E. W. RAIKES.

PNEUMATIC HAMMER.

APPLICATION FILED AUG. 28, 1909.

955,686.

Patented Apr. 19, 1910.

2 SHEETS—SHEET 1.

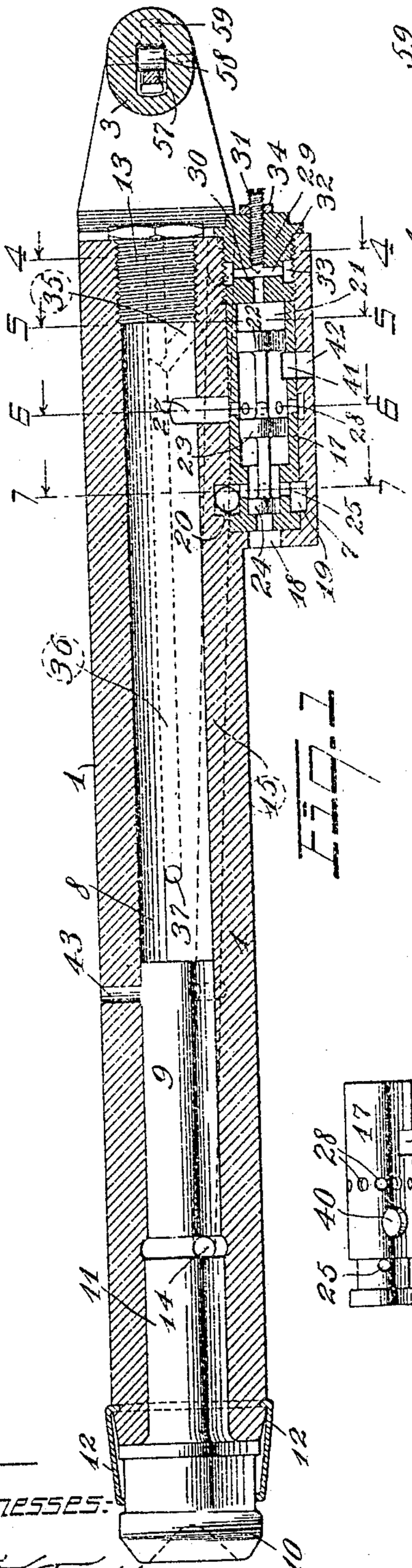

FIG. 1.

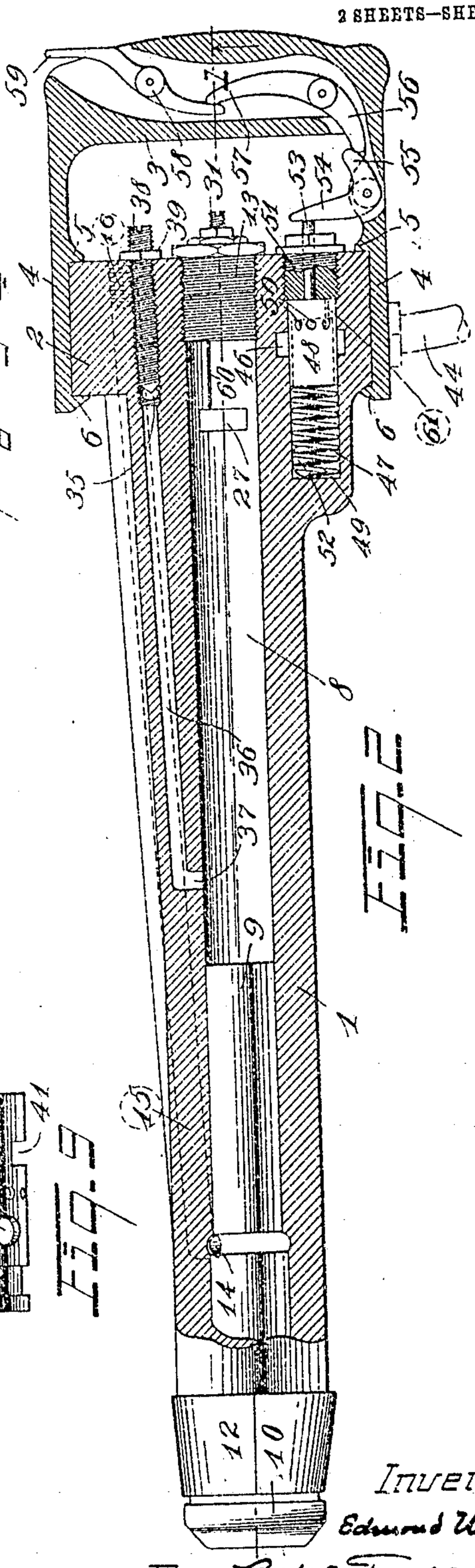

FIG. 2.

FIG. 3.

Witnesses:-

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2 SHEETS—SHEET 2.

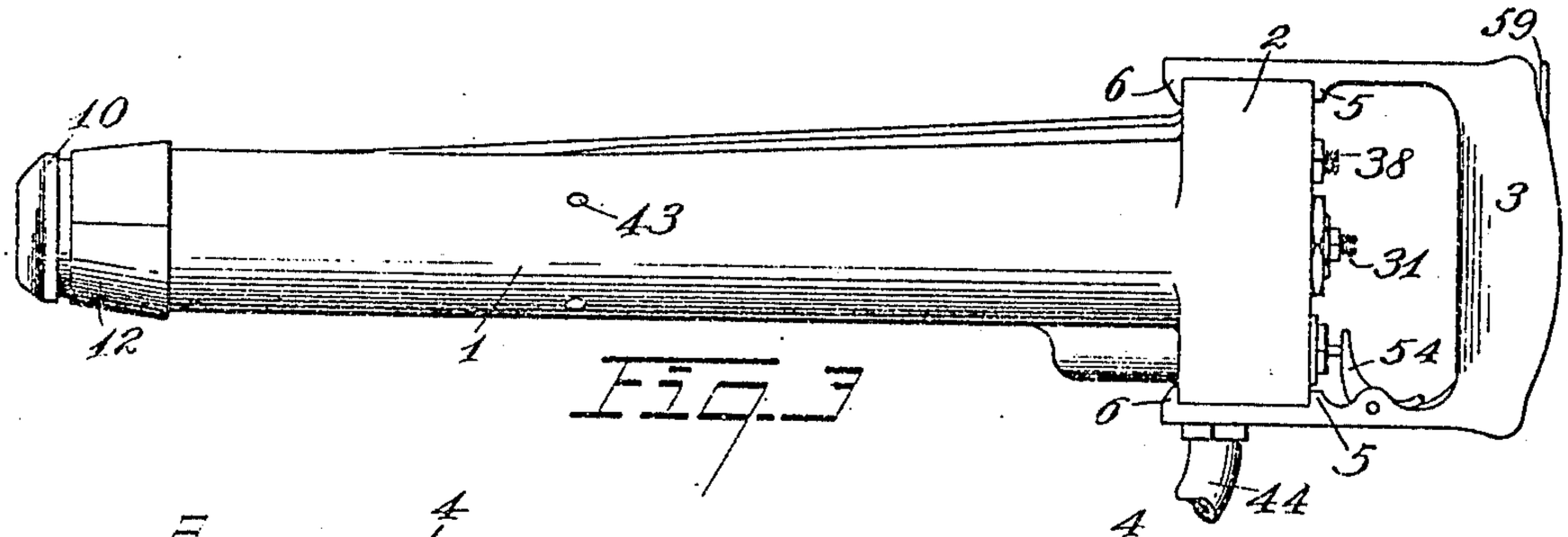

FIG. 3

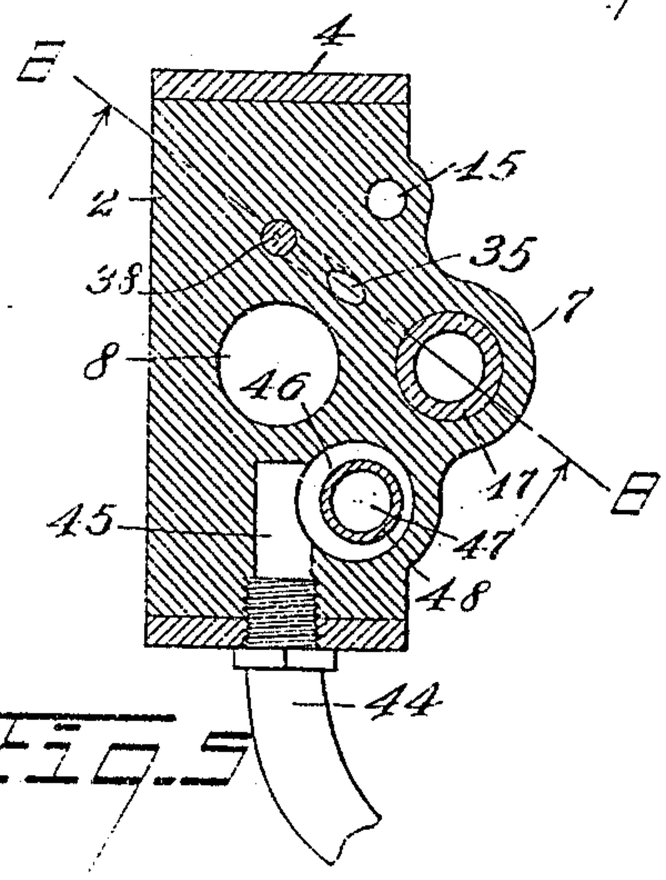

FIG. 5

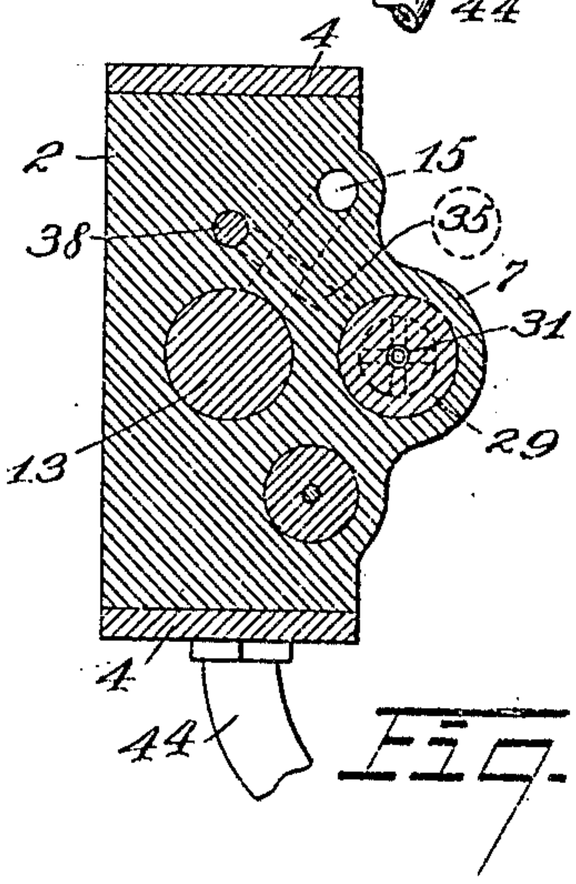

FIG. 4

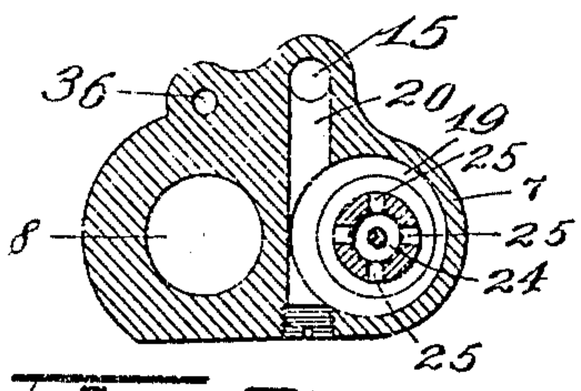

FIG. 7

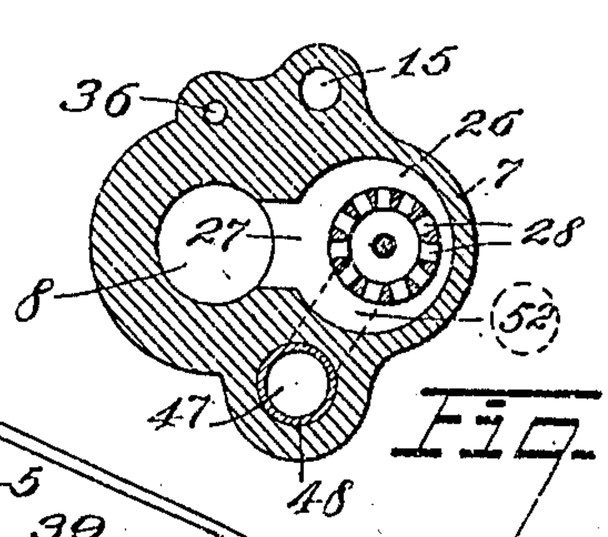

FIG. 6

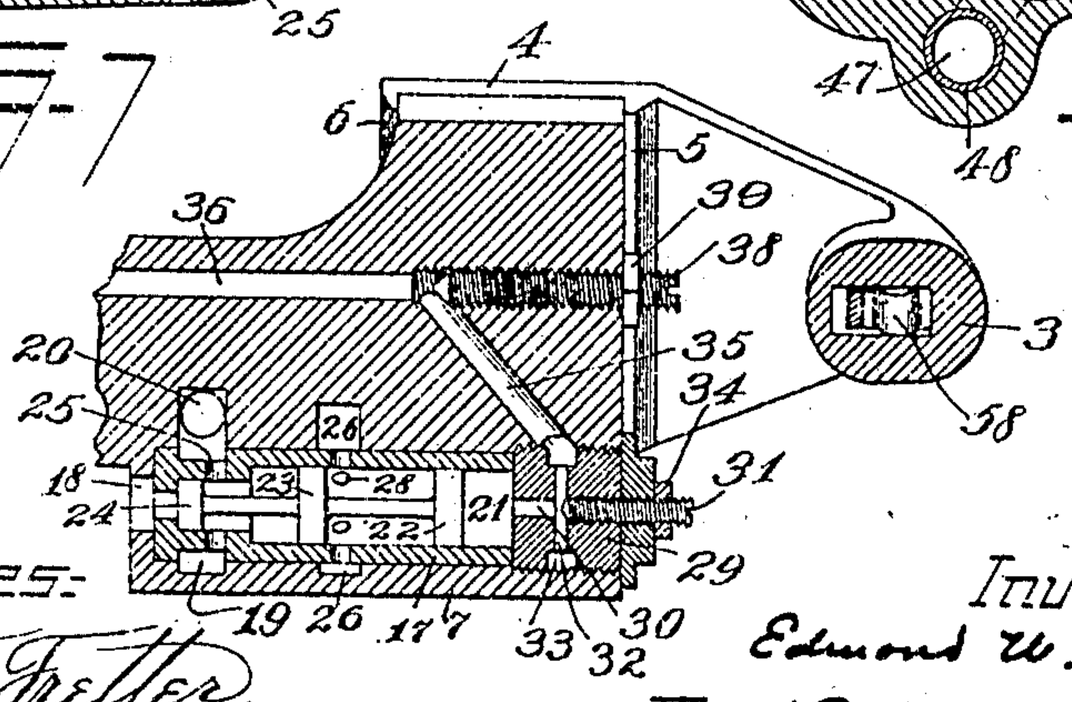

FIG. 8

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UNITED STATES PATENT OFFICE.

EDMOND W. RAIKES, OF CLEVELAND, OHIO.

PNEUMATIC HAMMER.

955,686. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed August 28, 1909. Serial No. 515,019.

To all whom it may concern:

Be it known that I, EDMOND W. RAIKES, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Pneumatic Hammers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to pneumatic hammers, the same being an improvement upon the hammer shown in Patent No. 826,802, granted July 24th, 1906 to J. M. and E. W. Raikes.

The object of said improvement is to render the hammer more efficient and to make the same susceptible to regulation of speed, whereby the number of blows delivered by the hammer in any given time, as well as the force of the blows may be increased or diminished at the will of the operator.

In the drawings forming a part hereof, Figure 1 is a longitudinal section taken through the hammer on the line 1—1 of Fig. 2; Fig. 2 is a central longitudinal section taken vertically through the showing in Fig. 4; Fig. 3 is a side elevation of the hammer complete; Figs. 4, 5, 6, and 7 are transverse sectional views taken through the hammer on different planes, as indicated by the correspondingly numbered lines in Fig. 1; Fig. 8 is a longitudinal sectional view through a part of the hammer, said view being taken on the line 8—8 of Fig. 5, and Fig. 9 is a side elevation of the valve casing.

Taking up a fuller description by the use of reference characters, 1 represents the barrel of the hammer, the same being cast integrally with a part 2 which I shall designate the head. 3 represents the handle piece, which is adapted for attachment to the head, as shown in Figs. 2 and 3. While this handle piece may be attached in any suitable manner, I prefer to form the same in a general U-shape, the arms 4 of the handle piece extending over the outer edges of the head and having guide ribs 5 and 6 at the rear and front of the head respectively. Also cast integral with the barrel and head and extending forwardly along side the barrel is an enlarged portion 7, the same being bored to form a chamber for the valve casing, hereinafter more specifically referred to. Extending centrally through the barrel 1 is the bore 8, in which the piston 9 reciprocates. At the outer end of the said bore 8 is the die member 10, said member having the stem 11 projecting into the bore, the member being held to the barrel in any suitable manner, as by a pressed metal sleeve 12 surrounding the said member and engaging in a groove in the outer end of the barrel, as shown in Fig. 1. At the rear or handle end of the barrel, the bore 8 is closed by means of a screw threaded plug 13.

Extending longitudinally through the wall of the barrel from the rear end to a point 14 just at the rear of the stem 11 of the die member is a port 15, the same being indicated in dotted lines in Figs. 1 and 2, and the rear end of the port being closed by a plug 16, as is indicated in dotted lines in Fig. 2. Within the bore of the enlargement 7, is a valve casing 17, the same being shown in detail view in Fig. 9. The bore for the valve casing is of substantially uniform diameter throughout its length, the forward part of the bore being provided with an opening at 18 to form an exhaust port. Adjacent the port 18, the bore for the valve, which I shall term the valve center, is enlarged, as shown at 19, said enlarged portion communicating with the port 15 through a port 20, see Fig. 7, whereby the valve chamber may be placed in direct communication with the bore 8 of the barrel near the forward end thereof through the said port 15. The valve casing 17 is also provided with a central longitudinal bore 21, in which reciprocates the automatic valve, said valve having three pistons 22, 23 and 24, the pistons 22 and 23 occupying the larger part of the bore of the casing and the piston 24 occupying a smaller portion of said bore.

Opposite the enlarged part 19 of the valve chamber the casing is provided with a series of radial ports 25, see Fig. 7, the piston 24 of the valve being adapted to control these ports. Near its longitudinal center, the bore for the valve casing is again enlarged, as shown at 26, and this enlarged portion communicates directly with the bore 8 of the barrel through a passage 27, as appears from Fig. 6. The valve casing is provided with a series of radial ports 28 which establish communication between the bore of the valve casing and the said enlargement 26. The rear end of the valve chamber is closed, and the valve casing is held in place by an exteriorly threaded nut or plug 29, said nut having a central port 30 therethrough. The

outer end of this port is slightly enlarged and screw threaded, and is closed by a screw 31 having a conical head which is adapted to enter the smaller part of the port 30 and close or restrict the same. Radiating outwardly from the port 30 at the end of the threaded portion thereof are ports 32, the plug 29 being provided with a peripheral groove 33 with which the radial ports communicate. In order to hold the valve screw 31 form accidental movement, the same is provided with a jam nut 34. Extending from the peripheral groove 33 in the plug diagonally through the head of the hammer is a port 35, the same communicating at its upper and forward end with a port 36 which extends longitudinally through the wall of the barrel and communicates with the bore in the latter at a point 37. The rear or handle end of the port 36 is somewhat enlarged and is screw threaded for the reception of a screw valve 38, the inner end of which is of conical shape in order to close or restrict more or less the effective size of the opening between the ports 35 and 36. The valve screw 38 is prevented from accidental displacement by a jam nut 39. By a proper adjustment of the screw valves 31 and 38, the proper size of air passage between the valve casing and the port 36 may be secured, and an air chamber formed between the said screw valves, for a purpose hereinafter set forth.

As appears from Fig. 9, the valve casing 17 is provided with a port 40 in the side thereof through which air may be admitted, and with a port 41 through which air may be exhausted, the latter port communicating with an exhaust passage 42 in the enlarged part 7 of the head. The barrel 1 is also provided with a plurality of radially extending ports 43, these ports being located between the ports 14 and 17.

The air is supplied to the hammer through a flexible hose pipe 44 that is preferably screw threaded through the lower arm 4 of the hammer handle and into the head of the hammer, said pipe communicating with an air passage 45 in the lower part of the said head. This passage communicates with an enlarged portion 46 of a bore 47 in the hammer head, within which bore I place an admission valve 48, the valve being held in its rear and closed position by a spring 49 in the bottom of the bore, the spring bearing against the forward end of the valve. The valve 48 is also provided with a central bore extending from its rear end almost through the valve; and, adjacent the rear end of said bore, the valve is provided with a series of radiating ports 50. The forward end of the bore for the valve is closed by means of a plug or nut 51, the spring 49 holding the end of the valve against the forward end of said plug. When in this position the ports 50 are out of register with the enlarged part 46 of the valve bore, and no air can pass into the valve. When, however, the valve is moved forwardly against the tension of the spring, the air may pass through the radial ports 50 into the bore within the valve. Leading from the forward part of the bore for the valve is a port 52, the same appearing in Fig. 2 and being indicated in dotted lines in Fig. 6 of the drawings. This port extends across to the main valve chamber, and registers with the port 40 in the valve casing 17. The valve 48 is moved forwardly through the means of a stem 53 that passes through the center of the plug 51, the rear end of the stem engaging with the upper arm 54 of a bell crank pivoted in the handle piece, the opposite end 55 being engaged by the lower end 56 of a lever that is also pivoted in the handle piece. The upper end 57 of this lever is engaged by the lower end of a lever 58 that is likewise pivoted in the handle piece and has its upper end 59 projecting outside of said piece so that it may be depressed by the operator when he wishes to use the hammer.

The operation of the hammer is as follows: Assuming the piston 9 and the automatic valve to be in the positions shown in Fig. 2, and the admission valve 48 to be open to admit air to the hammer, the live air entering the port 40 of the valve casing passes outwardly through the ports 25 to the ports 20 and 15 and to the front part of the piston, thus driving the piston rearwardly. This air being at substantially full pressure, the piston attains a rapid velocity before it uncovers the ports 43 in the barrel. The live air then passes outwardly through these ports to the atmosphere. During the greater part of this time the port 37 is closed by the piston, and air is confined in the valve chamber in the rear of the piston 22 of the automatic valve, the latter being thus held in what may be termed its closed position. During the rearward movement of the piston 9, the air in the bore 8 at the rear of the piston may exhaust freely through the ports 27, 28, 41 and 42. The piston 9 having acquired sufficient momentum to carry it past the port 37, when this port is opened that part of the valve chamber in the rear of the piston 22 may exhaust through the ports 30, 32, 35, 36 and 43 to the outside air. This permits the pressure at the rear of the valve to fall when the live air pressure on the front of the piston 23 causes the valve to shift to its rear or open position, thus opening communication from the valve chamber directly through the ports 28 and 27 to the bore of the barrel to drive the piston 9 toward the die member, the air in front of the piston escaping first through the ports 43 and then through the ports 14,

15, 20, 25 and 18 to the atmosphere. When the piston 9 has moved forwardly until the port 37 is uncovered, the live air pressure in the bore 8 acts backwardly through the ports 36, 35, 32 and 30 on the rear end of the valve piston 22, and forces the valve to its forward or closed position, as shown in Fig. 8. The blow of the piston 9 upon the die member is sufficient to cause the piston to rebound slightly and thus uncover the port 14 so that the live air may again enter in front of the piston, after which the cycle of operation just described is repeated, and said operations are continued in more or less rapid succession as long as the air is supplied through the valve 48.

By regulating the positions of the screw valves 38 and 31, the rapidity of operation of the reciprocating valve may be controlled, and the rapidity of operation of the piston, the length of stroke and the force of the blow delivered by the piston may likewise be controlled.

It will be observed by reference to Fig. 1 that, when the piston 9 is in the position therein shown, the port 37 is uncovered. This establishes communication through the ports 36, 35, 32 and 30 to the rear face of the valve piston 22, so that the pressure in the valve casing at the rear of said piston tends to fall, it being remembered that at this time the rear end of the bore 8 is in communication with the atmosphere through ports 27, 28, 41 and 42. The valve has not been shifted to the position shown, however, until the said port 37 has been uncovered and the live air has had time to act on the valve piston 22. Before the valve shifts forwardly, therefore, the air pressure in the compression chamber between the screw valves 31 and 38 has risen so high that it will not have sufficient time to fall to a pressure which will permit the valve to be again shifted rearwardly before the piston 9 has moved rearwardly, and has again covered the port 37. This compression chamber, therefore, acts as a kind of reservoir for compressed air and affords a means for regulating the rapidity of operation of the valve. By adjusting the screw valves 31 and 38 the effective size of the air passage between the ports 30 and 36 may be regulated, and the desired speed of operation, as well as the desired force of blows delivered, may be secured. In practice, the rougher adjustment may be made by the valve 38, and the finer adjustment secured by the valve 31.

When the hammer is out of use for some time the piston 9 may move rearwardly beyond the port 27 so as to close the latter. In order to admit air to the rear of the piston in such contingency, I cut a groove in the wall forming the bore 8 said groove being shown in Fig. 2 at 60 and leading from the port 27 rearwardly to the plug 13. While this groove is quite small, it will admit sufficient air to the rear of the piston to force the same forwardly until the port 27 is uncovered. I also extend a small port rearwardly through the rear end of the valve 48 so that there will be no vacuum formed at the rear of said valve when the same is moved forwardly, and also to permit the air which may be contained at the rear of the valve to escape when the same is moved rearwardly under the tension of the spring 49. This port is indicated in dotted lines in Fig. 2 by reference numeral 61.

Having thus described my invention, what I claim is:

1. In a pneumatic hammer, the combination with a barrel having a longitudinal bore therein, of a piston mounted to reciprocate in said bore, an automatic valve mounted to reciprocate in a valve chamber alongside the rear end of said barrel, the barrel being provided with ports leading from the valve chamber to the bore of the barrel, the valve controlling the operation of the piston, and a pair of adjustable valves for regulating the effective size of one of said ports at two different points, whereby air may be compressed in that port between the said adjustable valves for regulating the quantity of air passing through said port and thereby regulating the speed of operation of the automatic valve and of the said piston.

2. In a pneumatic hammer, the combination with a barrel having a longitudinal bore therein, of a piston mounted to reciprocate in said bore, the said barrel having an enlargement at its rear end and said enlargement having a longitudinal bore forming a valve chamber, a valve casing in said chamber, the barrel being provided with a pair of ports leading from the bore therein to the valve chamber near the opposite ends of said casing, and with a port connecting the bore in the valve with the chamber near the center of said casing, an automatic valve mounted to reciprocate in the valve casing, said valve being controlled by the compressed fluid, an exhaust port leading outwardly through the valve casing and the said enlargement on the barrel, and means for adjusting the effective size of one of the ports leading from the valve casing to the bore of the barrel, whereby the movements of the piston may be regulated.

3. In a pneumatic hammer, the combination with a barrel having a longitudinal bore therein, of a plug closing the rear end of said bore, a piston within the bore and adapted to reciprocate therein, an enlargement on said barrel having a valve chamber therein, a valve casing stationarily mounted within the said chamber, said casing having a bore therethrough and a port extending outwardly through the casing from said

bore, means for conducting compressed fluid to the latter port, an automatic valve mounted to operate in the valve casing, a plug closing one end of the valve chamber, said plug being provided with a port in its end next to the valve and with a series of ports radiating from the last mentioned port outwardly through the plug, an air passage connecting the said radiating ports with the bore in the barrel, a second air passage leading from the valve chamber to the bore of the barrel near the forward end of the latter, and a screw passing through the plug in the valve chamber for regulating the effective size of the port in the end of said plug.

4. In a pneumatic hammer, the combination with a barrel and with a head for the same, of a piston mounted to reciprocate in a longitudinal bore in the barrel, the said head and barrel being provided with an enlargement having a longitudinal bore therein forming a valve chamber, an automatic valve mounted to operate in said chamber, a screw plug closing the rear end of said chamber, said plug having a longitudinal port extending therethrough and a series of radiating ports extending outwardly from the longitudinal port through the side of the plug, a screw within the outer end of the longitudinal port, said screw being adapted to regulate the size of the passage between the latter port and the radiating ports, a port extending longitudinally in the wall of the barrel and communicating with the bore in the barrel, a diagonal port connecting the longitudinal port in the barrel with the radiating ports in the plug, and a screw in the longitudinal port in the barrel, said screw being adapted to act as a valve and regulate the effective size of the passage between the said port in the barrel and the diagonal port, the diagonal port thus having a valve at each of its ends by which the fluid entering the said diagonal port may be controlled and the speed of operation of the hammer piston may be regulated.

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

EDMOND W. RAIKES.

Witnesses:
S. E. FOUTS,
A. J. HUDSON.