No. 727,954. PATENTED MAY 12, 1903.

F. M. ILER.

PNEUMATIC HAMMER.

APPLICATION FILED JUNE 17, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

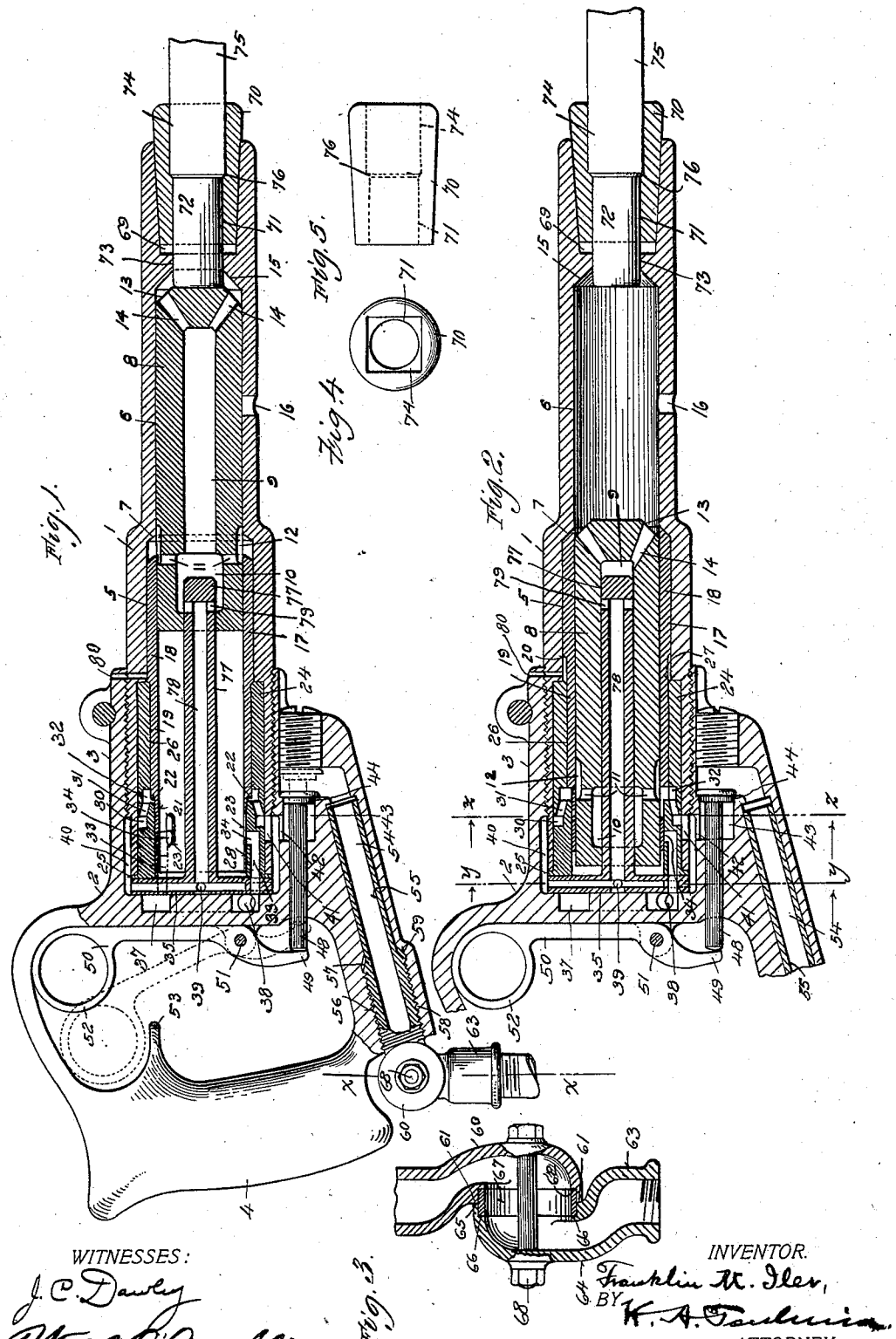


Fig. 1.

Fig. 5.

Fig. 4.

Fig. 2.

Fig. 3.

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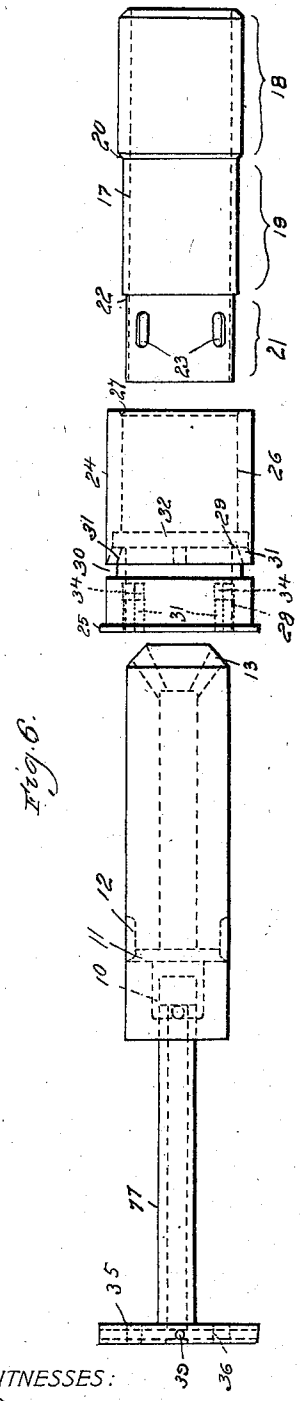


Fig. 6.

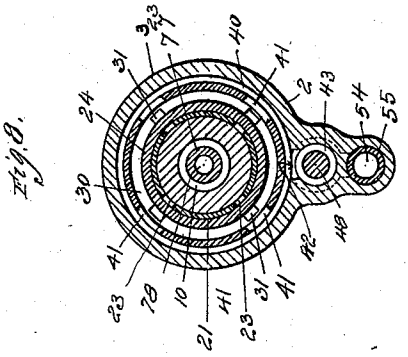


Fig. 8.

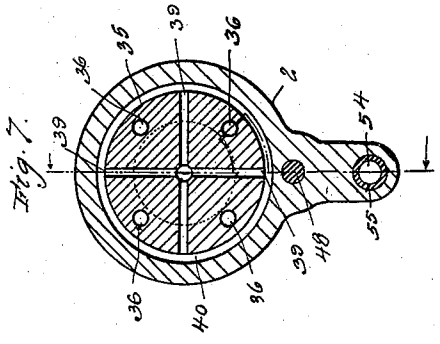


Fig. 7.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 727,954, dated May 12, 1903

Application filed June 17, 1901. Serial No. 64,794. (No model.)

To all whom it may concern:

Be it known that I, FRANKLIN M. ILER, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to pneumatic hammers, or, more properly speaking, to that class of percussion-tools in which a motor fluid of any suitable character is employed under pressure for the purpose of imparting a reciprocating motion to a piston, which at the same time serves as a hammer to deliver its blows to a suitable tool.

The present invention has for its object to provide a simple and effective device of this character which shall be comparatively free from the jarring or vibration which usually characterizes these devices; and to these ends the invention consists in certain novel features, which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is an elevation, partly in central longitudinal section, of a tool embodying my invention in one form. Fig. 2 is a similar view showing a different position of the operative parts. Fig. 3 is a detail sectional view taken on the line *x x* of Fig. 1. Figs. 4 and 5 are respectively an end view and side elevation of the tool-holding chuck or sleeve. Fig. 6 is a view showing in elevation the several parts which when the tool is assembled lie within the cylinder or body thereof. Fig. 7 is a sectional view taken on the line *y y* of Fig. 2 and looking in the direction of the arrows, and Fig. 8 is a similar view taken on the line *z z* of Fig. 2 and looking in the direction of the arrows.

In the said drawings, 1 indicates the cylinder or casing of the tool, and 2 indicates the head, which is provided with a body portion 3, into which the cylinder 1 is screwed or secured in any suitable manner. The head is also provided with a suitable handle or hand-grasp 4, by means of which the tool may be held when in use. The cylinder or casing 1 is provided at its handle end with a bore or chamber 5 and near its other end with a bore or chamber 6 of less diameter, the two being separated by an intervening annular shoulder 7.

8 indicates the piston, which also forms the hammer and which is of a diameter equal to that of the bore or chamber 6 of the cylinder. The piston 8 has extending through it longitudinally, almost but not quite to its working end, an aperture or bore 9, which near the handle end of the piston is enlarged to form a chamber 10, from which ports or passages 11 extend outward in opposite directions, said ports opening into longitudinal grooves 12, located on opposite sides of the body of the piston at this point. The working end of the piston is beveled or chamfered, as indicated at 13, and there are provided in said end ports or passages 14, extending from the internal bore 9 of the piston to the chamfered edge thereof, as shown. The adjacent end of the cylinder is correspondingly beveled, as indicated at 15. An exhaust-port 16 is formed in the side of the cylinder 1, opening into the bore or chamber 6 about midway of its length.

As already stated, the piston 8 is of a diameter equal to that of the chamber 6 and is correspondingly of less diameter than the chamber 5, and in the space thus formed between the piston and said chamber 5 is located the sleeve-valve 17. This valve is in the form of a hollow sleeve, having a portion 18, which fits between the piston and the wall of the chamber 5. A second portion of the valve (indicated at 19) is of a reduced external diameter, forming a shoulder 20 between the portions 18 and 19, and the third or terminal section of the valve (indicated at 21) is still further reduced in external diameter, forming a shoulder 22 between the parts 19 and 21. The internal diameter of the sleeve is the same throughout, and the part 21 thereof has formed through its wall ports 23.

Within the chamber 5, at the handle end thereof, which is suitably counterbored to receive it, is located the valve-casing 24, which is provided with a terminal flange 25, by means of which it is clamped between the body of the cylinder 1 and the cylinder-head, hereinafter referred to. This valve-casing is cylindrical in form and has a portion 26, which fits upon the portion 19 of the sleeve-valve and is provided with a terminal shoulder 27,

against which the shoulder 20 of said valve may abut when the valve reaches the limit of its movement in one direction. The other end of the valve-casing is of a reduced internal diameter, as indicated at 28, thus forming a shoulder 29, which coöperates with the shoulder 22 of the valve. In the exterior of the valve-casing is formed an annular groove 30, which communicates by inclined ports 31 with an internal annular groove 32 in the inner face of the valve-casing immediately at one side of the shoulder 29. There are also formed in the body of the portion 28 of the valve-casing exhaust-passages 33, having terminal openings 34 on the interior surface of the valve-casing in position to register with the ports 23 of the valve, said passages terminating at their other end at the end of the valve-casing adjacent to the cylinder-head.

35 indicates the cylinder-head, which is held in position against the head 2 by the body or cylinder 1 and which is provided with exhaust-passages 36, which register with the passages 33 and which communicate with an annular exhaust-chamber 37 in the head 2, provided with an exhaust-outlet 38. Through the body of the head 35 there are formed radial passages 39, extending to the edge of the disk-shaped head and there opening into a chamber 40 of annular form formed in the interior of the head 2. The chamber 40 communicates with the annular groove or passage 30 of the valve-casing by means of ports or passages 41, formed in the body of the cylinder 1. Said annular chamber 40 also communicates, by means of a port or passage 42, with a valve-chamber 43, formed in the head and provided with a seat 44 to receive a valve 45, having a short body portion 46, which fits within the valve-chamber 43, but is of less length than said chamber, and an enlarged head 47, which when the valve is closed seats against the face of the seat 44. The valve is provided with a stem 48, which extends through the body of the head into the eye or opening of the handle, where it terminates in the path of the end 49 of a lever 50, pivoted at 51 on the end of the head, said lever being provided at its other end with a finger-grasp, preferably in the form of a ring, as indicated at 52, and said lever lying wholly within the opening of the handle, which is provided with an inward projection 53 to form a guard for the eye of the lever.

The inlet-passage, which is indicated at 54, is formed in the body of the head and along the lower part of the handle and receives the extended inlet-tube 55, which fits therein. The outer end of this inlet-tube is enlarged and threaded externally, as indicated at 56, forming a shoulder 57 with the body of the tube, and the outer end of the inlet-passage is correspondingly enlarged and threaded, as indicated at 58, and forms a shoulder 59, which does not contact with the shoulder 57. By reason of this construction the leakage of air at the point where the inlet-pipe is joined to the body of the device is prevented by the thread and extended inlet-tube, while at the same time the entire inlet-tube is permitted to swivel, moving in and out as it turns.

In order to provide a double-swivel connection between the device and the hose or other flexible supply-pipe by means of which the motor fluid is conveyed to the tool, I also provide a swivel-joint at the outer end of the inlet-pipe immediately below the handle, as shown in Figs. 1 and 3, in order that the supply-pipe may be coupled thereto in such a position as to not project beyond the handle toward the operator, but rather at any suitable angle to the body of the tool. To this end I provide on the end of the inlet-pipe a semiglobular enlargement 60, having a smooth face 61 and a shouldered seat 62. 63, which represents the connection for the supply-pipe, is provided with a similar enlargement 64, having a smooth face 65 to abut against the face 61 and having a shouldered face 66 corresponding to the seat 62. An annular sleeve 67 fits within the seats 62 and 66, so as to make a tight joint, and the two semiglobular sections of the coupling are drawn together by means of a bolt 68 at right angles to the swiveling inlet-pipe, so as to make a tight joint at this point and at the same time permit the angle of connection of the supply-pipe to the inlet-pipe to be varied as desired. That end of the cylinder farthest from the handle is provided with a tapering recess or socket 69, circular in cross-section, to receive a correspondingly-tapered chuck or tool-holding sleeve 70, which fits snugly therein. This chuck or sleeve is provided in that half thereof nearest to the body of the cylinder with a circular bore or opening 71 to fit the correspondingly-shaped cylindrical portion 72 of the shank of the tool. The end of the chamber 6 adjacent thereto is provided with an aperture 73, through which the shank of the tool extends snugly, projecting into the chamber 6 in the path of the end of the piston 8. The outer half of the chuck or sleeve 70 is provided with an opening 74 rectangular in cross-section to receive the correspondingly-shaped portion 75 of the shank of the tool. It will be observed that at the junction between the two portions 71 and 74 of the bore of the chuck there is thus formed a shoulder 75, the shank of the tool being provided with a corresponding shoulder 76, which abuts against the same and has a meeting surface of sufficient extent to act as an efficient preventage of leakage at this point.

The cylinder-head 35 is provided with a central stem 77, which fits within the bore 9 of the piston 8, and said central stem is provided with a longitudinal opening 78, communicating at one end with the radial passages 39 and terminating at the other end short of the extremity of the central stem, there being provided lateral ports or outlets 79 a short distance from the end of the stem.

The operation of the device is as follows:

The controlling-valve 45 being opened so as to admit air under pressure, it passes through the port 42 into the annular chamber 40, and thence through the ports 41 into the groove 30 of the valve-casing and through the ports 31 of said casing into the groove 32. At the end of the non-working stroke of the piston, during which it is moving toward the handle, the air between the piston and the cylinder-head 35 is compressed in the manner hereinafter described, and such pressure acts upon the exposed end of the portion 21 of the sleeve-valve and tends to move the same toward the right in Figs. 1 and 2, or in a position to bring its ports 23 into the position shown in Fig. 2, where they will register with the groove 32, at the same time closing the exhaust-ports 34. This movement of the valve is further aided by the pressure of the air within the groove 32, which is constantly against the shoulder 22 of the valve. The piston 8 is of such length that its chamfered end 13 passes the shoulder 7 before its other end has reached the cylinder-head, and when this has occurred the air between the said shoulder 7 and the end of the valve 17 exhausts into the chamber 6, thereby permitting the pressure of the air on the end of valve 17 and on its shoulder 22 to shift the valve, as above indicated. The air compressed between the piston and cylinder-head 35 also serves to reverse the direction of travel of said piston and cause the same to move to the right a sufficient distance to bring its end beyond the ports 23 of the sleeve-valve. This initial movement of the piston is gradual and without shock, being merely the reaction of the compression, and the full force of the air-pressure is not exerted upon the piston until after it has started on its working stroke and passed the ports 23. In this way the shock or jar caused by an immediate introduction of the full pressure between the piston and cylinder-head is avoided. A portion of the air under pressure introduced into the chamber 40 passes through the radial passages 39 into the central passage 78 of the stem 77. The said stem fits within the bore 9 of the piston, the walls of which close the ports 79 during the greater portion of the outward or effective stroke of the piston. As said piston approaches the end of this stroke, however, the ports 79 register with the enlarged chamber 10 in the piston, and the air under pressure is permitted to pass through the ports 79 into the chamber 10 and thence through the ports 11 into the groove 12, where it exerts its pressure between the lower end of the valve 17 and the shoulder 7, and owing to the increased thickness of this end of the valve it reverses the position of the valve, so as to bring the ports 23 thereof opposite the exhaust-ports 34, as shown in Fig. 1, at the same time closing the groove 32 and cutting off the admission of air between the piston and cylinder-head. At the same time the air which escapes through the ports 79 into the chamber 10 passes from said chamber through the bore 9 and outlet-ports 14, thereby reversing the direction of travel of the piston and causing it to move upward toward the handle end of the tool. When the end of the piston has uncovered the port 16, the air under pressure, which has done its work in reversing the direction of travel of the piston, escapes through the port 16. As the piston approaches the handle end of the cylinder it closes the exhaust-ports 34, and the air between the piston and cylinder-head 35 being compressed by the further movement of the piston the sleeve-valve starts to shift in the manner already described, and eventually compression becomes sufficient to also reverse the direction of travel of the piston, and the series of operations proceeds in the manner already described. The cushioning effect thus obtained at the end of the back stroke, together with the comparatively slow starting on its effective stroke of the piston, and the fact that the piston is already in motion when the air-pressure is finally admitted back of it in order to give it its effective stroke all contribute to cause the tool to work easily and without the jarring action which is common to most tools of this class.

In order to facilitate the movement of the valve and prevent pressure accumulating between the shoulders 20 and 27, I have provided a vent-port 80 through the cylinder at this point.

I do not wish to be understood as limiting myself to the precise details of construction hereinbefore described, as it is obvious that these details may be varied without departing from the principle of my invention.

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

1. A fluid-pressure hammer comprising a cylinder or casing, a piston reciprocating therein, a sleeve-valve also reciprocating between the piston and the cylinder or casing and provided with a port, the cylinder or casing being provided with inlet and outlet ports with either of which said valve-ports may register, the sleeve-valve closing one of said ports when the valve-port is in register with the other, the piston fitting within said sleeve-valve and being adapted to close its port and by compression ahead of it to exert a pressure on the valve tending to move it in one direction, substantially as described.

2. A fluid-pressure hammer comprising a cylinder or casing closed at one end, a piston reciprocating therein, a sleeve-valve also reciprocating between the piston and the cylinder or casing and provided with a port, the cylinder or casing being provided with inlet and outlet ports with either of which said valve-port may register, the sleeve-valve closing one of said ports when the valve-port is in register with the other, the piston fitting within said sleeve-valve and being adapted to close its port and by compression between

it and the closed end of the cylinder tend to move the valve in one direction, the compression thus obtained returning the piston until the valve-port is again opened, substantially as described.

3. A fluid-pressure hammer comprising a cylinder or casing, a piston reciprocating therein, a sleeve-valve also reciprocating between the piston and the cylinder or casing and provided with a port and a shoulder or enlargement adjacent thereto, the cylinder or casing being provided with inlet and outlet ports with either of which said valve-port may register, the sleeve-valve closing one of said ports when the valve-port is in register with the other, the piston fitting within said sleeve-valve and being adapted to close its port and by compression ahead of it to exert a pressure on the end of the valve, the shoulder of the valve being constantly exposed to the pressure of the fluid, substantially as described.

4. A fluid-pressure hammer comprising a cylinder or casing having two chambers of different diameters with an intermediate shoulder, a piston fitting the chamber of smaller diameter, a sleeve-valve longitudinally movable in the larger chamber and fitting between the piston and chamber-wall, said valve being provided with a port and a shoulder adjacent thereto, the cylinder or casing being provided with inlet and outlet ports with either of which said valve-port may register, the sleeve-valve closing one of said ports when the valve-port is in register with the other, and the piston being adapted to close the valve-port and by compression ahead of it to exert a pressure on the end of the valve to move it in one direction, the shoulder of the valve being constantly exposed to the fluid-pressure to move it in that direction, and means for introducing the pressure fluid into the piston, said piston being provided with ports whereby the pressure fluid is introduced between the other end of the sleeve-valve and the shoulder of the cylinder or casing to shift the valve in the opposite direction, and said piston being adapted to clear the shoulder to permit the shifting of the valve in the first-mentioned direction, substantially as described.

5. A fluid-pressure hammer comprising a cylinder closed at its ends and provided near one end with inlet and exhaust ports, a sleeve-valve reciprocating within the cylinder and controlling said inlet and exhaust ports, a piston fitting within the cylinder and valve and having a longitudinal bore provided with a chamber and ports near one end and with ports at the other end, a stem having a pressure-inlet passage provided with lateral ports and fitting the longitudinal bore of the piston, and an auxiliary exhaust-port through the cylinder or casing near that end thereof farthest from the ports controlled by the sleeve-valve, substantially as described.

6. A fluid-pressure hammer comprising a cylinder or casing having two chambers of different diameters provided with an intervening shoulder, a sleeve-valve adapted to reciprocate in the larger chamber and having an internal diameter equal to that of the smaller chamber, said sleeve-valve being externally of relatively large diameter at one end, its central portion being externally of smaller diameter and its other end of still smaller diameter and being provided with a valve-port adjacent to the shoulder between the two last-mentioned parts, the casing or cylinder being provided with inlet and outlet ports with either of which said valve-port may register, the sleeve-valve closing one of said ports when the valve-port is in register with the other, a piston fitting the smaller chamber of the cylinder and also fitting the sleeve-valve and adapted to close its port and by compression ahead of it to tend to move the valve in one direction, the valve-shoulder being constantly exposed to the fluid-pressure to tend to move it in that direction, said piston clearing the shoulder between the two chambers to exhaust the air between said shoulder and the adjacent end of the valve to permit said valve to shift in the direction above referred to, and means controlled by the piston on its return for introducing the fluid-pressure between the thick end of the sleeve-valve and the shoulder of the cylinder to shift the valve in the opposite direction, substantially as described.

7. In a fluid-pressure hammer, the combination, with a head provided with a handle and having an air-supply passage threaded at its outer end, of a swiveling air-supply pipe having an extension fitting within the passage proper, and a threaded portion to fit the threaded portion of said passage, substantially as described.

8. A fluid-pressure hammer comprising a cylinder, and a piston reciprocating therein, said cylinder being provided at one end with a tapering socket and cylindric opening, in combination with a tool-holding chuck or sleeve, tapered externally to fit said socket and provided internally for a portion of its length with a cylindric opening corresponding with the similar opening of the cylinder end, and for the remainder of its length with a polygonal opening, thus forming an intervening shoulder, and a tool the shank whereof is provided with a cylindric portion to fit the corresponding openings in the cylinder end and chuck or sleeve, and with a polygonal portion to fit the polygonal portion of the chuck or sleeve opening, and an intervening shoulder to abut against the shoulder of the chuck or sleeve, substantially as described.

9. A fluid-pressure hammer comprising a cylinder, and a piston reciprocating therein, said cylinder being provided at one end with a tapering socket and cylindric opening, in combination with a tool-holding chuck or sleeve, tapered externally to fit said socket and provided internally for a portion of its

length with a cylindric opening corresponding with the similar opening of the cylinder end, and for the remainder of its length with a rectangular opening, thus forming an intervening shoulder, and a tool the shank whereof is provided with a cylindric portion to fit the corresponding openings in the cylinder end and chuck or sleeve, and with a square portion to fit the square portion of the chuck or sleeve, and an intervening shoulder to abut against the shoulder of the chuck or sleeve, substantially as described.

10. In a fluid-pressure hammer, the combination, with a head having an inlet-passage threaded at its outer end, of an inlet-pipe having an extension to fit the unthreaded portion of said passage and threaded at its outer end to fit the threaded portion thereof, a supply-pipe, and a swivel-joint connecting said pipes and having its pivotal axis at right angles to that of the inlet-pipe, substantially as described.

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

FRANKLIN M. ILER.

Witnesses:
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