No. 682.492. Patented Sept. 10, 1901.

W. PAYTON.

FLUID PRESSURE HAMMER.

(Application filed Apr. 29, 1901.)

(No Model.) 3 Sheets—Sheet 1.

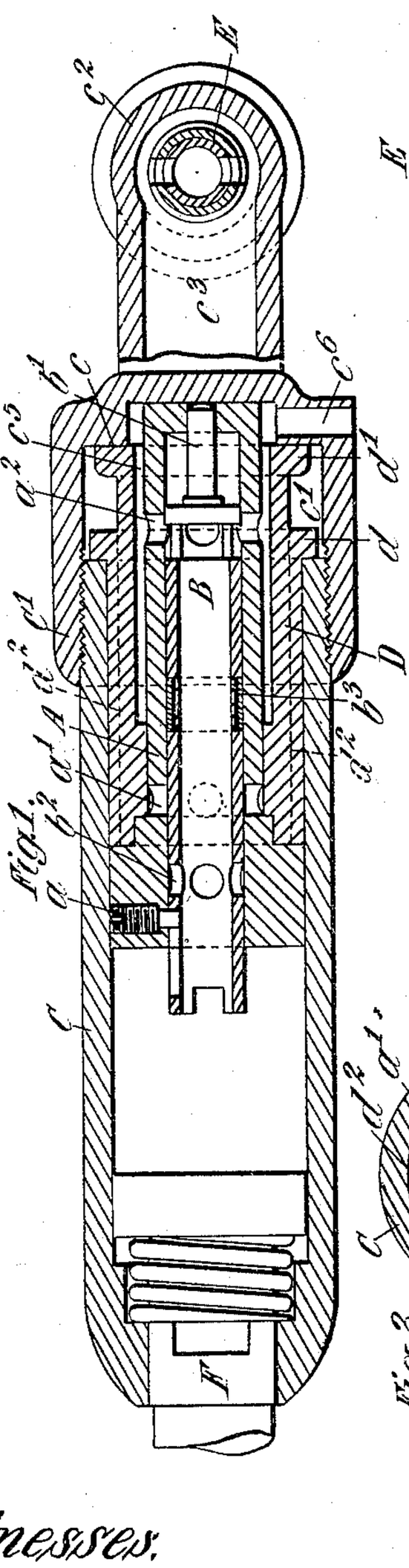

Fig. 1.

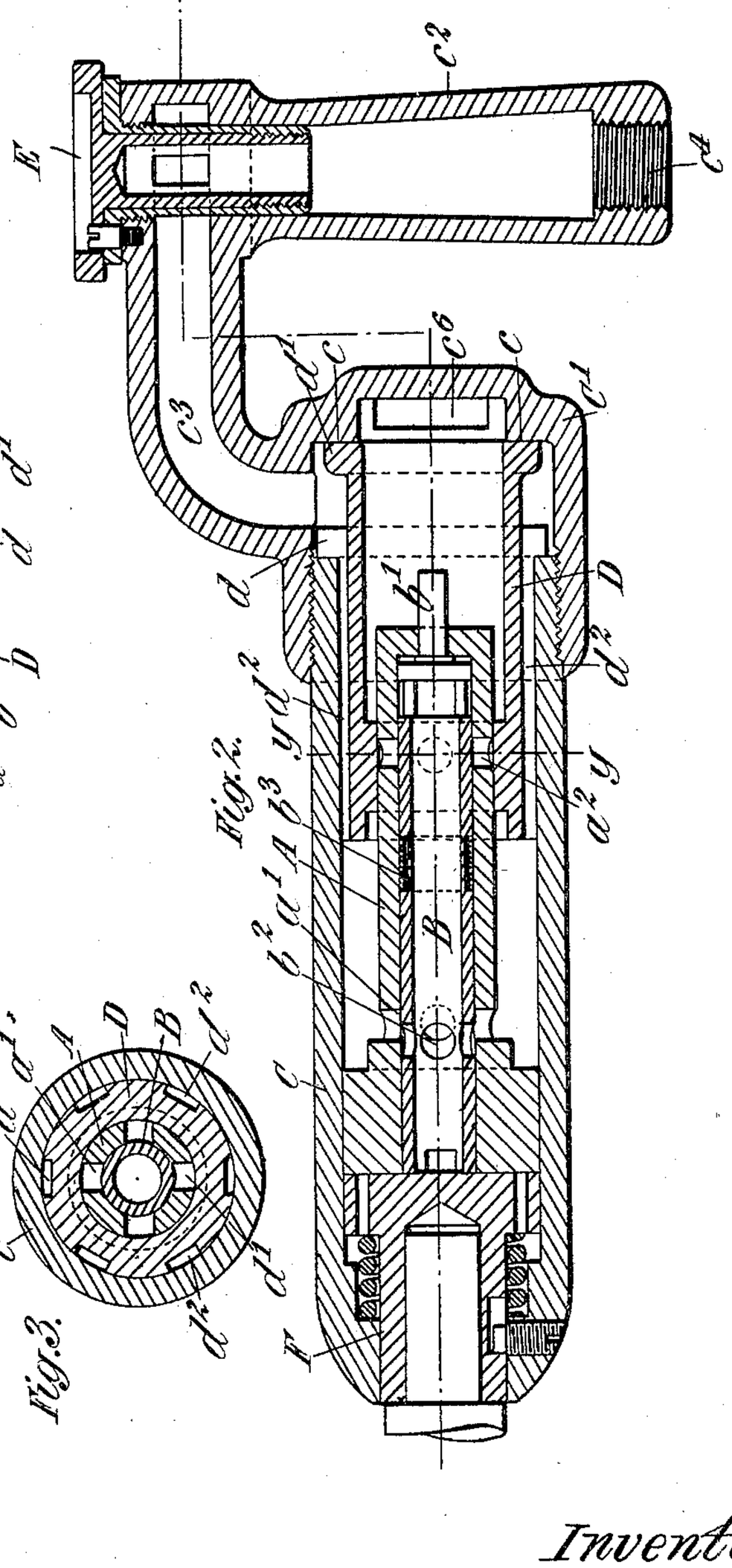

Fig. 2.

Fig. 3.

Witnesses.
Dennie Sumby.
Robert Evatt.

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(No Model.) 3 Sheets—Sheet 2.

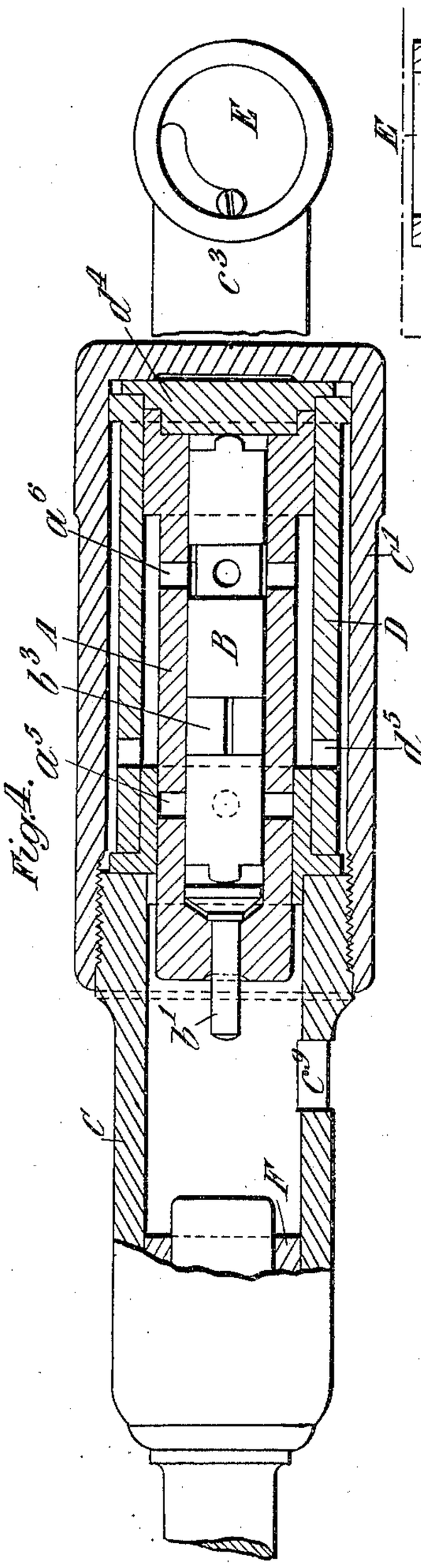

Fig. 4.

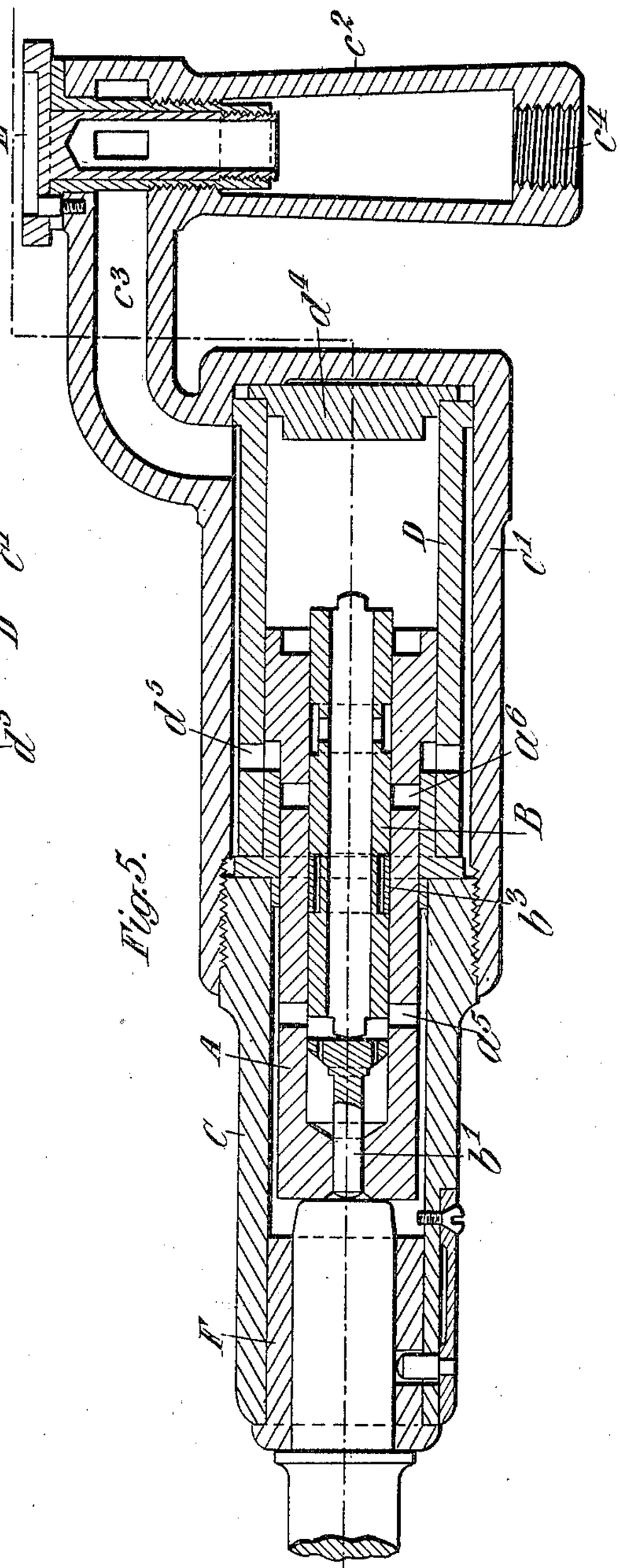

Fig. 5.

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(No Model.) 3 Sheets—Sheet 3.

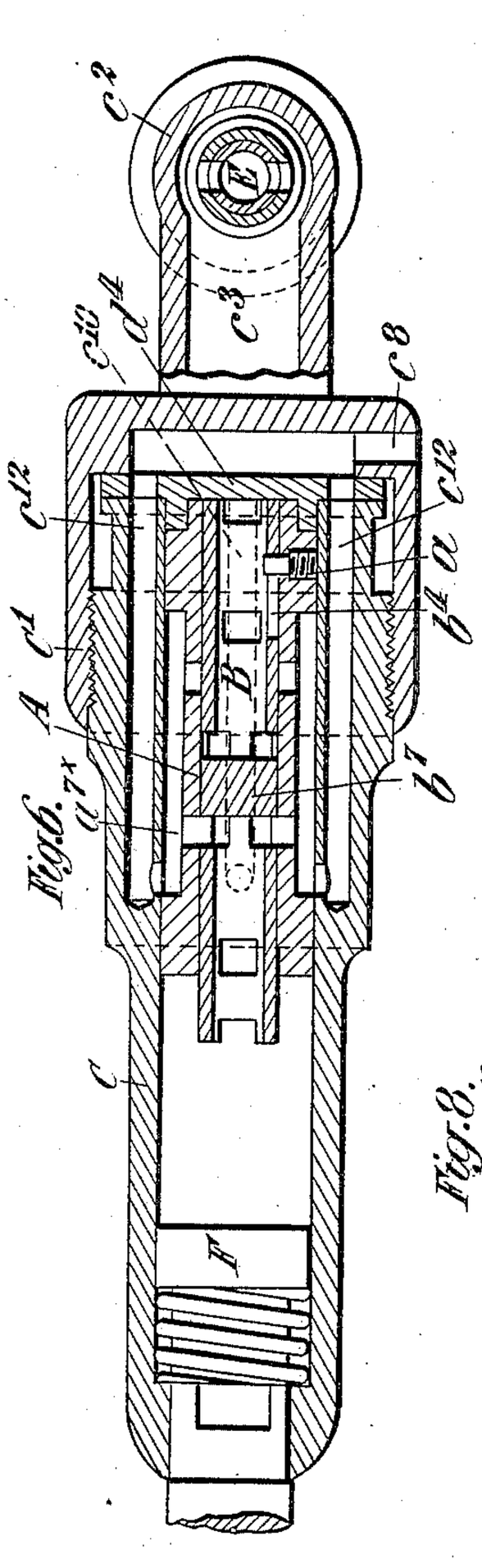

Fig. 6.

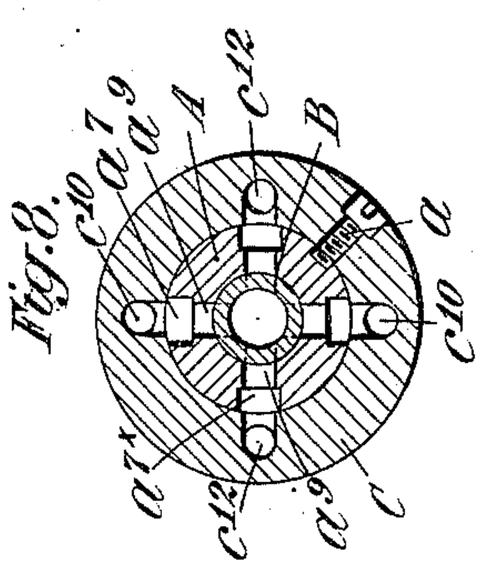

Fig. 8.

Fig. 7.

Witnesses,
Dennis Sunby.
Robt Gordt.

Inventor,
Walter Payton,
By James L. Norris,
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UNITED STATES PATENT OFFICE.

WALTER PAYTON, OF RICHMOND, ENGLAND.

FLUID-PRESSURE HAMMER.

SPECIFICATION forming part of Letters Patent No. 682,492, dated September 10, 1901.

Application filed April 29, 1901. Serial No. 58,056. (No model.)

To all whom it may concern:

Be it known that I, WALTER PAYTON, engineer, a subject of the King of Great Britain, residing at 138 Sheen road, Richmond, Surrey, England, have invented certain new and useful Improvements in and Relating to Portable Fluid-Pressure Hammers and Similar Tools, of which the following is a specification.

This invention relates to that class of portable fluid-pressure engines in which reciprocating pistons controlled by valves constitute hammers adapted to deliver rapidly-recurring blows to a chipping or other tool located in the path of such impact-pistons; and the chief objects of the invention are to construct such engines in a simpler and more efficient manner than heretofore and to use to better advantage and with greater economy than heretofore the motive fluid by which the pistons are actuated. Engines of this kind are adapted to work by compressed air and are generally termed "pneumatic hammers" and as usually constructed consist of four types, to all of which my invention is equally applicable. The first type is that in which the piston has two diameters, the smaller of which reciprocates in the rear end of a cylinder and is continuously subject to the pressure of the motive fluid, while the larger diameter reciprocates in the forward end of said cylinder, the reciprocation of the said piston being obtained by alternately admitting the motive fluid to the face of its larger or forward end and exhausting it therefrom. The second type is that in which a piston arranged in a similar manner to that referred to in the first type is actuated by alternately admitting the motive fluid to and exhausting it from the front surface of the enlarged part of the piston, the said motive fluid continuously acting upon the smaller rear surface of the enlarged part of the piston. The third type is that in which a piston similar to that referred to in the first and second type is used, but having its larger diameter reciprocating in the rear of the cylinder and its smaller diameter in the forward part of the cylinder, the piston being actuated by alternately admitting the motive fluid to and exhausting it from the rear surface of the enlarged part of the piston, the said motive fluid continuously acting upon the smaller or front surface of the enlarged part of the piston. The fourth type is that in which a piston of only one diameter is used, such piston being reciprocated by alternately admitting the motive fluid to and exhausting it from the opposite end surfaces of the piston.

An important feature of my invention is the provision of the piston (whether the latter be one of the kind referred to in the first type or in the other types of engine) with a sliding or tappet valve, which is so arranged that the movement of the piston as it completes its strokes will cause the said valve to strike against suitable pieces or abutments situated within the working cylinder, and thereby move into proper position to open and close the inlet and exhaust ports or passages and permit the motive fluid to actuate the piston, as aforesaid. It will thus be observed that in accordance with my invention the said tubular valve is not actuated directly by the fluid-pressure, as is the case in some fluid-pressure hammers heretofore proposed, but is actuated by the percussive force due to the impact of the moving valve with the abutments, as aforesaid. These abutments do not reciprocate with the piston, but are carried by or form part of the body or cylinder of the engine. By providing for the percussive movement of the said tubular valve I can insure that it will be shifted at regular predetermined intervals in the stroke of the piston, so that the engine will work quite smoothly and without intermittent stoppages, which are liable to occur with valves actuated by the motive fluid, such intermittent stoppages being due in most cases to the cushioning effect of the motive fluid on the valve, especially when the latter is working at a high speed.

In a prior application for patent, filed on or about the 10th of December, 1900, I set forth and claimed my invention with regard more particularly to pneumatic engines or hammers of the first-mentioned type. My present application is directed particularly to pneumatic engines or hammers of the other types above referred to.

Figures 1 and 2 are longitudinal sections taken in planes approximately at right angles to each other, showing my invention ap-

plied to a pneumatic hammer of the second of the above-mentioned types of pneumatic hammers, these figures representing the piston, respectively, in its retracted and forward positions. Fig. 3 is a transverse section taken approximately on the line *y y* of Fig. 2. Figs. 4 and 5 are longitudinal sections taken in planes at approximately right angles to each other, showing my invention applied to a pneumatic hammer of the third type and representing the piston, respectively, in its retracted and forward positions. Figs. 6 and 7 are similar views to Figs. 4 and 5, showing my invention applied to a pneumatic hammer of the fourth type. Fig. 8 is a transverse section taken approximately on the line *x x* of Fig. 7.

In all these figures like letters indicate similar parts.

A is the piston, B the sliding or tappet valve, and C the body of the hammer in which said piston reciprocates.

Referring more particularly to Figs. 1 to 4, the piston A is formed of two diameters, of which the smaller reciprocates freely but in an air-tight manner in a ring D. This ring is provided with two flanges *d* and *d'*, the former of which lies against the rear end of the body C and the latter of which lies against an annular shoulder *c* of the portion C' of the cylinder, this portion of the cylinder being provided with a screw-threaded socket to screw upon the rear end of the body C, and thus securely retain said ring D in place. The two portions C and C' when thus screwed together constitute the working cylinder within which the motive fluid operates to reciprocate the piston, as hereinafter explained. The portion C' of the cylinder forms a chamber which is divided by the said ring D into two concentric compartments, to the outer *c'* of which the motive fluid has access from the passage c^3, but is prevented from reaching the interior compartment c^5, which is used as an exhaust-chamber and communicates with the atmosphere through a lateral passage c^6. The said portion C' has formed as part of it or attached to it a transverse handle c^2 to enable the apparatus to be held in the hand of the workman, and such handle is made hollow, so as to form a passage through which the motive fluid has access to the outer concentric chamber *c'* through the hollow arm c^3. The handle is provided with a screw-threaded opening c^4 or may be provided with other suitable means for coupling it to a flexible hose or pipe leading from the supply of motive fluid, and it is also provided with a regulating-valve E of any appropriate kind for controlling the flow of the motive fluid through it to the working cylinder. The motive fluid is conveyed by passages d^2, formed in the wall of the ring, from the compartment c^5 to the annular space between said ring and the rear side of the enlarged part of the piston, and by acting on the latter forces said piston in a forward direction.

The sliding or tappet valve B is tubular and is arranged in a central longitudinal cavity extending from the forward end of the piston almost to the rear end thereof. The said tubular valve is limited in its movement by a pin carried by the piston and engaging with a slot *b* in the said valve, Fig. 1. At the inner end of the piston I provide a push-piece *b'*, which extends through the inner end of said piston and is adapted to come into contact with the end wall of the portion C' of the cylinder as the piston is retracted and so shift the tubular valve and reverse the stroke of the piston. (See Fig. 1.) The opposite end of the tubular valve can project through the larger end of the piston and strike against the tool-holder F as the piston completes its forward movement, thereby shifting the said valve into a position to cause the motive fluid to enter the space in front of the piston to drive it in its rearward direction. The tubular valve is formed with lateral ports b^2, which are adapted to come opposite lateral ports *a'* in the piston to permit the motive fluid to pass from the space around the smaller diameter of the piston and enter the interior of the tubular valve and so reach the front of the enlarged portion of the piston to cause the latter to be retracted. There are also other lateral ports a^2 in said piston, which ports when the said piston is in its forward position are closed by the inward movement of the tubular valve. These ports, as said piston completes its inward movement, are uncovered by the said valve as it is shifted forwardly by the push-piece *b'* striking against the end of the portion C', (see Fig. 1,) whereby the motive fluid is permitted to escape through the exhaust-port c^6. At the same time the ports *a'* are closed by the tubular valve, and the motive fluid is thereby permitted to act upon the rear face of the enlarged part of the piston and so drive it in the forward direction. b^3 is a spring-ring contained in a recess in the said tubular valve, said ring operating to exert sufficient friction to insure that the valve shall not become displaced when the apparatus is inverted or shaken.

In Figs. 4 and 5 the ring D is made in two parts, one of which is flanged to bear against the end of the body C and the other of which is fitted over the first-mentioned part and bears at one end against the said flanged portion. At its opposite end the outer ring is closed by a cover d^4, which abuts against the end of the portion C' of the cylinder-body, so that by screwing said portion C' upon the portion C the said rings are held firmly in place, and the cover is securely retained against the end of the outer ring. The larger diameter of the piston is adapted to move within the outer ring and the smaller diameter of said piston is adapted to move within the other ring. The motive fluid is admitted by lateral passages d^5 in the outer portion of the ring to the annular space between the enlarged end of the pis-

ton and the said outer portion of the ring and presses the piston in a rearward direction. The space at the forward end of the portion C is permanently open to the atmosphere through a port c^9. The tubular valve B is inserted at the rear end of the piston, and the push-piece b' is located at its forward end. In this type of the apparatus the reciprocations of the piston are caused by alternately admitting the motive fluid to and exhausting it from the rear end of the piston, a constant pressure of the motive fluid being exerted upon the piston in the annular space between the forward face of the enlarged part of the piston and the ring D by means of the lateral ports a^5 a^6 in the piston. The inlet and outlet of the motive fluid are controlled by the movements of the tubular valve B as it is shifted by striking alternately against the cover d^4 and the tool G in an analogous manner to that described with reference to the last preceding form of the apparatus.

In Figs. 6 to 8 the piston is made of the same diameter at each end, with recesses a^7 $a^{7\times}$ between said ends, and the aforesaid ring D is dispensed with, the motive fluid being conveyed to the two opposite recesses a^7 by passages c^{10}, formed in the wall of the portion C of the body of the cylinder. These passages are closed at their rear ends by a cover d^4, similar to that referred to in Figs. 8 and 9, which cover is held in place by the portion C′ of the apparatus. The motive fluid reaches the said passages c^{10} by the lateral ports c^{11}. In addition to the aforesaid passages c^{10} there are two other passages c^{12}, which are not closed by the cover d^4, but are permanently in communication with the two opposite recesses $a^{7\times}$ and with the atmosphere through the port c^8, these passages being unprovided with lateral ports for the motive fluid to enter therein. The valve is not in this case bored completely through, as in the previous examples, but has a partition b^7 at about the middle of its length. The piston is, however, bored completely through its length in order that the valve may project beyond the ends of the piston at either end as it is shifted by striking against the tool-holder and the end of the portion C′, as already described. Angular movement of the valve and piston, respectively, about their axes, which would more or less close the various passages for the motive fluid described, is prevented by means of a screw-pin a. The reciprocation of the piston is caused by alternately admitting the motive fluid to and exhausting it from the ends of the piston, the lateral ports b^8 b^8 in the valve and the lateral ports a^8 a^9 in the piston being so arranged as to allow of this being done.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a portable fluid-pressure hammer, the combination with a casing formed of two detachable parts and constituting the working cylinder, said casing having a handle at one end and a tool-holder at the other end, of a reciprocating piston constituting the hammer proper and consisting of a block having a central longitudinal hole extending completely therethrough, of a sliding tubular tappet-valve located in said central longitudinal hole and of a push-piece located contiguous to one end of said tubular valve and projecting from one end of the piston, said valve and piston being provided with ports adapted to be opened and closed by the changes in position of the tubular valve relatively to the piston, substantially as described.

2. In a portable fluid-pressure hammer, the combination with a casing formed of two detachable parts and constituting the working cylinder, said casing having a handle at one end and a tool-holder at the other end, of a reciprocating piston constituting the hammer proper and consisting of a block having two external diameters and a central longitudinal hole extending completely therethrough, of a sliding tubular tappet-valve located in said central longitudinal hole and of a push-piece located contiguous to one end of said tubular valve and projecting from one end of the piston; said valve and piston being provided with ports adapted to be opened and closed by the changes in position of the valve relatively to the piston, substantially as described.

3. In a portable fluid-pressure hammer, the combination with a casing formed of two detachable parts and constituting the working cylinder, said casing having a handle at one end and a tool-holder at the other end, of a reciprocating piston constituting the hammer proper and consisting of a block having two external diameters and a central longitudinal hole extending completely therethrough, of a sliding tubular tappet-valve located in said central longitudinal hole and of a push-piece located contiguous to one end of said tubular valve and projecting from the smaller end of the piston, said valve and piston being provided with ports adapted to be opened and closed by the changes in position of the valve relatively to the piston, substantially as described.

4. In a portable fluid-pressure hammer, the combination with a casing formed of two detachable portions and constituting the working cylinder, said casing having a handle at one end and a tool-holder at the other end, of a reciprocating piston constituting the hammer proper and consisting of a block having a central longitudinal hole extending completely therethrough and of smaller diameter at one end than at the other, of a sliding tubular tappet-valve located in the larger diameter of said central longitudinal hole, of a spring-ring situated in an annular cavity in the exterior of said valve, of a stop-piece for limiting the extent of longitudinal movement of said valve, and of a push-piece located contiguous to one end of said valve and provided

with a stem that extends through the smaller diameter of said central longitudinal hole and projects beyond the end of the piston, said tubular valve and piston being provided with ports adapted to be opened and closed by the changes in position of the valve relatively to the piston, substantially as described.

5. In a portable fluid-pressure hammer, the combination with a casing formed of two detachable portions and constituting the working cylinder, said casing having a handle at one end and a tool-holder at the other end, of a reciprocating piston constituting the hammer proper and consisting of a block having a central longitudinal hole extending completely therethrough, of a sliding tubular tappet-valve located in said central longitudinal hole and adapted to project from opposite ends of the piston as the latter reaches the ends of its reciprocations, and of a central transverse partition dividing the interior of said tubular valve into two compartments, said valve being provided with ports on opposite sides of its partition and near its ends, for coöperating with ports in the piston as said valve changes its position relatively to the piston, substantially as described.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 18th day of April, 1901.

WALTER PAYTON.

Witnesses:
THOS. C. WARDLE,
WM. MELLERSH JACKSON.