ports 25 as long as there is a tool in the lower head. When the piston is in this position, the admission of compressed air through the ports 25 tends to move the piston upward, the air on the upper side exhausting through port 27 from the piston-chamber into the chamber of the valve-casing which surrounds the neck 19 and thence through the port 28 and through the side of the head G and through a passage 64 in a clamp 65, to which a pipe may be connected, if desired. (See Fig. 3.) The clamp 65 serves to bind the head G to the valve-casing D and to the cylinder-casing B′ more securely than it could be held by the threads alone. Passages 29 and 30 lead out of the bottom of the valve-chamber at opposite ends beyond the limit of movement of the valve and register, respectively, with passages 31 and 32, which extend down in the cylinder-walls and open into the piston-chamber through holes 33 and 34 at some distance below the enlarged portion of the piston-chamber in which the piston-head 26 moves and preferably on the same circumferential line as the hole 17 through which the passage 16 opens.

The stem 35 of the piston C serves also as a valve to open and close the air-passages, as will be described. The chamber of the cylinder B is made of reduced interior diameter below the portion in which the piston-head moves, the stem 35 of the piston having a sliding fit therein, as does the head 26 of the piston in the enlarged portion. Cut in the circumferential stem 35 there are four sets of H-shaped grooves, the one marked 36 37 38 connecting the opening 17 from passage 16 in the wall of the cylinder with the opening 34 from passage 32 in the wall of the cylinder when the piston is in the position shown in Fig. 1. At the same time the groove 39 40 41 connects the opening 33 from passage 31 with an exhaust-port 48 through the wall of the cylinder, the groove 36 37 38 being on the same level as the groove 39 40 41, but on the opposite half of the piston. The groove 42 43 44 and the groove 45 46 47 are on the same level with each other at some distance below the groove 36 37 38 and the groove 39 40 41, above described, but on different quarters from said first-described pair of grooves and preferably of greater length in order to be certain of reversing the valve and admitting air to the back of the piston for the purpose to be hereinafter described. The lower sets of grooves are located at a distance below the upper sets nearly equal to the length of stroke of the piston, so that as the piston approaches the end of its upstroke the channel 45 registers with hole 17 and makes connection, through neck 46 and channel 47, with opening 33 to passage 31. At the same time channel 42 registers with opening 34

and makes connection, through neck 43 and channel 44, with an exhaust-port 46′. In the drawings the length of the grooves 36 38 is the same as that of grooves 39 41 and the length of grooves 42 44 is the same as 45 47; but if it is desired to apply the pressure to one end of the valve before opening the exhaust from the other end, or vice versa, this can be accomplished by making one of said grooves of different length from its companion groove. By having the necks of the grooves on one end of the piston simultaneously admit and exhaust pressure to opposite ends of the valve it is possible to have the ports to the piston-chamber all in the same circumferential line. Hence the piston covers these ports in its opposite stroke until the grooves in the other end register, and it follows that I obtain the maximum travel for a given length of piston. The H-shaped grooves at the forward end of the piston I make a little longer than those at the back in order to be certain of reversing the valve and admitting air to the back of the piston to check the backward impetus and prevent the piston striking the head and to drive it forward. The recoil on the forward stroke aids to reverse the direction, and short grooves only are needed. I have located the admission-port at the extreme end of the back chamber. It would be possible to place this port a short distance from the end, so that the piston would cover it on the return stroke, and thus give a compression-space to prevent the piston striking the back head and serving for a cushion-recoil, and thus a shorter forward neck would be used. For the type I have shown I prefer the arrangement indicated and can cut the H-grooves up at will, depending upon the air-pressure used sufficiently to prevent the piston from striking the head. In the lower part of the cylinder there is a vent 60, extending from the piston-chamber through the wall to the outside air to exhaust when the piston descends. The lower or hammer end 61 of the piston is preferably reduced in diameter. The lower head I is bored to receive a disk bushing 51 with a round hole, through which the cylindrical lower or hammer end of the piston passes to strike the work-tool. A bushing 53 with square hole butts up against the bushing 51 to receive the square shank of the work-tool, so that the shank of the work-tool also in part butts up against the disk bushing 51. A flush key 54 is inserted in the joint of the cylinder B and head I to prevent the head I from working loose. A split clamp-handle J holds the key in place and also serves as a handle with which to turn the tool while in use. A keyway 49 is cut in the piston-stem, in which a removable key 50 engages to prevent the piston from turning and to keep the H-shaped grooves in proper registration. The key passes through a hole in the cylinder-wall and is retained therein by a pin 66, which is removable, so that the key 50 can be removed.

The operation is as follows: Before the work-tool is inserted the piston will be down in the lower part of the cylinder, as shown in Fig. 2. If the compressed air is turned on before a work-tool is inserted, the piston-head 26 being below the compressed-air inlets 25 the compressed air will have a tendency to hold the piston down, as shown in Fig. 2. When a work-tool is inserted, it pushes up the piston into the position shown in Fig. 1, with the piston-head above the compressed-air inlets 25. If now the grasping-handle is pushed down to open communication between the passage 10 in the handle and the passage 12 in the head through the holes 11 and chamber 1, the compressed air will pass through channel 13, port 14, into the valve-chamber between the partition 20 and head 22, thence through port 23 into passage 24, down inside of the wall of the cylinder, and through holes 25 into the piston-chamber beneath the head 26 of the piston. The compressed air thus admitted drives the piston up, the air on the upper side exhausting through port 27 in the bottom of the valve-casing into the chamber between partition 20 and head 18 and out through port 28, which extends out through the side of the cylinder-head G. When the compressed air is turned on and passes down into the piston-chamber through holes 25, it also at the same time passes through channel 14, passage 15 and 16 and hole 17, and groove 36 37 38, passages 34, 32, and 30 into the right-hand end of the valve-chamber, tending to hold the valve in its left-hand position, as in Fig. 1. When the piston moves up, the entrance of live air from passage 17 to 34 is shut off. When the piston approaches the end of its upward stroke, the channel 45 registers with hole 17 and groove 47 registers with hole 33. Live or compressed air is conducted through groove 45 46 47 to passage 33, thence through passages 31 and 29 into the left-hand end of the valve-casing, thus putting pressure on the left-hand end of the valve and tending to drive the valve to the right. At the same time the groove 42 registers with 34, and air from the right-hand end of the valve is carried down through passages 30, 32, and 34, through groove 42 43 44, and out through exhaust-port 46′, so that the valve can move to the right under the pressure already described. When the valve moves to the right, the valve-head 18 closes the exhaust-port 28 and the movement of the head 22 opens exhaust-port 68. Partition 20 passes to the right of port 14, so that the live air is now admitted to the valve-chamber around neck 19 between the partition 20 and head 18, thence through port 27 into the cylinder on top of the piston, driving the piston down. The air on the un-

der side of the piston-head 26 exhausts through holes 25, channel 24, channel 23, and exhaust-port 68. When the piston approaches the lower end of its downstroke, channel-groove 36 will register with live-air passage 17, and live air passes through neck 37, groove 38, passages 34, 32, and 30, and puts pressure to the right-hand end of the valve. Channel 39 registers with passage 33, and channel 41 registers with exhaust-port 48, so that when the valve is driven to the left the air will exhaust through 29, 31, 33,39, 40, 41, and 48.

It is obvious that other kind of fluid-pressure than compressed air may be used.

I claim as my invention—

1. In a pneumatic impact-tool, a cylinder and piston, a valve-casing having a valve therein for controlling the movements of the piston, a head secured to said cylinder and held in fixed relation thereto and to said valve-casing, a handle or support upon which said head is rotatably mounted and means to rotate said cylinder.

2. In a pneumatic impact-tool, a cylinder and piston, a valve-casing having a valve therein for controlling the movements of the piston, a head secured to said cylinder and held in fixed relation thereto and to said valve-casing, a handle or support upon which said head is rotatably mounted and longitudinally movable with relation thereto and means to rotate said cylinder.

3. In a pneumatic impact-tool, a cylinder and piston, a valve-casing having a valve therein for controlling the movements of the piston, a head secured to said cylinder and held in fixed relation thereto and to said valve-casing, a handle or support upon which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, means to control the admission of fluid to said valve-casing, and means to rotate said cylinder.

4. In a pneumatic impact-tool, a cylinder and piston, a valve-casing having a valve therein for controlling the movements of the piston, a head secured to said cylinder and held in fixed relation thereto and to said valve-casing, a handle or support upon which said head is rotatably mounted, said head having a passage for motive fluid which is alternately placed in communication with opposite ends of the cylinder, a passage in said handle which may be connected with a source of fluid-pressure supply and is adapted to be placed in communication with said passage in the head, and means to rotate said cylinder with relation to said handle and source of fluid-pressure supply.

5. A pneumatic impact-tool, having a cylinder provided with a head, a grasping-handle having a projecting stem longitudinally movably mounted in the head, said head having a passage communicating with the interior of the cylinder and a passage through said handle and stem which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head, means whereby said cylinder may be rotated with relation to said grasping-handle, and means whereby the motive fluid may be supplied to the cylinder through said passages when the handle is in its forward position and the cylinder is rotated with relation to said grasping-handle and source of fluid-pressure supply.

6. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a grasping-handle having a stem longitudinally movably mounted in said head, a passage therein which may be connected with a source of fluid-pressure supply, said passage leading to an outlet in the stem which is adapted to communicate with the passage in the head, means whereby the cylinder may be rotated with relation to said grasping-handle, and means whereby the motive fluid will be supplied to the cylinder through said passages when the handle is in its forward position and the cylinder is rotated with relation to said grasping-handle and source of fluid-pressure supply.

7. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a grasping-handle provided with a stem, a passage in said handle and stem which may be connected with a source of fluid-pressure supply, said passage leading to an outlet in the stem, said stem being rotatably mounted and longitudinally movable in the head, means whereby the cylinder may be rotated with relation to the grasping-handle, means whereby the motive fluid may be supplied to the cylinder through said passages when the handle is in its forward position and the cylinder is rotated with relation to the grasping-handle and source of fluid-pressure supply, and means whereby said stem is retained in the head.

8. A pneumatic impact-tool having a cylinder provided with a head held in fixed relation thereto and having a passage communicating with the interior of the cylinder, a grasping-handle provided with a stem projecting forwardly at an angle thereto and rotatably mounted in the head, a passage in said handle and stem which may be connected with a source of fluid-pressure supply, said passage leading to an outlet in said stem, means to rotate said cylinder and head, and means whereby said outlet in the stem may be maintained in communication with said passage in the head when the latter is rotated with relation to said grasping-handle and stem.

9. A pneumatic impact-tool having a cylinder provided with a head held in fixed relation thereto and having a passage communicating with the interior of the cylinder, a handle having a stem rotatably mounted in the head and a passage therein for the motive fluid, said handle having a passage therein which may be connected with a source of fluid-pressure supply, said passage being connected with an outlet in said stem, means to rotate said cylinder and head, means whereby said outlet in the stem may be brought in communication with said passage in the head to furnish a supply of motive fluid thereto when the tool is in operation and when the cylinder and head are rotated with relation to the grasping-handle.

10. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a handle having a stem and a grasping portion projecting at an angle from said stem, a passage in the stem and grasping portion of the handle which may be connected with a source of fluid-pressure supply, said passage leading to an outlet in the stem, said stem being rotatably mounted and longitudinally movable in the head, means for retaining the stem in the head, means whereby the cylinder may be rotated with relation to the handle and means whereby the motive fluid may be supplied to the cylinder through said passages when said handle is in its forward position and the cylinder is so rotated with relation to said handle and source of fluid-pressure supply.

11. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a grasping-handle having a stem longitudinally and rotatably mounted in the head, said handle and stem having a passage which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head, means whereby the cylinder may be rotated with relation to the grasping-handle, and means whereby the motive fluid may be supplied to the cylinder through said passages when the handle is in its forward position and the cylinder is so rotated with relation to said handle and source of fluid-pressure supply.

12. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a grasping-handle having a stem longitudinally and rotatably mounted in the head, means for retaining said stem in the head, said handle and stem having a passage which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head, means whereby the cylinder may be rotated with relation to the grasping-handle, and means whereby the motive fluid may be supplied to the cylinder through said passages when the handle is in its forward position and the cylinder is so rotated with relation to said handle and source of fluid-pressure supply.

13. A pneumatic impact-tool having a cylinder provided with a head adapted to receive the stem of a grasping-handle, and having a passage communicating with the interior of the cylinder, a grasping-handle having a stem longitudinally and rotatably mounted in the head, means for retaining said stem in the head, said handle and stem having a passage which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head, when the handle and stem are in a forward position, means whereby the cylinder may be rotated with relation to the grasping-handle, and means whereby the motive fluid may be supplied to the cylinder through said passages when the cylinder is so rotated with relation to said handle and source of fluid-pressure supply.

14. A piston impact-tool having a cylinder and a grasping-handle provided with a projecting stem mounted rotatably and longitudinally to said cylinder, a passage in the handle and stem which may be connected with a source of fluid-pressure supply, means to control the admission of motive fluid to the interior of the cylinder, a handle secured to the cylinder for rotating the latter, and means whereby the motive fluid may be supplied to the cylinder through said passage when said grasping-handle is in its forward position and the cylinder is rotated with relation to the grasping-handle and source of pressure-supply.

15. A pneumatic impact-tool having a cylinder provided with a head, a passage therein communicating with the interior of the cylinder, a grasping-handle provided with a stem longitudinally and rotatably mounted in the head, a passage in the handle and stem which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head when the handle is in a forward position, a handle secured to the cylinder for rotating the latter, and means whereby the motive fluid may be supplied to the cylinder through said passages when said grasping-handle is in its forward position and the cylinder is rotated with relation to the grasping-handle and the source of fluid-pressure supply.

16. A pneumatic impact-tool having a cylinder provided with a head, a passage therein communicating with the interior of the cylinder, a grasping-handle provided with a stem longitudinally and rotatably mounted in the

head, a passage in the handle and stem which may be connected with a source of fluid-pressure supply and is adapted to communicate with the passage in the head, said cylinder being provided with a forward head secured thereto and having a socket therein adapted to engage the shank of a working-tool, a handle secured to the cylinder for rotating the latter and said working tool, and means whereby the motive fluid may be supplied to the cylinder through said passages when the said grasping-handle is in its forward position and the cylinder is rotated with relation to said grasping-handle and source of fluid-pressure supply.

17. A pneumatic impact-tool having a cylinder containing a piston, a valve for controlling the motive fluid within said tool, a valve-casing located within the rear of the piston-chamber, a head and a handle having a pressure-supply passage therethrough leading to the valve-casing, said head being rotatably mounted on said handle, means for holding said head in a fixed relation to the cylinder, and means for rotating said cylinder and head with relation to said handle.

18. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a handle or support on which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, a passage in said head to which the motive fluid is supplied by said passage in the handle when the tool is in operation, and means to rotate said cylinder and head with relation to said handle.

19. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a handle or support on which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, a passage in said head to which the motive fluid is supplied by said passage in the handle when the tool is in operation, means to rotate said cylinder with relation to said handle and a forward head to the cylinder adapted to engage the shank of a working tool to rotate the latter.

20. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a handle or support on which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, a passage in said head to which the motive fluid is supplied by said passage in the handle when the tool is in operation, means to rotate said cylinder and head with relation to said handle and means whereby the motive fluid will be supplied through said passage in the handle to said passage in the head when the latter is rotated with relation to said handle.

21. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a valve-block having a valve therein for controlling the movements of the piston, a handle or support on which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, a passage in said head through which the motive fluid may be supplied from said passage in the handle to the valve-block and means to rotate said cylinder and head with relation to said handle.

22. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a valve-block having a valve therein for controlling the movements of the piston, a handle or support on which said head is rotatably mounted, a passage in said handle which may be connected with a source of fluid-pressure supply, a passage in said head through which the motive fluid may be supplied from said passage in the handle to the valve-block, means to rotate said cylinder and head, and means whereby the motive fluid may be supplied through said passage in the handle to said passage in the head when the latter is rotated with relation to said handle.

23. An impact-tool having a cylinder provided with a head secured in fixed relation thereto, a handle or support on which said head is rotatably and longitudinally mounted, a passage in said handle which may be connected with a source of fluid-pressure, a passage in said head to which the motive fluid is supplied from said passage in the handle, when the latter is in its forward position and the cylinder and head are rotated with relation to said handle.

24. A pneumatic impact-tool having a grasping-handle with an air-passage therethrough, a cylinder, a cylinder-head to receive said handle and formed with an air-passage adapted to communicate with an outlet from the passage in the handle, said handle having a stem which fits into the interior of the head and having an annular flange which fits outside of said head, thereby forming an annular grooved bearing for the rear end of the head.

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

WILLIAM E. BADGER.

Witnesses:
THOMAS SEVITHIN,
JOHN H. DINEGAN.