No. 836,778. PATENTED NOV. 27, 1906.

A. J. PATCH.

PNEUMATIC HAMMER.

APPLICATION FILED JULY 6, 1904.

4 SHEETS—SHEET 1

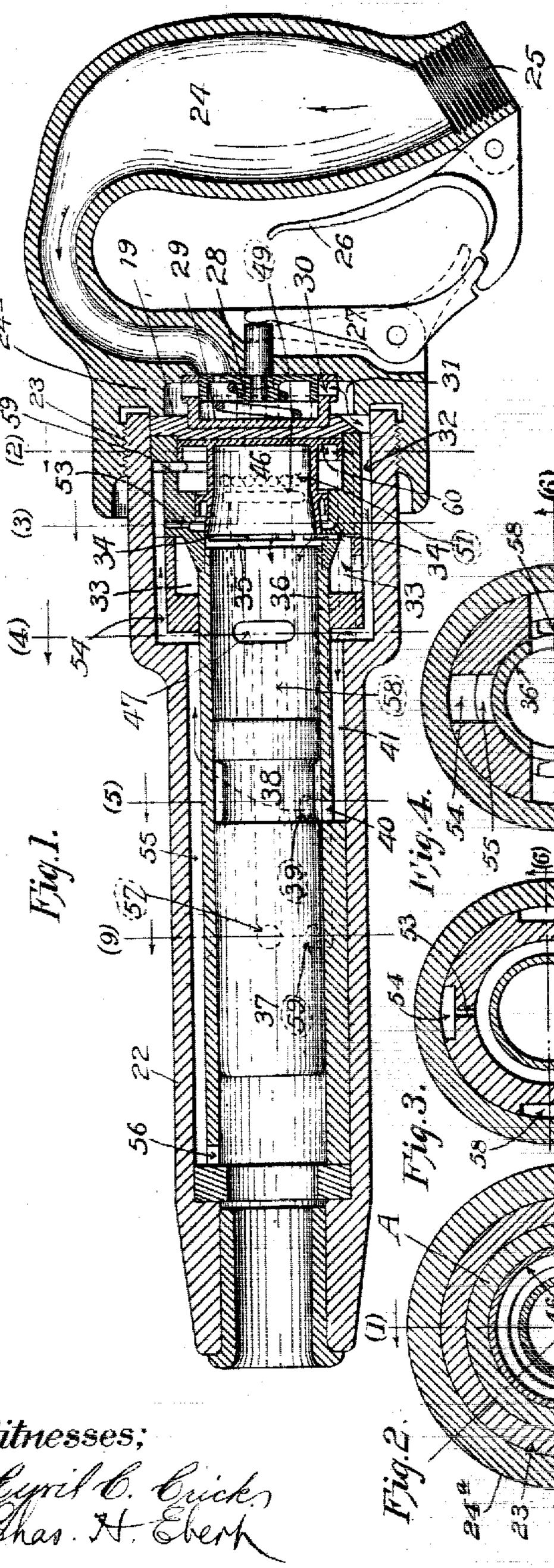


Fig. 1.

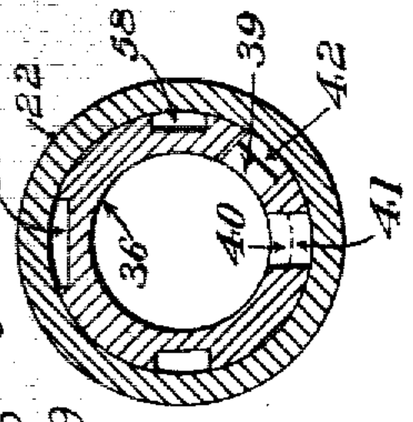


Fig. 5.

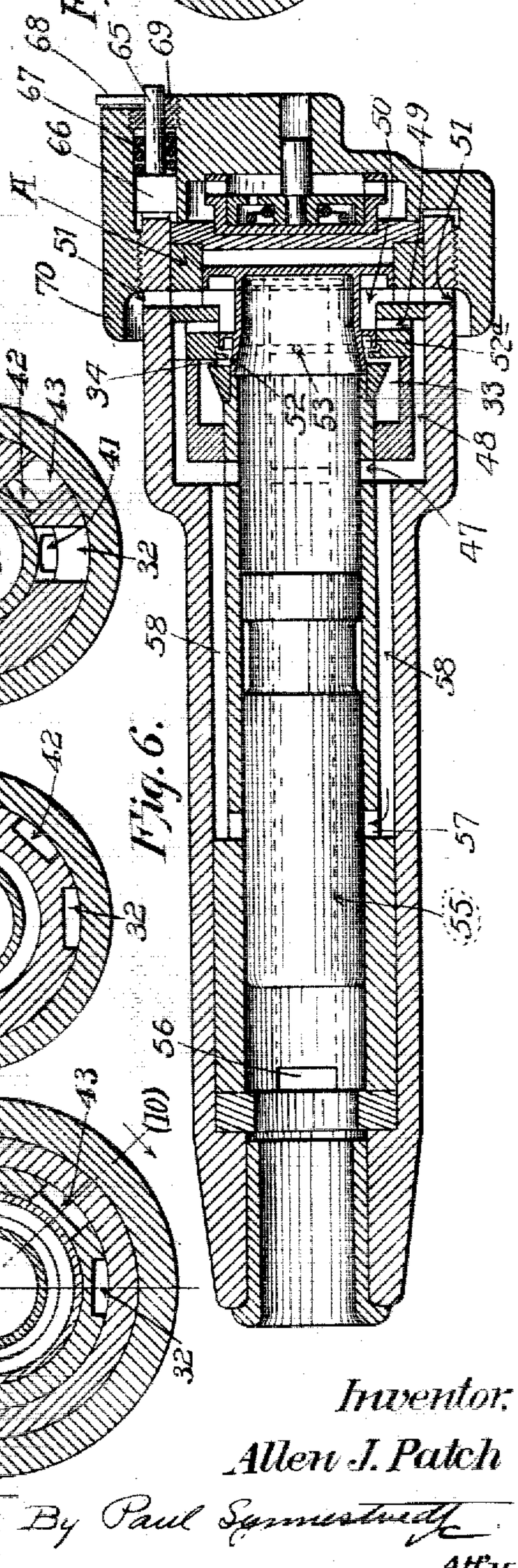


Fig. 6.




Fig. 4.




Fig. 3.




Fig. 2.

Witnesses;

Cyril B. Bicker

Chas. H. Eberh

Inventor:

Allen J. Patch

By Paul Synnestvedt

Atty.

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4 SHEETS—SHEET 2

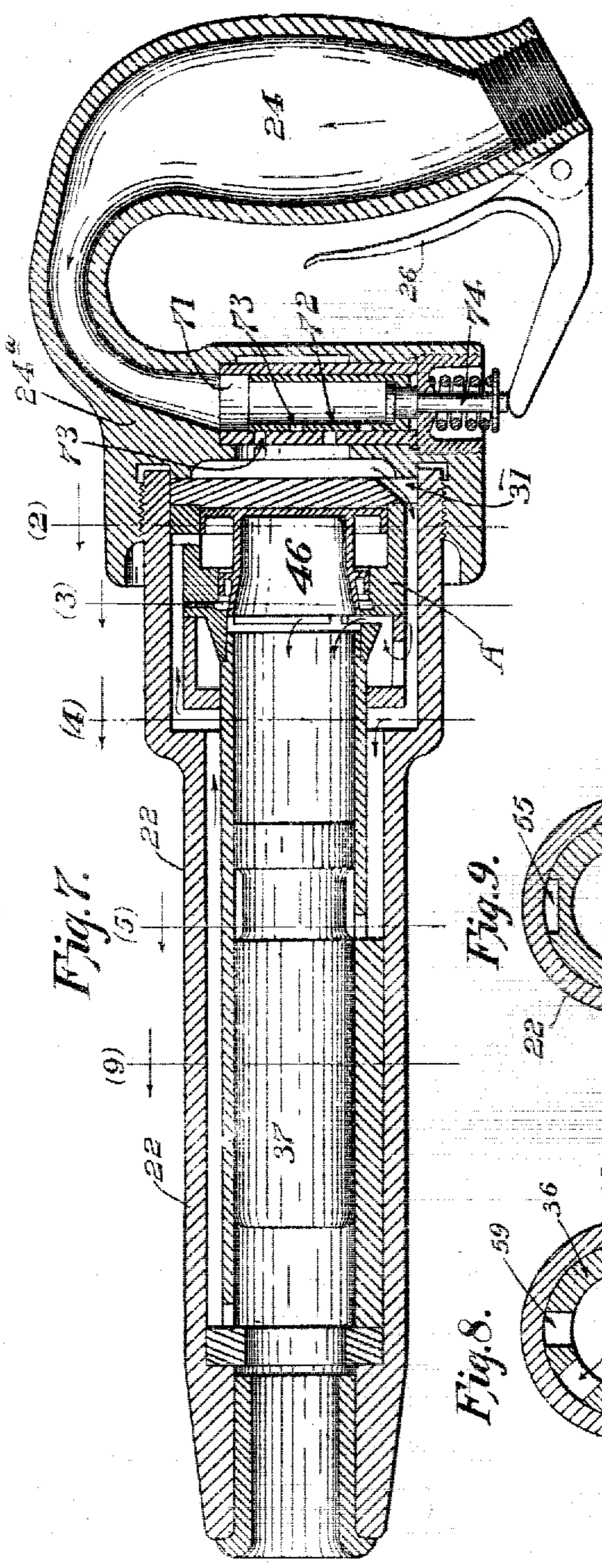


Fig. 7.

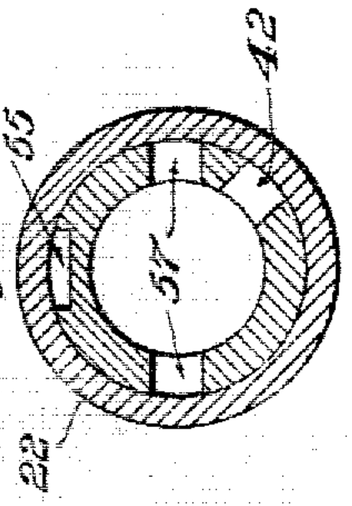


Fig. 9.

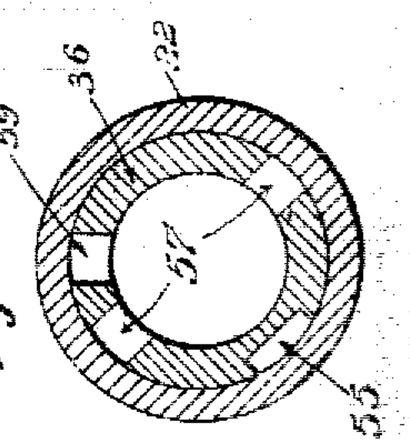


Fig. 8.

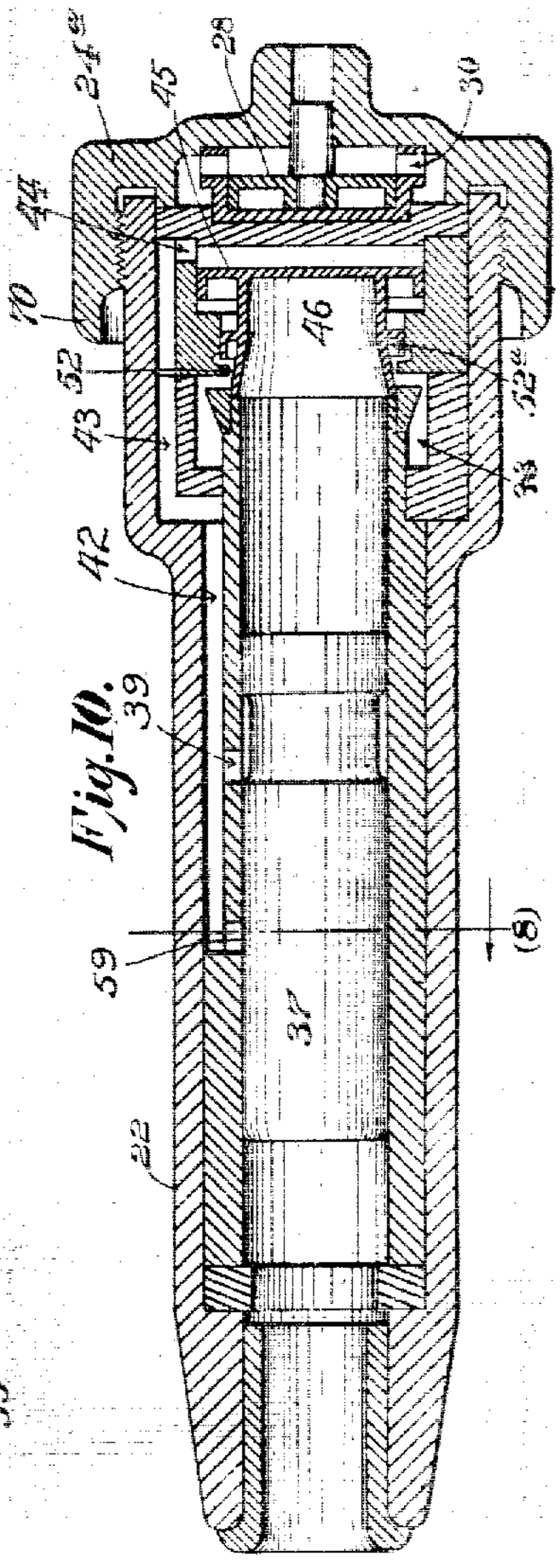


Fig. 10.

Witnesses;
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PNEUMATIC HAMMER.

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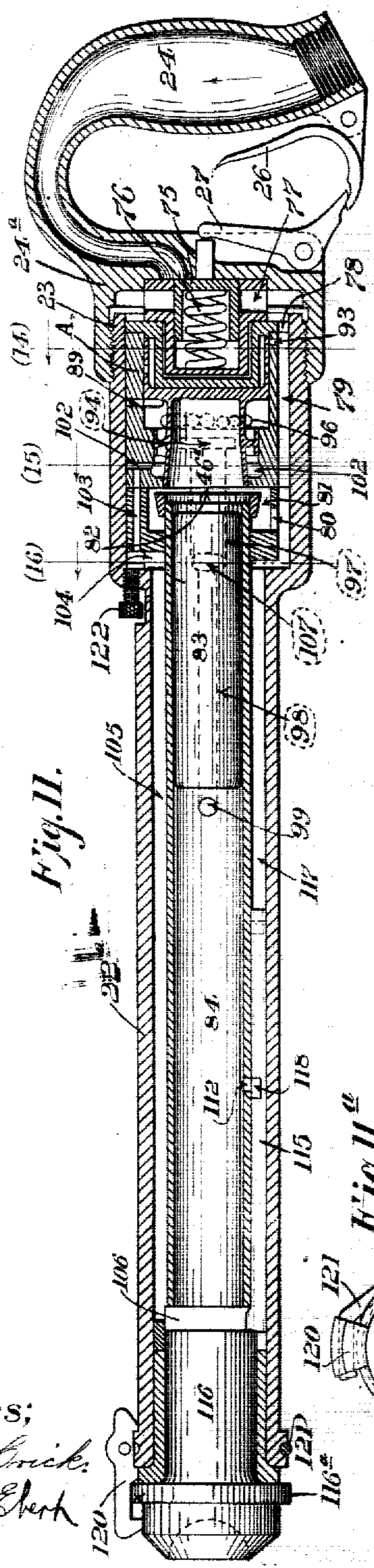
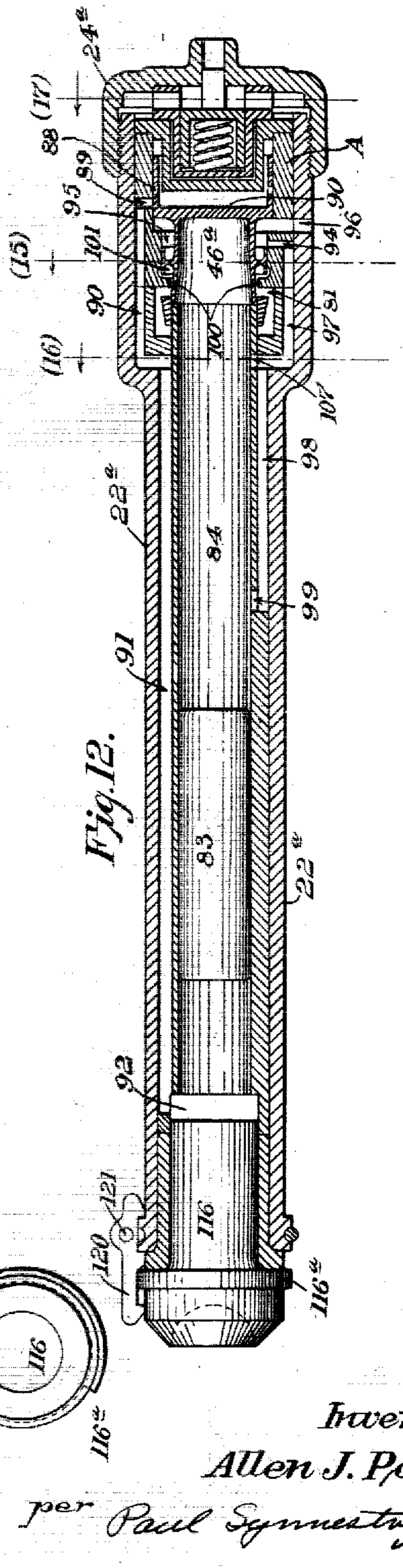
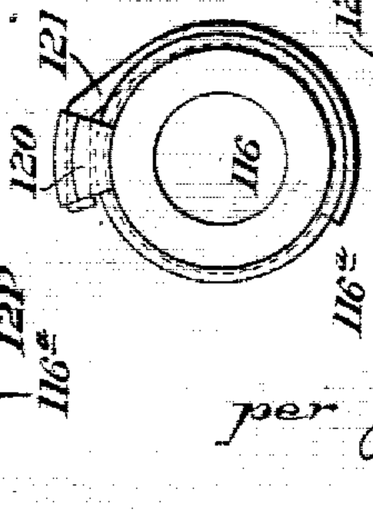
4 SHEETS—SHEET 3




Witnesses;
Cyril A. Brick.
Chas. H. Ebert

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Allen J. Patch
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Att'y

No. 836,778. PATENTED NOV. 27, 1906.

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PNEUMATIC HAMMER.

APPLICATION FILED JULY 6, 1904.

4 SHEETS—SHEET 4.

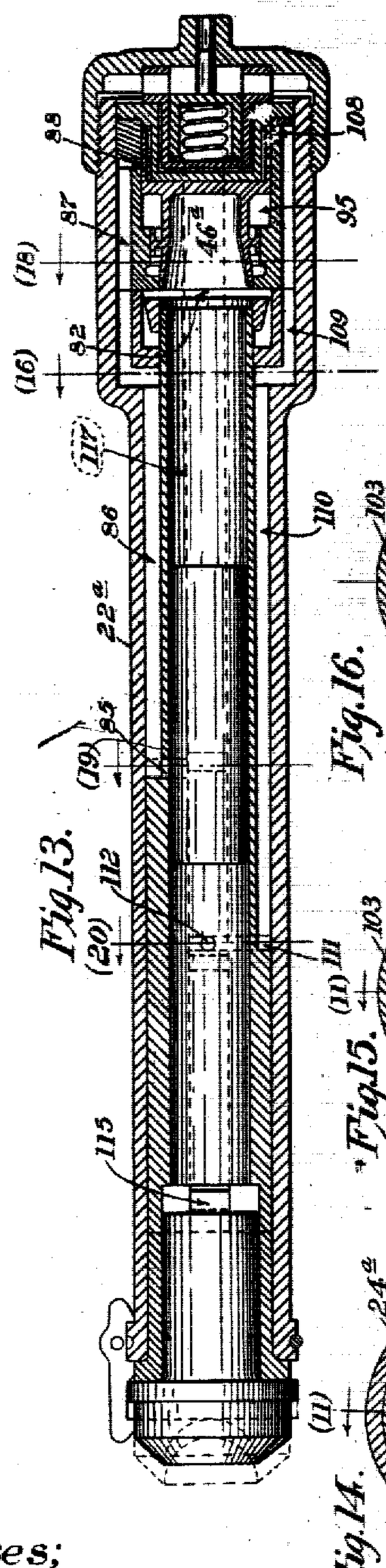


Fig. 13.

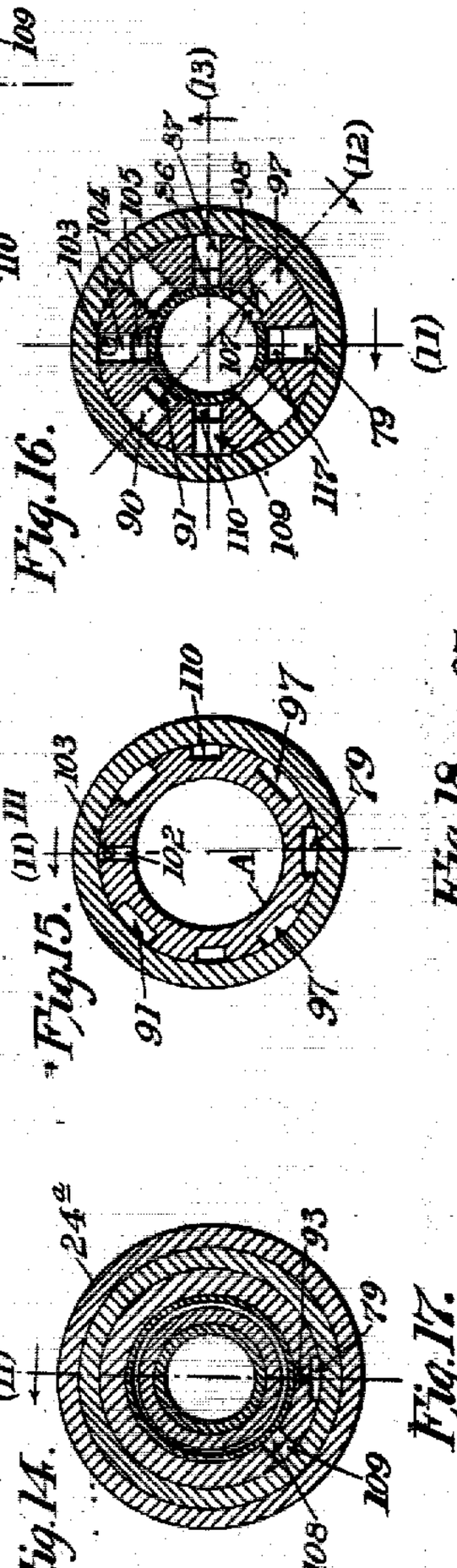


Fig. 16.

Fig. 15.

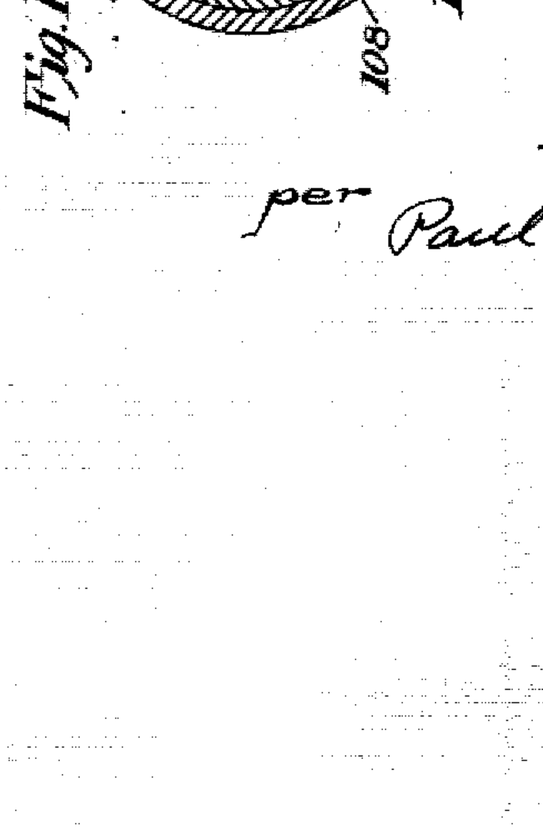


Fig. 14.

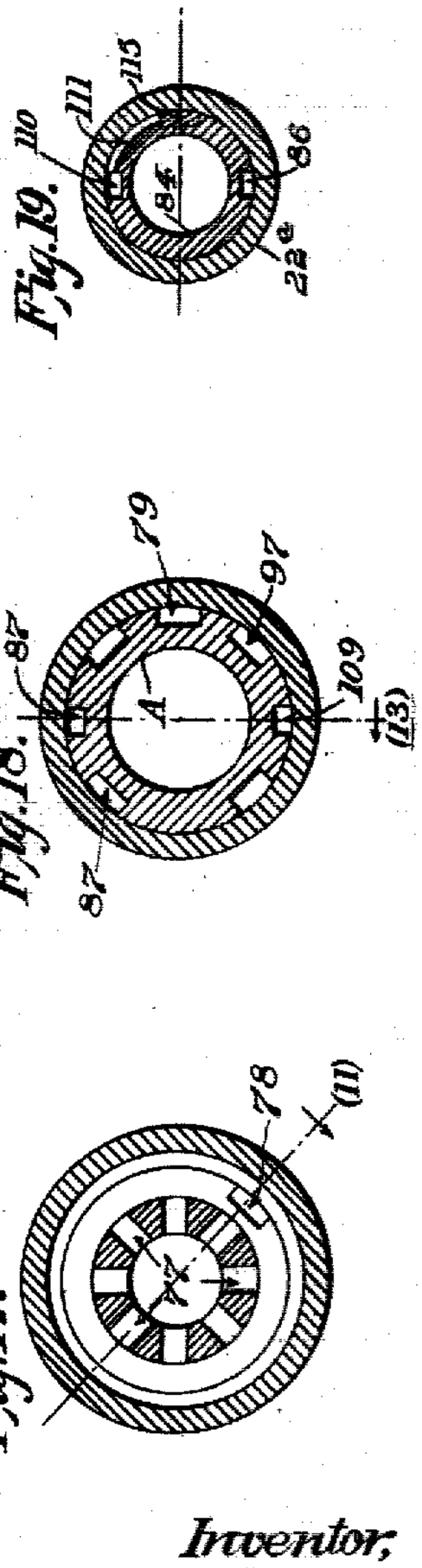


Fig. 20.

Fig. 19.

Fig. 18.

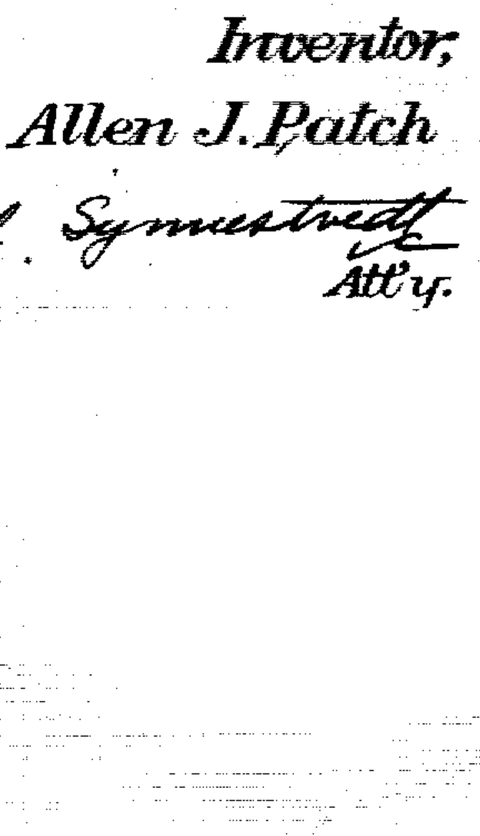


Fig. 17.

Witnesses;
Cyril C. Crick.
Chas. H. Ebert

Inventor;
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Att'y.

# UNITED STATES PATENT OFFICE.

ALLEN J. PATCH, OF BELOIT, WISCONSIN, ASSIGNOR TO FAIRBANKS, MORSE & COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

## PNEUMATIC HAMMER.

No. 836,778. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed July 6, 1904. Serial No. 215,555.

*To all whom it may concern:*

Be it known that I, ALLEN J. PATCH, a citizen of the United States, residing at Beloit, in Rock county, State of Wisconsin, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a specification.

My invention relates to fluid pressure actuated automatic hammers for chipping, riveting, etc., and particularly to the valve mechanism thereof. The objects of the invention are to improve and simplify the action of pneumatic hammers operated by a single valve; to improve the efficiency of the valve in such hammers for economy in the fluid and to make the action more reliable and efficient; to provide a superior safety device to prevent the hammer from acting on the tool or rivet set when it is removed from its place in action; to simplify the construction and generally improve the structure and operation of pneumatic hammers. These objects, together with other advantages which will hereinafter appear, I obtain by means of the construction shown in preferred forms in the accompanying drawings, wherein—

Figure 1 is a central longitudinal section in the plane of the handle showing a preferred type of my hammer as designed for short stroke.

Figures 2, 3, 4, and 5 are cross sections taken on lines (2), (3), (4), and (5) respectively, in Figure 1.

Figure 6 is a central longitudinal section of the barrel of the hammer taken in a different plane from that of Figure 1, namely along the line (6) of Figure 2.

Figure 7 is a section similar to that of Figure 1 showing a modified form of inlet valve and its mounting in the handle.

Figures 8 and 9 are cross sections taken respectively on the line (8) of Figure 10 and the line (9) of Figures 1 and 7.

Figure 10 is a longitudinal section of the barrel of the hammer taken in a plane at an angle to the section of Figures 1 and 7, along line (10)—Fig. 2.

Figures 11 and 12 are central longitudinal sections taken respectively in the plane of the gripping handle and in a plane at an angle thereto (see Fig. 16), and showing the safety and regulating devices to be used in either form of the hammer and the barrel and valves designed for a long stroke hammer.

Figure 11ª is an end elevation of the device showing the means for retaining the tool set.

Figure 13 is a central longitudinal section of the hammer taken in a different plane from that of Figure 12 and showing the piston and valve in different positions, the section being on line (13), Fig. 16.

Figures 14 to 20 are cross sections taken respectively on the lines (14), (15) and (16) of Figure 11, line (17) of Figure 12, and lines (18), (19), and (20) of Figure 13.

Referring first to Figures 1 to 10 which show the devices arranged for a short and rapid stroke such as desired for a chipping hammer, it will be understood that the tool is automatic and the essential parts are the usual barrel, piston chamber, a movable piston therein serving as a hammer, and a grasping handle with arrangements for admitting steam or compressed air to the operating valve, so that the tool continuously acts as long as the manually operated inlet valve is held open to admit the motive fluid. The structure will be apparent from the drawings and from the following description of the operation incidentally describing the structure and arrangement of the parts.

From Figure 1 it will be seen that the handle 24 is made hollow for the passage of the motive fluid and it will be understood that in use a flexible hose is attached and introduces fluid at the opening 25. The rear end of the barrel 22 is provided with threads 23 which receive the threaded hub 24ª of the handle 24 and secure the parts together while at the same time retaining the main valve 46 therein by means of cover plate 19 and also the inlet valve and casing, held in place as shown by the face of the handle 24ª. The handle is supplied with a trigger 26 which operates upon a lever 27 to depress the stem of the inlet valve 28 in its casing 29 against the coiled spring and thrust it into position shown in Figure 1 and 6, whereupon the motive fluid enters through the ports 30, annular chamber 31, the passage 32, the annular chamber 33, the several elongated ports 34 and the opening 35 under the forward edge of the main valve 46, admitting the fluid into the casing 36 behind the piston 37. The

main valve 46 has been before this time thrust backward both by the recoil of the previous stroke of the piston and by the fluid pressure on its small area 52ª as hereinafter described.

The piston moves forward, and when it reaches the position shown in Figure 1 it will be seen that the reduced portion or neck 38 of the piston 37 comes opposite to the ports 39 and 40 leading to the passage 41 and communicating with the passage 32 heretofore described as being supplied with the motive fluid from the inlet valve. By the port 39 the motive fluid is admitted from passage 41 (Figure 1) and by way of passages 42 and 43 (see Figure 10) and port 44, is admitted behind the large area 45 of the main valve 46; this pushes the valve forward into the position shown in Figures 10 and 6. It will be seen from Figure 6 especially that this closes the inlets 34 and 35 to the piston chamber, and opens the radial ports 49 leading from passage 48 and ports 47, thus allowing escape of the motive fluid from behind the piston through the port 47, passage 48, ports 49, the annular space 50 and the exhaust outlets 51, as clearly shown in Figure 6. It will be understood of course that at this time the impetus already given to the piston affects the stroke upon the tool.

It will be seen from Figure 6 that the forward position of the main valve opens the small passages 52 between the valve casing and the forward wing of the valve, and admits live fluid from the annular space 33 to the small area 52ª of the valve and thereupon starts the valve backward again, and at the same time the return of the piston is effected, as shown by Figure 1 particularly, by admission of the live pressure from the annular space 52 through the small port 53 and thence by way of the passages 54 and 55 and the forward port 56 to the front of the piston to drive it back to the initial position. It is to be noted that the entry of the piston into the hollow main valve 46 will form an air cushion behind the same and insure the firm seating of the valve in its rearward position and also prevent the piston from delivering a blow upon the valve or surrounding chamber. In order to fully open the main valve and seat it in its rearward position at the right time, the air behind it is first exhausted when the forward end of piston 37, in its rearward travel, passes ports 59 (Figure 10) and 57 (Figure 6), which establishes communication from port 44 and passages 43 and 42 to passages 58 and 48 (Figure 6) and the outlet ports 49 and 51. The valve then is seated by the pressure on its small area from port 52, which movement closes the exhaust ports and opens ports 34. It will of course be understood that when the valve is in its rearward position the port 59 shown in Figure 1 is open so that there is free escapement of the fluid in front of the piston by way of the passages 54 and 55, the annular space 50 and the outlet ports 51 as shown in Figure 6.

In Figure 6 I have shown a locking device to prevent the unscrewing of the hub 24ª of the handle from the barrel 22. It consists essentially of a ratchet 66 on the stem 65 pressed downward by coiled spring 67 and engaging notches in the edge of the end 23 of the barrel, which is toothed for this purpose. The stem 65 is sustained in place by a nut 69 and is provided with a pin 68 which engages a slot in the nut in order to prevent its unscrewing. It will be observed also from this figure and from Figure 1 that the hub 24ª of the handle extends forward and has an overhanging lip 70 so as to cover the exhaust ports 51 and act as a deflector to protect the workman handling the tool.

The hammer as shown in Figure 7 is essentially the same as the one just above described except for the arrangement of the inlet valve. It will be observed in this case that the trigger 26 on the handle 24 operates upon the pin 74 of the tubular valve 72 whose ports 73 register with the ports of its surrounding casing 71 to admit the fluid into the chamber and passages 31 in the same manner as heretofore described. The hammer is otherwise the same in construction and operation.

In Figures 11 to 20 inclusive I show the devices as designed for a long stroke hammer, and in this modification the form of the valve is somewhat altered but its operation is essentially the same. Starting with the parts in the position shown in Figure 11 in which it is left by the return of the piston from the previous stroke, it will be understood that the motive fluid through the ports 77, the annular chamber 78, the passage 79, port 80, annular space 81, and through the port 82 under the forward edge of the hollow valve 46ª into the piston chamber 84 behind the piston 83 and starts the same forward therein.

When in the forward movement of the piston 83 its rear end passes the port 85 the motive fluid is introduced to move the valve forward, by entry from the chamber and by the passage 86 (see Figure 13), passage 87, port 88, and the radial openings 89 through the rear flange of the valve 46ª and acting on the large area of the valve the motive fluid thrusts it forward into the position shown in Figure 12. In this motion the valve first closes the ports 88 and ports 89 (Figure 12), which exhaust the forward chamber by passages 90 and 91 and port 92, then closes ports 82 at the rear, and then opens the port 93 of Figure 11, whereupon motive fluid is admitted from passage 79 behind the valve to complete its forward motion and then close the

inlet ports 82 leading from the annular space 81. From Figure 12 it will be seen that at the same time the forward movement of the valve will open the port 94 to chamber 95 and the exhaust port 96 and exhaust the passages 97 and 98 leading to the piston chamber by the port 99, so as to allow the escape of the motive fluid.

It will be understood that the impetus given to the piston 83 will deliver the blow upon the tool set. It will be seen from inspection of Figure 12 the forward movement of the valve has uncovered the small communication 100 between the annular space 81 and the annular space 101, which as will be seen from Figure 11 communicates with the port 102 and by way of the passage 103 and port 104 communicates with the passage 105 and allows admission of the motive fluid through the forward port 106 to the front end of the piston chamber in order to return the piston to its backward position, the exhaust meanwhile being by way of port 107 and passage 97 etc. (Figure 12).

When in the rearward motion of the piston its forward end passes the port 99 as shown in Figures 13 and 12, the motive fluid behind the large area of the main valve will be allowed to escape by way of the port 108, passages 109 and 110, the ports 111 and 112 (see Figure 13), the outlet port 99, (Figure 12) the passages 98 and 97 and ports 94 and 96 to the atmosphere, thus allowing of its return to its original position. The motive fluid entering from the annular passage 81 by way of the small by-pass 100 as shown in Figure 12 will operate upon the small area of the valve and return it to its backward position. This closes the exhaust port 94 as shown in Figure 12, and at the same time, (Figure 12), allows escape of the motive fluid from the front of the piston by way of port 92, passages 91 and 90 and by port 89 shown in Figures 11 and 12 to the outlet port 96 by the annular space 95 around the valve. The cycle of operations heretofore described is then repeated.

In Figure 11 particularly, I show a safety device to prevent the operation of the hammer when it is removed from the work. It consists in the sliding valve rod 115, the forward end of which rests upon the tool set 116 and the rear end (119) of which is exposed to the motive fluid admitted by way of passage 117 from passage 79. It is provided with a port 118 and it will be seen from Figures 11 and 20 that when in its normal position, with the tool applied to the work, the valve is thrust backward and the port 118 registers with the ports 112 and 111, (Figure 13), and thereby allows of the normal operation of the hammer. But when the tool is removed from the work the motive fluid behind this valve will move it to its forward position as shown in dotted lines in Figure 13, thereby preventing the escape of motive fluid from the large area of the valve by way of passages 105 and 106 and the ports 112 and 118, and admitting the motive fluid to the rear of large area of the valve and the passages 86 and 87 into the port 85 as shown in Figure 13, so that this will hold the valve firmly in its forward position and prevent further operation of the hammer until the tool set is again applied to the work in order to thrust the valve 115 to its backward position.

The tool retaining device shown in Figures 11 and 11ª consists essentially of the dog 120 which is provided with a lip or catch at each end and one of these engages the ring 116ª of the tool set 116. The dog is held in place by the spring loop 121 which extends around the barrel and through an opening in the dog.

In Figure 11 I show a device for controlling the feed and recoil of the hammer, which consists essentially of the adjustable screw valve 122 arranged so as to control the port 104 leading from passage 103 to passage 105 in order to admit motive fluid to the forward end of the piston chamber for returning the piston as heretofore described.

It will be understood of course that when desired the safety valve 115 shown in Figure 11 may also be applied to the other form of hammer and the controlling screw valve 122 may also be used when desired. It is to be observed that in both forms of the hammer the valve casing A is removable from the rear, and that the valve 46 is also removable from the casing when the lug 24ª of the handle is removed from the tool barrel.

It is to be noted that by use of the tubular valve and the parts cooperating therewith in the form as set forth, I obtain a very large entry port for a given stroke of valve, avoiding loss of pressure by fluid friction, while the valve is rendered doubly certain in its rearward seating by the use of the live air pressure and the air confined in the tubular valve behind the piston in its rear stroke to form the cushion. It will be observed that the inclined portion of the valve has the effect to introduce the air behind the piston gradually as it emerges from the valve, which avoids recoil on the hammer handle and makes the handling of the tool easier. It is to be further observed that all ports for admittance of pressure during the movement of the valve are arranged in pairs oppositely placed so that the valve is perfectly balanced and has very little tendency to wear the seats out of true. The valve casing is made of heavy design, and all its surfaces, as well as the surfaces of the valve, are such as can be turned; and since the casing will retain its shape after being hardened and ground and fitted, the valve and casing may be duplicated and all parts readily assembled in the

rear of the barrel, while the single screw fastening of the handle on the rear barrel retains the parts in place. The design also allows of so assembling the parts as to avoid the necessity of blocking in drilled holes, as they are closed in all cases by the adjoining parts of the hammer. Other advantages of the device will readily occur to those familiar with the device.

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

1. In a pneumatic hammer a cylindrical shell valve provided with three seating surfaces and an inclined surface, in combination with a valve seat having an annular passage adapted to be closed by said valve in one position and opened by the shifting of said inclined surface, substantially as described.

2. In a pneumatic hammer, in combination with a piston and a cylinder having ports and passages for admitting and exhausting the fluid therefrom, a single operating valve comprising an imperforate cylinder closed at one end and having three seating surfaces and three pressure areas on its outer surface, adapted respectively to receive forward and back pressure to move it, and an intermediate steadying pressure.

3. In a pneumatic hammer a single operating valve comprising a hollow cylindrical shell closed at one end and having a flared open mouth adapted to receive the piston on its return stroke and form an air cushion therefor, substantially as described.

4. In a pneumatic hammer a cylindrical imperforate shell valve, having a closed end and a flared open end to receive the piston, whereby the piston is cushioned and the valve is operated in part by the air cushion.

5. In a pneumatic hammer a main operating valve comprising a cylindrical shell with closed end, and a flanged base, a second flange forming a smaller pressure area in front of the base, and a flared mouth having an inclined outside surface adapted to open and close a port in the valve seat by shifting of the inclined surface, substantially as described.

6. In a pneumatic hammer the combination of a barrel, a cylinder lining in the barrel, a valve seat on the cylinder lining, a main operating valve abutting the end of the cylinder lining and located in the valve seat, a cover plate for the main valve, a throttle valve and casing resting on said plate, and a handle screwed upon the barrel and retaining all of said parts in place, the bearings of all the parts being alined with the axis of the barrel, whereby the removal of the handle permits all the parts to be readily taken out.

7. In a pneumatic hammer the combination with a barrel having radial exhaust ports at its rear end, a handle screwed on the barrel and having an integral forwardly extending overhung shield covering said exhaust ports and directing the discharge forward, to protect the operator's hand.

8. In a pneumatic hammer the combination with a cylinder and a piston therein, of a pneumatically operated governing valve comprising a valve seat having an annular inlet passage, and a sliding valve having an inclined surface adapted to open and close said inlet passage gradually, as the inclined surface moves over the passage, and means for operating the valve by the motion of the piston.

9. In a pneumatic hammer the combination with a cylinder and a piston, ports and passages and a main valve adapted to control the piston, and a feed passage to the forward end of the cylinder to return the piston, said passage being independent of the inlet for the forward drive, and a regulating valve beyond the main valve therein controlling the size of said passage, whereby the speed of the return stroke may be regulated without interfering with the forward stroke.

10. In a pneumatic hammer the combination with the cylinder having the outlet passage 112, of the tool set shiftable in the cylinder, and the safety valve 115, comprising a bar resting on the tool set and having an opening 118 registering with the passage 112 when the tool set is under pressure, and said bar being exposed directly to live pressure on its rear end, so that said passages are automatically closed when pressure on the tool set is released.

11. In a pneumatic hammer the combination with a barrel and piston and suitable ports and passages for operating the piston therein, of an inlet port to the barrel and an adjacent valve seat with a port for admission of fluid upon the valve to return the same, and a sliding valve controlling both said ports and having an inclined face coöperating with the seat to gradually close the second port as the valve slides over it.

In testimony whereof I have hereunder signed my name in the presence of the two subscribed witnesses.

ALLEN J. PATCH.

Witnesses:
P. C. BROOKS,
GEO. B. INGERSOLL.