S. OLDHAM.

PNEUMATIC HAMMER.

APPLICATION FILED JAN. 19, 1911.

996,880.

Patented July 4, 1911

2 SHEETS—SHEET 1.

Fig. 1.

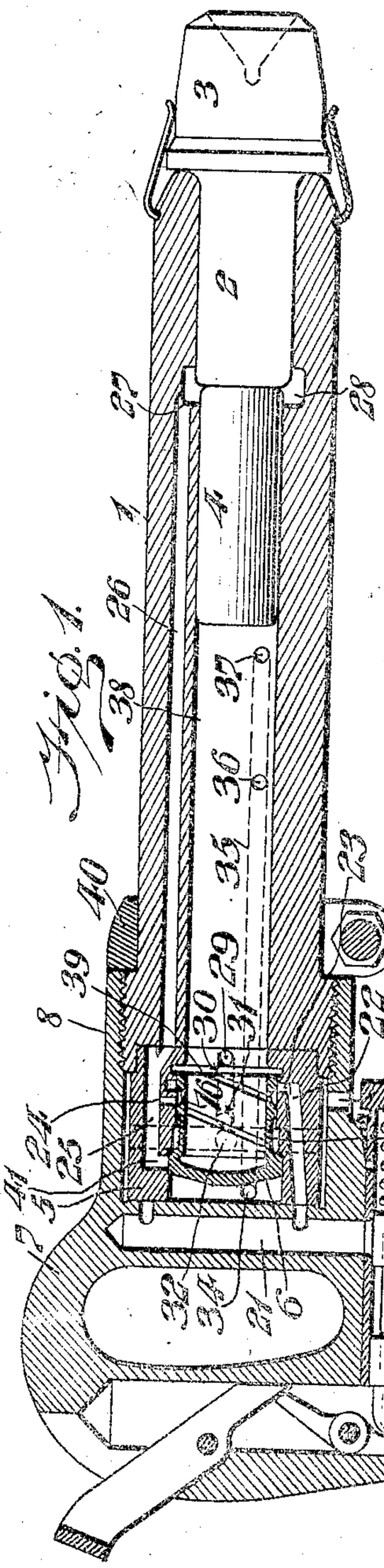


Fig. 4.

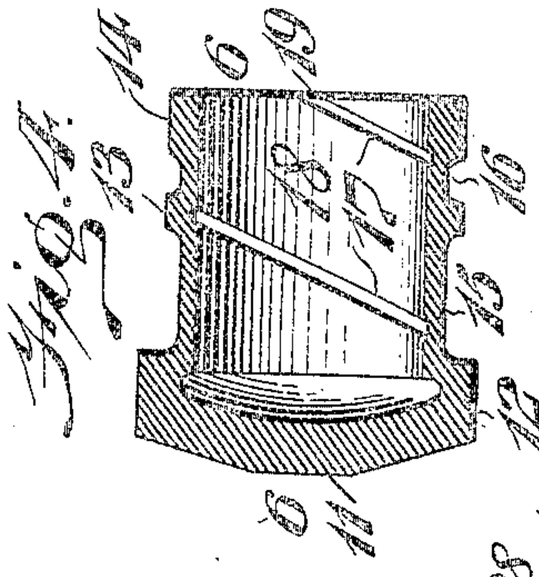


Fig. 3.

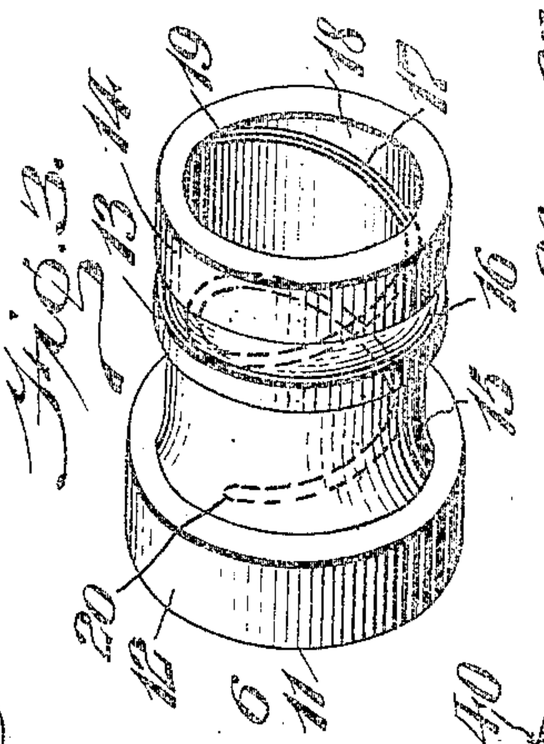
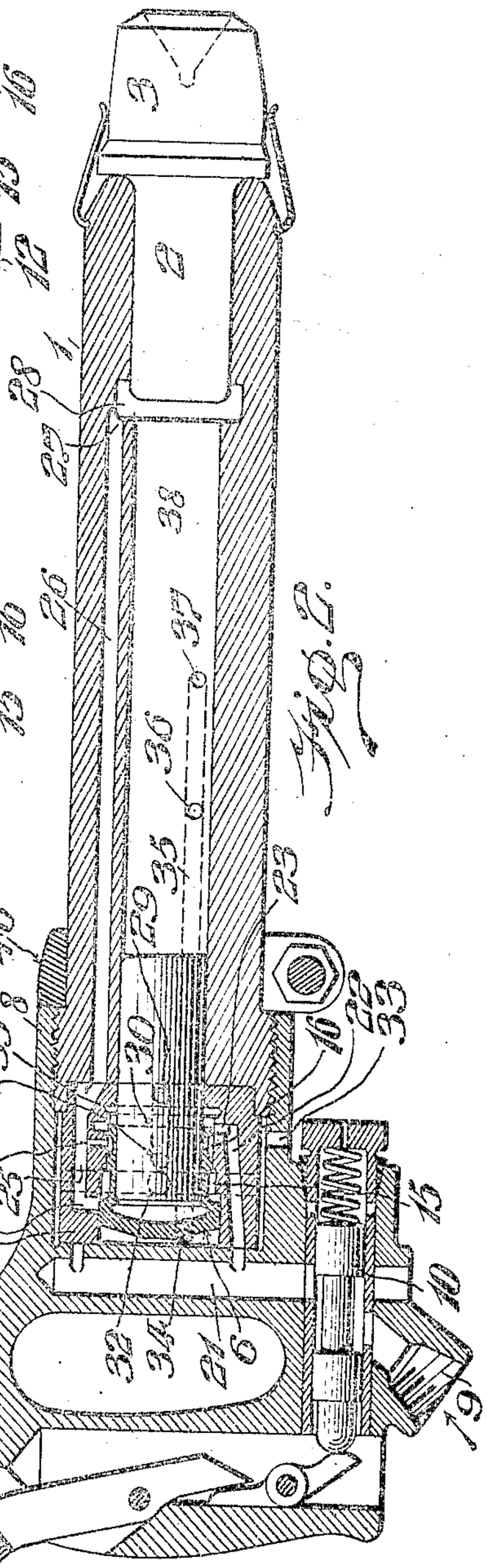


Fig. 2.



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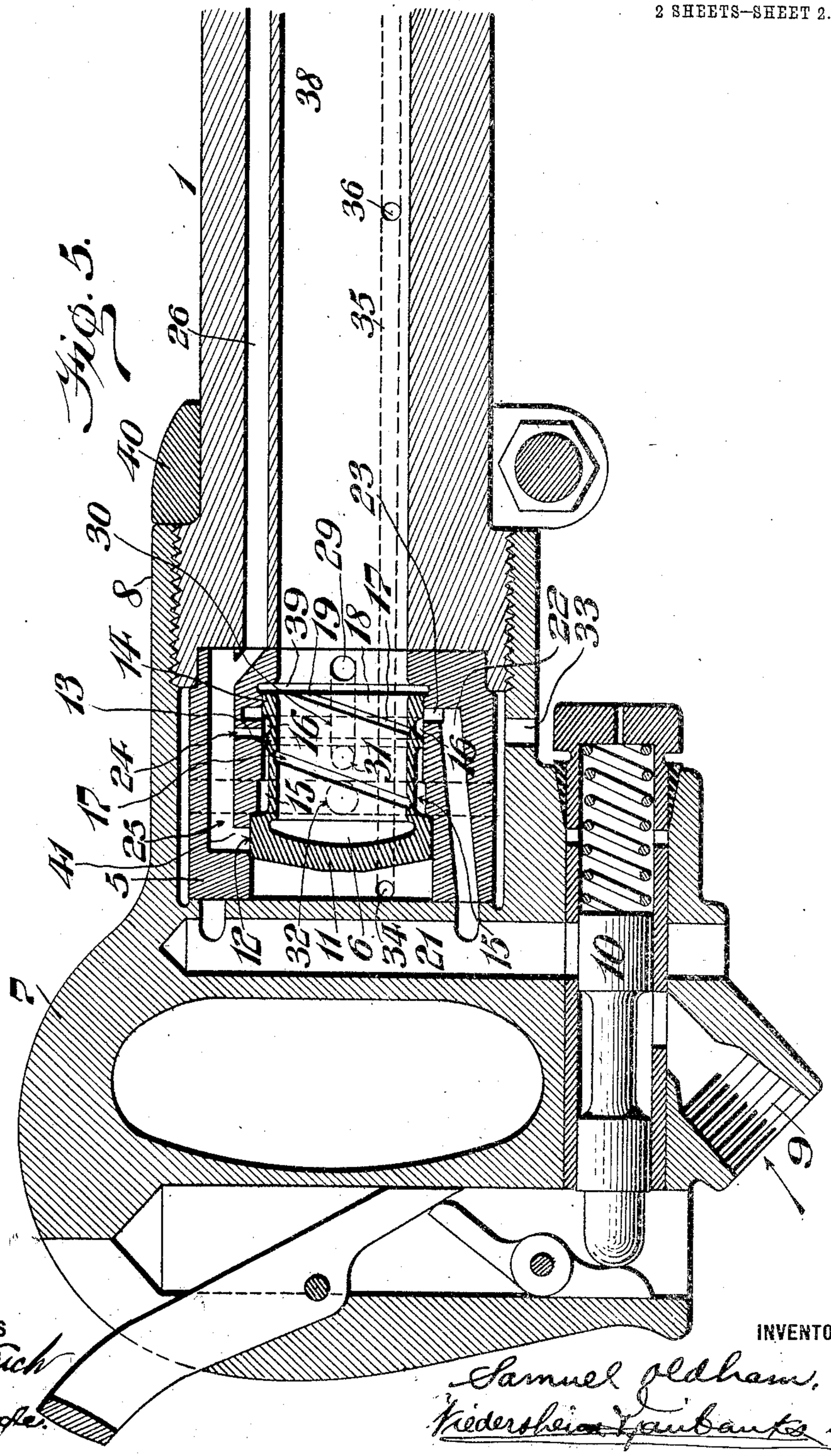
2 SHEETS—SHEET 2.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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PNEUMATIC HAMMER.

996,880. Specification of Letters Patent. Patented July 4, 1911.

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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 Pneumatic Hammer, of which the following is a specification.

My present invention relates to that class of fluid actuated tools commonly known as pneumatic hammers wherein the blow of a reciprocating piston is imparted to the working tool, such piston being controlled by a valve mechanism located in proximity to one end of the piston cylinder, the valve of said mechanism being cup shaped, and imperforate and being moved in its forward direction by live air, and in its rearward direction by the momentum of the piston and for purposes of illustration, I have shown a construction in which the length of stroke of the piston is greater than its own length, it being apparent to those skilled in this art that the novel valve mechanism herein disclosed is equally adaptable for a construction wherein the length of stroke of the piston is less than the length of the piston.

My invention consists of a novel construction of fluid actuated hammer having a novel construction of an imperforate, cup shaped valve and a novel valve movement, the valve mechanism being located at one end of the piston cylinder and preferably in alinement therewith.

It further consists of a novel manner of changing the valve which is moved in one direction by live motive fluid and in the opposite direction by the momentum of the reciprocating piston.

It further consists of novel means for causing the initial forward movement of the reciprocating piston.

It further consists of a novel construction of an imperforate valve into which the piston is adapted to travel, said valve having an open end and imperforate walls and provided on its inner periphery with a groove for conducting live motive fluid along the piston to the rear end thereof.

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 drawing one form thereof which is at present preferred by me, since the same has been 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 a longitudinal section of a pneumatic hammer embodying my invention. Fig. 2 represents a longitudinal section of my device similar to Fig. 1 but showing the parts in the position they assume at a different stage of the operation. Fig. 3 represents a perspective view of the valve. Fig. 4 represents a longitudinal section of the valve. Fig. 5 represents, on an enlarged scale, a longitudinal sectional view of the hammer, with the parts in the position seen in Fig. 1.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates the cylinder having the shank 2 of the rivet set or other working tool 3 inserted therein and provided with the piston 4.

5 designates the valve block having the valve 6 therein and 7 designates the grasping handle of the tool having the threaded sleeve 8 in engagement with the cylinder 1, whereby the handle, valve block and cylinder are kept in assembled position.

9 designates the inlet for the motive fluid which is controlled by the throttle valve 10 located outside the grasping part of the handle, said valve being actuated by suitable lever mechanism whose operation will be apparent and need not further be described as the same forms no part of the present invention.

The piston 4 is preferably of the form of a cylindrical bolt of uniform diameter, while the valve 6 is cup-shaped having one end open and the other end closed by a wall 11 of considerable thickness and terminating in the head or flange 12.

13 designates a flange or rib of less diameter and width than the head 12, being

separated from the latter by the groove 15, while the head 14 is of greater width than the head 13 and is separated therefrom by the groove 16.

17 designates a preferably spiral groove in the inner wall 18 of the valve 6, said groove beginning at the point 19 and terminating at the point 20.

When the parts are in the position indicated in Fig. 1, the throttle valve 10 is closed and the valve 6 and piston 4 are in their extreme forward position. On moving the throttle valve 10 to the position indicated in Fig. 2, the live air, when the parts are in the position seen in Fig. 1, passes into the passages 21 and 22 and the port 23 by the groove 16 and port 24 into the passage 25 of the valve block 5 into the passage 26 and through the port 27 into the chamber 28 and the piston starts on rearward stroke or toward the valve 6. The exhaust from the rear of the piston passes through the port 29, passage 30 and port 31 around groove 15 and out ports 32 and 33 to the atmosphere, the valve still being in the position seen in Fig. 1. The valve 6 remains in the position seen in Fig. 1 until the piston 4 moves past the port 29 toward the position seen in Fig. 2, whereupon the valve 6 is moved rearwardly slightly to the left of the position seen in said Fig. 2 by the momentum of the piston 4 which is governed by the location of the port 29. The air in rear of the valve 6 escapes to the atmosphere through port 34. passage 35, ports 36 and 37, piston chamber 38, port 27, passage 26, passage 25, port 41, around annular groove 15, ports 32, and ports 33.

I desire at this point to call especial attention to the fact that my novel construction of imperforate, cup-shaped valve is shifted rearwardly or toward the handle by the momentum of the piston for the following reasons. I locate the port 29 at the mouth or open end of the valve so that when the piston moves rearwardly past said port, it will trap a body of air within the imperforate cup shaped valve, and will compress said body of air to such an extent that an air buffer is formed within the valve. The valve and piston now move rearwardly in unison by reason of the momentum of the piston to the full extent of the length of stroke of the valve. During this continued rearward stroke of the valve and piston, owing to the momentum of the piston, the piston continues its rearward movement after the rearward movement of the valve has ceased, whereby this trapped body of air, becomes compressed to a greater extent, so as to accelerate the initial forward movement of the piston.

It will be apparent that by locating the port 37 toward the forward end of the cylinder, the air from the rear of the valve 6 is permitted to exhaust earlier, whereby resistance to the rearward movement of the valve, effected by the momentum of the piston, as above explained, is reduced to a minimum.

I am aware that it is a common right to move a fluid actuated valve in a pneumatic impact tool by compression of air between the valve and the piston, as in British patent to Lake, No. 2182, of 1875; in patent to Von Buhler, No. 510,155, Dec. 15, 1893; and Uren, No. 303,344, Aug. 12, 1884, but I do not desire to employ such construction as I have found my method of valvular operation to be more reliable in practice and to produce more satisfactory results. In the prior art devices when the valve gets worn or fits loosely in its valve box, it will be apparent that live air can, or is liable, to leak into the compression chamber which will cause the valve to change earlier than it should and the tool will then "short stroke" or in other words, the piston will not travel its full length on its rearward stroke, an objectionable feature, which is entirely obviated in my novel tool. Returning now to the detailed operation of my novel valve mechanism, it will be seen that the piston 4 and the valve 6 have now assumed the position seen in Fig. 2 whereupon live motive fluid may pass through the port 23, thence through the groove or passage 17 in rear of the piston to cause the initial forward movement of the piston 4.

It will be understood by those skilled in the art that in the ordinary or normal operation of the tool, the piston 4 instantly shifts or reverses its movement, as above explained, and that the especial function of the groove 17 is to admit live air instantly to the rear of the piston, in case the piston should happen to be in its extreme rear position when the air is turned on, which might occur when the tool is held in a vertical or upwardly inclined position before the motive fluid is admitted to it. As soon as the piston passes the port 23 it will receive the full force of the live motive fluid. The air in front of the piston may exhaust through port 27, passage 26, passage 25, also port 41, around groove 15, and thence through ports 32 and 33 to the atmosphere. As soon as the piston 4 uncovers the port 36, live motive fluid may pass through passage 35 and port 34 in rear of the valve 6, and cause the latter to be initially moved forwardly, it being clear that after the piston has passed port 37 live motive fluid may pass through both the ports 36 and 37 into passage 35 and thence through port 34 in rear of the valve and maintain the same in its forward position, the valve remaining in such forward position until it is moved rearwardly by the momentum of the piston.

40 is a clamping ring, preventing im-

proper movement of the handle and cylinder. The valve 6 at its rear end is preferably of a considerable thickness in order to impart weight thereto, the result of which is that the valve moves forwardly and more readily when the cylinder is held in such a manner that the working tool is pointing downwardly. The groove 17 on the inner face of the valve may extend in any desired direction from the open end of the valve to the rear wall or end thereof.

Special attention is directed to the novel construction of valve mechanism employed and its novel manner of operation, especial attention being called to the fact that the valve is operated in its rearward direction by the momentum of the piston and is thus differentiated from the prior structures already referred to also from prior devices, such as Meissner, No. 822,146, patented May 29, 1906, wherein the valve is shifted by compression of the air between it and the piston at the return stroke of the latter. Attention is also directed to the novel construction of valve which is provided with imperforate walls and an imperforate end and the internal groove 17 which may be straight or spiral or of such contour as to conduct live motive fluid to the rear of the valve to effect the initial forward movement of the piston, when the parts are in the position seen in Fig. 2. By the employment of a piston of plain, cylindrical shape, without any groove or ports therein, the same is rendered exceedingly durable and can be cheaply manufactured.

I am aware that it is old and public property in this country to provide a hammering piston with a stroke exceeding its own length and I make no claim to such feature *per se*, but by the provision of a cylinder having a cup-shaped imperforate valve coacting therewith and shifted rearwardly by the momentum of the piston, said cylinder having a port for the fluid control of said valve opening into the cylinder at a greater distance from either end of the cylinder than the length of the piston, I am enabled to provide a novel valve mechanism which shifts instantly in the desired direction and enables my piston to strike a very powerful and heavy blow directly upon the shank of the button set, rivet set, chisel or other working tool.

By the co-action between the parts comprising the pneumatic hammer proper, such as the cylinder, a piston therein constructed as described and having a length of stroke greater than its own length, the novel valve mechanism located wholly at one end of the cylinder and consisting of a cup shaped, imperforate valve, shifted by the momentum of the piston, said valve having grooves thereon as described, which is held in position by the grasping handle and its adjuncts, taken in conjunction with the supply duct and the throttle valve located wholly outside of the grasping portion of said handle, I am enabled to provide a tool of great simplicity and durability at a minimum cost. It will be understood that while the present invention is applicable for riveting and other work in metal as chipping, calking and the like, I do not desire to be limited thereto, since my invention is applicable for all uses wherein a mallet and chisel have heretofore ordinarily been employed.

It will now be apparent that I have devised a novel and useful construction of a pneumatic hammer which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description and while I have, in the present instance, shown and described a preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

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

1. In an impact tool, a cylinder, a reciprocating piston therein, an imperforate cup shaped valve arranged in alinement with said piston and adapted to have the latter enter and cushion in it, means for shifting said valve forwardly by live air pressure, and means for enabling said valve to be shifted rearwardly by the momentum of said piston.

2. In an impact tool, a cylinder, a reciprocating piston therein, inlet and exhaust passages for the motive fluid, an imperforate cup shaped valve movable in a chamber at the rear end of the cylinder and adapted to have the piston enter and cushion within it, and means for enabling said valve to be shifted forwardly by live air and rearwardly by the momentum of the piston.

3. In an impact tool, a cylinder, a reciprocating piston therein, an imperforate cup shaped valve, located at the rear of said piston and in alinement therewith and adapted to have the latter enter and cushion within it, said cylinder having ports and passages for causing said valve to be shifted forwardly by live air pressure, and means for enabling said valve to be shifted rearwardly by the momentum of said piston.

4. In an impact tool, a cylinder, a reciprocating piston therein, an imperforate cup shaped valve arranged in alinement with said piston and adapted to have the latter enter and cushion in it and having a plurality of grooves thereon, one groove controlling the exhaust and the other of said

grooves controlling the inlet of motive fluid, means for shifting said valve forwardly by live motive fluid, and means for enabling said valve to be shifted rearwardly by the momentum of the piston as the latter approaches the extremity of its rearward stroke.

5. As an improved article of manufacture, a hollow valve having a groove on its inner periphery, extending from the open end of said valve to its rear end and adapted to admit motive fluid to the rear of the interior of said valve to effect the initial movement of the piston.

6. As an improved article of manufacture, a hollow cup shaped valve having a groove on its inner periphery, extending from the open end of said valve to its rear end and adapted to admit motive fluid to the rear of said valve to effect the initial movement of the piston.

7. As an improved article of manufacture, a hollow cup shaped valve having a spiral groove on its inner periphery, extending from the open end of said valve to its rear wall.

8. In a fluid actuated hammer, a hollow cup shaped valve having an imperforate end and side walls, and into which the piston is adapted to travel, and provided on its inner periphery with a groove for permitting passage of live motive fluid to initially move the piston, said valve controlling admission of exhaust of motive fluid to and from the opposite ends of the cylinder, and being moved in one direction by live motive fluid and in the opposite direction by the momentum of the piston.

9. As a new article of manufacture, a differential cup shaped valve having an imperforate end and imperforate side walls and provided on its inner face with a groove extending from the open end in proximity to said imperforate end, and having on its outer periphery a plurality of grooves.

10. As a new article of manufacture, a differential hollow valve having an imperforate end and imperforate side walls and provided on its inner face with a spiral groove terminating in proximity to the imperforate end and said valve having on its outer periphery a plurality of grooves.

11. As a new article of manufacture, a differential hollow valve, having imperforate walls, one end thereof being open and the other end thereof being closed by an imperforate wall having its outer surface beveled, the inner periphery of said valve being provided with a groove extending from the open end into proximity to the closed end and the lesser diameter of said valve having on its outer periphery a plurality of annular grooves.

12. As an improved article of manufacture, a hollow cup-shaped valve having one end closed by a thickened wall 11 and provided with heads 12, 13 and 14, and grooves 15 and 16, the inner periphery of said valve having the spiral groove 17 therein.

13. In a fluid actuated hammer, the combination of a cylinder having a recess in its rear end, a valve casing adapted to be seated in said recess and having ports for admission and exhaust of motive fluid to and from the cylinder, a differential valve moved in one direction by live motive fluid and in the opposite direction by momentum of the piston, said valve being located within said casing and having imperforate side walls and having at its rear end an imperforate wall, a piston adapted to enter into said valve and the latter having means on its inner periphery for permitting passage of live motive fluid to the rear of said valve to cause the initial forward movement of said piston, when the latter is in its extreme rearward position.

14. In a pneumatic tool, a cylinder, a piston, and a cup-shaped valve controlling admission of fluid to both ends of said piston, said cylinder having a port for the fluid control of said valve opening into the cylinder at a greater distance from either end of the cylinder than the length of the piston, said valve having means on its inner periphery for permitting the inlet of live motive fluid to its rear to cause the initial forward movement of the piston.

15. In a pneumatic tool, a cylinder, a piston therein, a cup-shaped valve controlling admission of fluid to both ends of said cylinder and means for moving said cup-shaped valve operated through a port in the cylinder farther from either end of said cylinder than the length of the piston, said valve having means on its inner periphery for permitting the inlet of live motive fluid to its rear to cause the initial forward movement of the piston.

16. A pneumatic tool comprising a cylinder, a cup-shaped valve located wholly at one end of said cylinder and controlling fluid admission to both ends of said cylinder, the latter having a port for fluid control of movement of said valve and a hammering piston in said cylinder completely passing said port in each direction of its travel, said valve having means on its inner periphery for permitting the inlet of live motive fluid to its rear to cause the initial forward movement of the piston.

17. A pneumatic tool comprising a cylinder, a hammering piston therein having a stroke in excess of its length, and a cup-shaped valve for admitting fluid to both ends of said cylinder and itself controlled by fluid from the cylinder through a single port therein, and said piston passing beyond and uncovering said port when in each of its extreme positions, said valve having means

on its inner periphery for permitting the inlet of live motive fluid to its rear to cause the initial forward movement of the piston.

18. In a pneumatic tool, a cylinder, a hammering piston whose largest diameter and major portion comprises one unbroken surface, and a cup-shaped valve located wholly beyond one end of said cylinder exterior thereto for controlling the inlet of the motive fluid to opposite ends of the piston chamber to reciprocate the piston, said valve having means on its inner periphery for permitting the inlet of live motive fluid to its rear to cause the initial forward movement of the piston.

19. In a pneumatic tool, a cylinder, a piston therein, a valve block for said cylinder and a cup-shaped imperforate valve controlling admission of fluid to both ends of said piston, said cylinder having a port for the control of admission and exhaust of motive fluid to the rear of said valve opening into said cylinder at a greater distance from either end of the cylinder than the length of the piston, said valve being provided on its outer periphery with the exhaust groove 15 and the inlet groove 16 and said cylinder and valve block having ports and passages, coacting with said valve and piston for the admission and exhaust of motive fluid.

20. In a pneumatic tool, a cylinder, a piston therein, a valve block for said cylinder and a cup-shaped imperforate valve controlling admission of fluid to both ends of said piston, said cylinder having a port for the control of admission and exhaust of motive fluid to the rear of said valve opening into said cylinder at a greater distance from either end of the cylinder than the length of the piston, said valve having its closed end weighted and being provided on its outer periphery with the exhaust groove 15 and the inlet groove 16 and said cylinder and valve block having ports and passages, coacting with said valve and piston for the admission and exhaust of motive fluid.

21. In an impact tool, a cylinder, a reciprocating piston therein, an imperforate cup-shaped valve arranged in alinement with said piston and moving in the same direction as the latter, said piston being adapted to enter said valve, means for shifting said valve forwardly by live air pressure and means for enabling said valve to be shifted rearwardly by the momentum of said piston.

SAMUEL OLDHAM.

Witnesses:
E. HAYWARD FAIRBANKS,
H. S. FAIRBANKS.