No. 834,641. PATENTED OCT. 30, 1906.

C. PRUNER.

PNEUMATIC HAMMER.

APPLICATION FILED DEC. 29, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

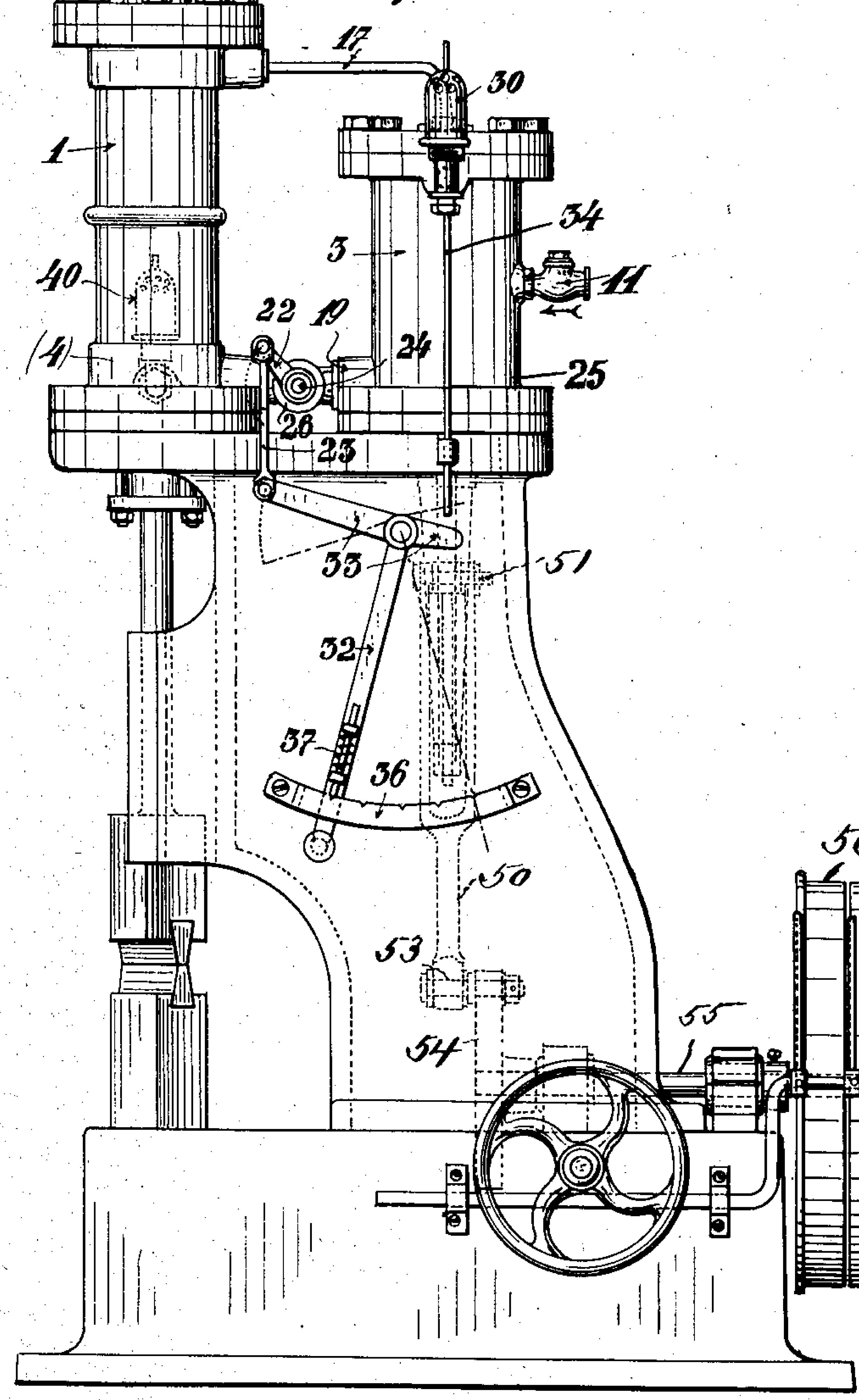


Fig. 2.

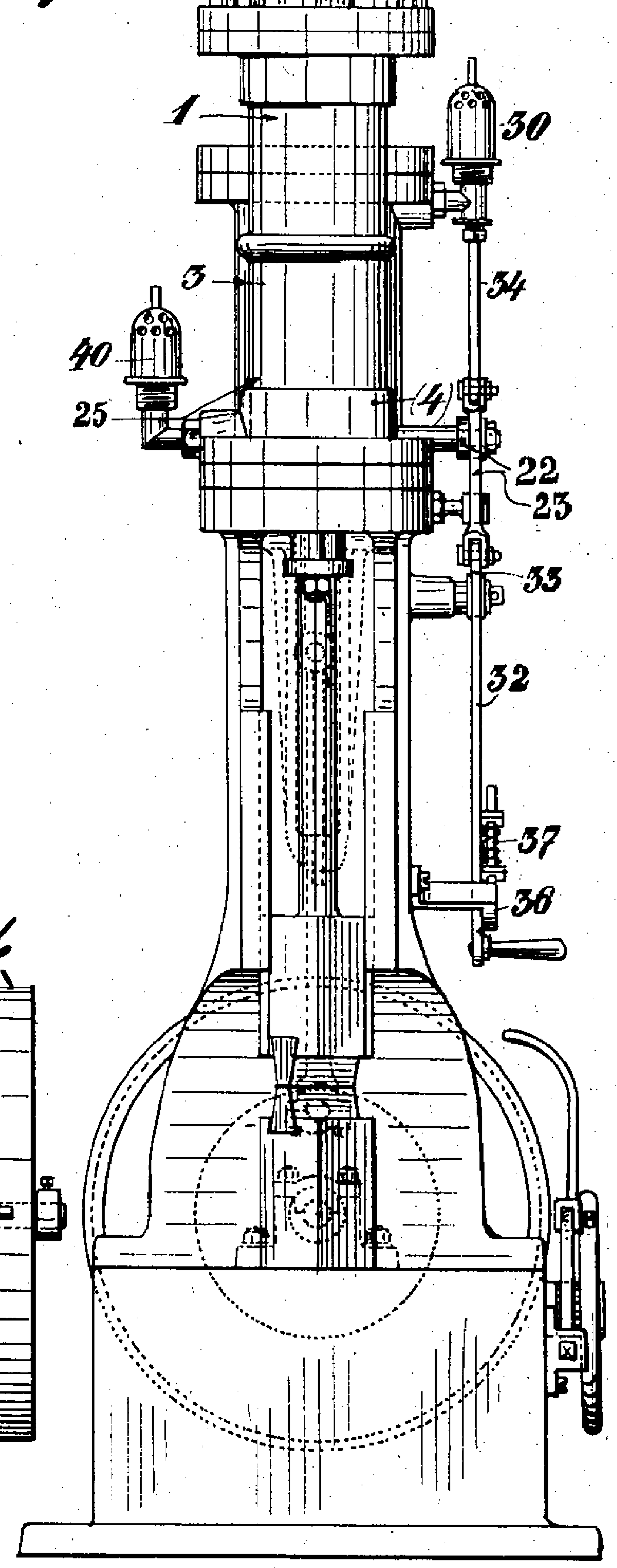
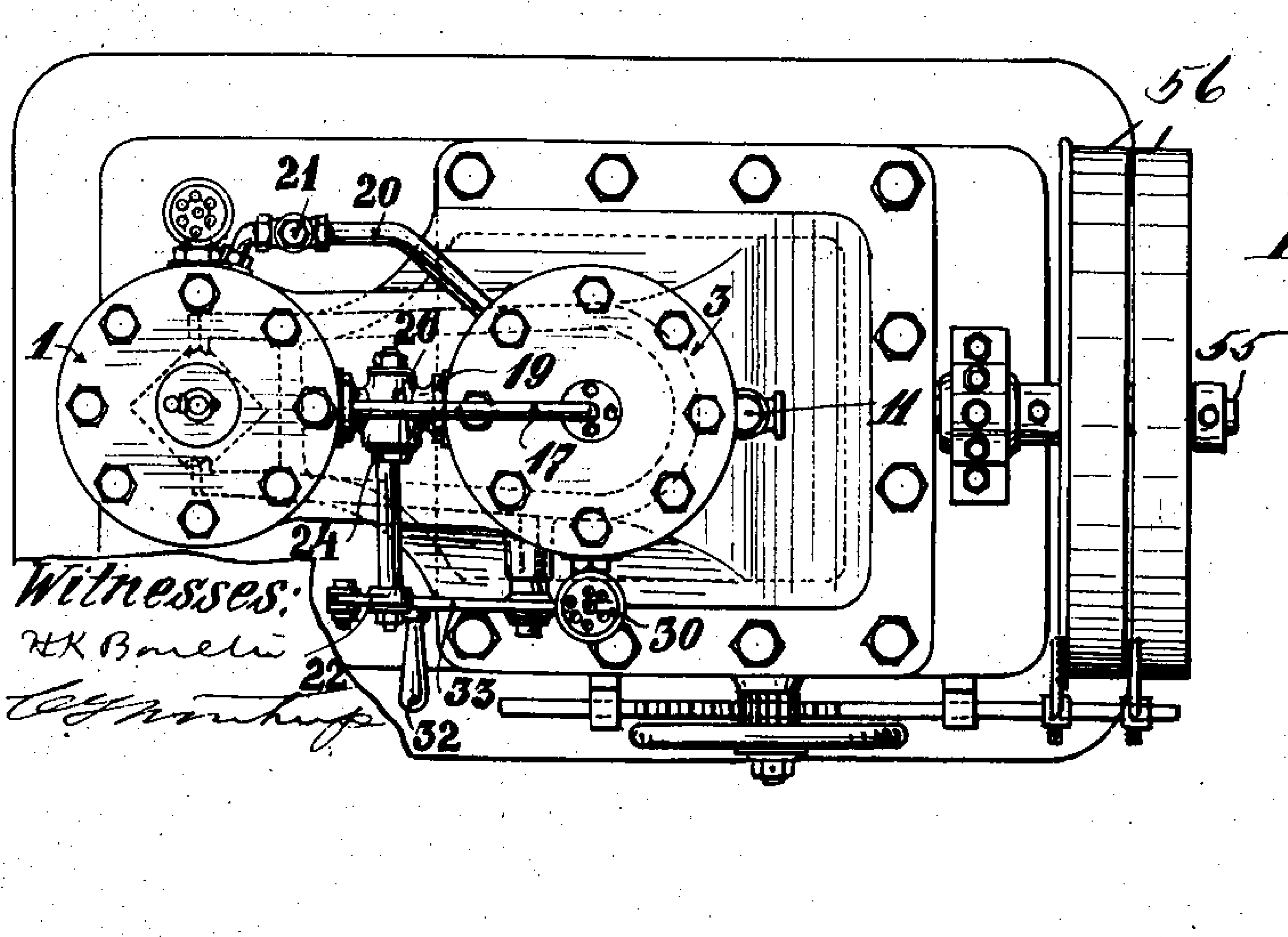


Fig. 3.



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[signature]

Inventor:
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his Attorney.

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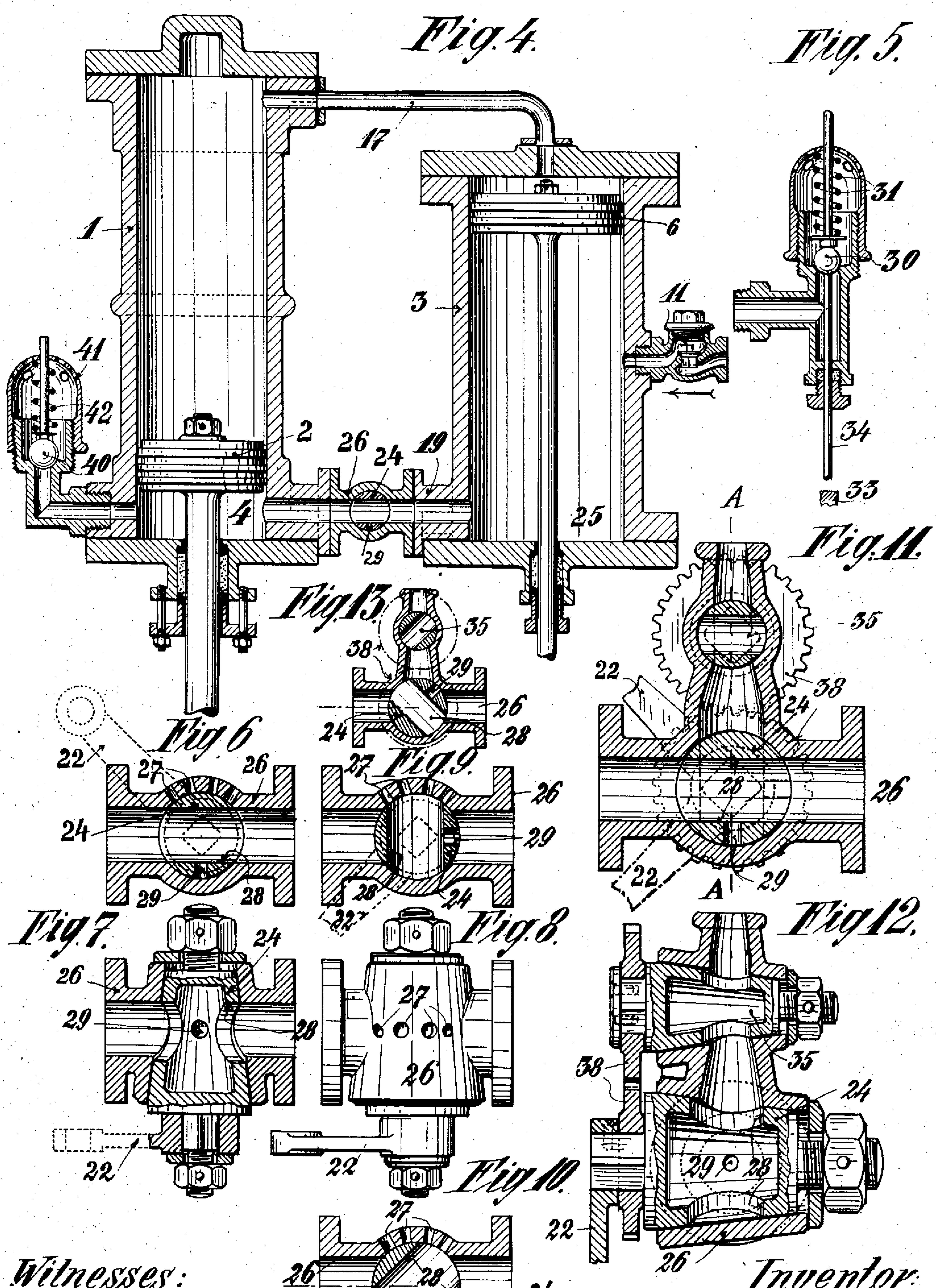
2 SHEETS—SHEET 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

CONRAD PRUNER, OF WIENER-NEUSTADT, AUSTRIA-HUNGARY.

PNEUMATIC HAMMER.

No. 834,641. Specification of Letters Patent. Patented Oct. 30, 1906.

Application filed December 29, 1903. Serial No. 187,050.

To all whom it may concern:

Be it known that I, CONRAD PRUNER, manufacturer, a citizen of Austria-Hungary, and a resident at Wiener-Neustadt, near Vienna, in the Province of Lower Austria, Austria-Hungary, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a full, clear, and exact specification.

The object of the present invention is the construction of a pneumatic hammer as a substitute for a steam-hammer to effect the same purpose with a small weight of hammer-ram, but operating with considerable pressure, there being a device for regulating the pressure, and thereby the force of the blow, and also a step-by-step device for raising the hammer-ram and holding it in the uplifted position.

The improved pneumatic hammer is illustrated in the accompanying drawings, in which—

Figure 1 is a side view, Fig. 2 a front view, and Fig. 3 a plan view, of the hammer. Fig. 4 is a longitudinal section through the two cylinders with their fittings. Fig. 5 illustrates a longitudinal section through an air-discharge valve. Fig. 6 is a vertical section, Fig. 7 a horizontal section, and Fig. 8 a plan view, of the gearing-cock. Figs. 9 and 10 show, in the same views as Fig. 8, two different positions of the cock-plug. Figs. 11 to 13 show another modification of the gearing-cock with two plugs, of which Fig. 11 represents a vertical section through the cock, the parts being in that position when the hammer works with full pressure. Fig. 12 is a vertical cross-section on the line A A of Fig. 11, the parts being in that position when the hammer is out of action. Fig. 13 is a similar section like Fig. 11, showing the parts in that position when the hammer works with half-pressure.

The hammer consists of a vertical cylinder 1, fitted with a ram-piston 2, and an air-pump cylinder 3, fitted with the pump-piston 6, which are mounted together on a suitable frame. The cylinders 1 and 3 of the air-pump and hammer are in connection with each other on both sides of the pistons by means of pipes 17 and 19. The pump-cylinder 3 is provided at a suitable point in its length with an intermittently-opened air-supply organ 11, which in its simplest form consists merely of a non-return valve opening inward, (see Fig. 4,) through which on the movement of the piston 6 air is drawn in alternately on each side of this latter. This valve 11 is so arranged that the passage from this valve is closed by the air-pump piston 6 when the ram-piston 2 begins its upward stroke, so that when the ram-piston 2 ascends it is not able to draw air through the valve 11. The inflow of air will chiefly occur when the pump-piston 6, traveling away from the corresponding end of its cylinder 3, has passed the mouth of the valve-passage.

The best situation of the valve 11 is at or about the middle of the stroke of the pump-piston 6, so that air can also be drawn in on its other side on the return stroke and maintain on the average atmospheric pressure above the ram-piston 2. Interposed between the lower end 4 of the hammer-cylinder 1 and the corresponding end 25 of the cylinder 3 of the air-pump is a turn-cock 24, (see Figs. 6 to 10,) the shell 26 of which is provided with a number of release-orifices 27, which on the closing of the plug 24 come successively into communication with the bore 28 of the plug 24 in such a way that the more the passage 19 from one cylinder 3 to the other, 1, is throttled the more open will be the escape to the atmosphere. According, therefore, to the position of the plug 24 of the turn-cock either the whole volume of air forced out of the air-pump 3 6 will pass to the hammer-cylinder 1, in which case the hammer will operate with its full stroke and fall, (see Figs. 6 and 7,) or only a portion of the air will enter the hammer-cylinder 1, the remainder escaping into the orifices 27, in which case the stroke and fall will be correspondingly reduced. (See Fig. 10.) The passage 19 from cylinder 3 to cylinder 1 may be entirely closed, (see Fig. 9,) and then all the air will escape to the orifices 27, so that, although the pump-piston 6 is operated, the hammer-ram 2 will remain at rest. If the plug 24 is entirely closed, the air coming from the air-pumps enters the bore 28 of the plug 24 by an orifice or orifices 29.

In addition to the direct passage 19 from cylinder 3 to cylinder 1, governed by the turn-cock 24, above described, an additional communication 20 is provided, containing a non-return valve 21, which opens toward the hammer-cylinder 1, the purpose of which is to enable the ram 2 to be lifted step by step as follows:

If the turn-cock 24 is so placed that only a part of the air can escape to the open through the orifices 27, a portion will be forced through the non-return valve 21 into the hammer-cylinder 1 beneath the ram-piston 2, raising it step by step, and when it has reached its highest position it will be there maintained by continued pumping. The pipe 20 communicates at its ends with the cylinders 1 and 3 at points adjacent to the bottom of the cylinders—*i. e.*, just below the lowest points of movement of the pistons.

To facilitate the steady ascent of the ram and avoid fluctuations, it will be advisable to get rid of the pressure on the upper surface of the piston 2 by fitting a mechanically-operated escape-valve 30, which can be either a lift-valve, a turn-cock, a screw-down valve, a slide-valve, or, preferably, may take the form of a ball-valve 30, (see Fig. 5,) pressed onto its seat by a strong spring 31. By means of a lever-and-link mechanism 32 33 23 22 and the rod 34 this valve 30 is connected to the turn-cock 24, above mentioned, controlling the passage 19 to the under side of the ram-cylinder 1 in such a way that if the latter is open the former is closed, and when the turn-cock 24 is closed the escape from above the ram-piston will be freely open.

The employment of a spring-loaded valve 30 has the advantage that when the pump-piston and hammer are in rapid action an undue pressure will be avoided by lifting the valve.

Instead of employing the turn-cock above described a valve may be used, and instead of a series of openings 27 a second turn-cock (see Figs. 11 to 13) may be fitted, the plug 35 of which is in mechanical connection with that of the former—as, for instance, by means of toothed sectors 38 or levers and links.

The steady ascent of the ram-piston may be effected by inserting an ordinary stop-cock in the passage 19 to the under side of the ram and providing above and below the piston of the latter escape valves or cocks. To adjust the degree of opening, it will be advantageous to provide a notched quadrant 36 and a lever 32, carrying a pawl 37, adapted to engage with the notches and hold the lever 32 in a definite position.

It often happens, especially in dusty and sooty workshops, that the valves get dirty and do not accurately fit their seatings. To avoid evil results from this cause, it will be advisable that all the air-passages in and out should terminate in a common air-chamber, so that the same air may be repeatedly employed, any loss being compensated for by a supply through a pipe leading to the open air and provided, if desired, with a filtering medium. This air-chamber should be large, so that the air may be maintained in a cool condition.

Owing to the high number of strokes and the circumstance that the workman must give his full attention to the block instead of to the gearing-lever, it may easily happen that the turning motion of the cock 24 in the position effecting the free connection of the cylinders 1 and 3 is effected just at the time when the plunger 2 is lowered. In this case a second filling of the pump-cylinder 3 is pressed in the ram-cylinder 1, whereby the air-pressure below the ram-plunger 2 becomes so high that the latter might push against the upper cylinder-cover. Besides, this high air-pressure opposes the following lowering of the ram (in spite of the upper pressure action) to such a degree that the first blow is entirely without any effect, or nearly so. Not until the excess of air-pressure is compensated does the hammer begin its regular action. In order to overcome this fault, a weighted discharge-valve 40 is provided, capable of bringing into communication the cylinder-chamber 4 (below the ram-piston 2) with the atmosphere. This discharging-valve is preferably a globe-valve 40 under action of a spring 42, the charge of which may be varied by screwing up or down the discharge-flap 41. The charge is regulated in such a manner that during the normal working of the hammer the pressure of air effecting the raising of the hammer is not able to open the valve, so that no loss neither of air nor pressure results.

When after the raising of the hammer a second filling of the air-cylinder has been pressed into the ram-cylinder, whereby the air-pressure in the latter is considerably augmented, this pressure will open the valve, the excess of air will discharge, and the hammer will act regularly. Instead of a spring-actuated valve I may employ a simple weighted safety-valve.

In operation the piston 6 will be reciprocated by any suitable means—as, for instance, by means of a rod 50, jointed at 51 to the piston-rod, said rod 50 being at its lower end jointed to a wrist-pin 53 on a disk 54, mounted on one end of a driving-shaft 55, whose opposite end carries belt-pulleys 56.

Assuming the parts to be in the position seen in Fig. 4, with the piston 6 at the limit of its upward movement and the piston 2 at the limit of its downward movement, when the piston 6 descends the air below it will be compressed and all or only a part of such air (according to the position of the cock 24) will be forced into cylinder 1 beneath the piston 2 and raise the latter. The descending movement of the piston 6 forms a partial vacuum behind it, and the valve 11 will be opened to admit air into cylinder 3 as soon as the piston 6 has passed by the port leading from the valve 11.

Upon the upward movement of piston 6 the air will be drawn from beneath the piston

2, part of it escaping to the open air and part entering cylinder 3, while the air above the piston 6 will be compressed and cause the piston 2 to descend, thus making its working or hammer stroke. In the upward movement of piston 6 air will be drawn in beneath it through valve 11 as soon as the piston has passed the port leading from said valve. In the above manner the hammer-piston will be alternately raised and lowered.

Having now described the nature of my said invention, what I claim is—

1. In an apparatus of the character described, the combination with a hammer or ram cylinder, an air-pump cylinder, a piston working in each of said cylinders, and connections between the cylinders above and below the pistons therein, of an air-inlet valve arranged on the air-pump cylinder at such a point that the valve will be closed by the lowering pump-piston about at the beginning of the raising motion of the hammer-piston to prevent the drawing in of air during the quick raising motion whereby an air-cushion below the ram-piston is prevented, a valve 24 in the lower connection between the cylinders, an air-discharge valve connected with the upper end of the pump-cylinder and adapted to permit of the escape of air from above the hammer-piston to the atmosphere, and a connection between the valve in the lower connection between the cylinders and the said air-discharge valve, comprising a rod adapted to raise the air-discharge valve, and a series of jointed levers one of which is connected with the valve 24 and adapted to be actuated thereby and another of said levers being adapted to actuate the said rod, all being arranged and adapted for coöperation whereby said air-discharge valve and valve 24 will be operated simultaneously in the manner described.

2. In an apparatus of the character described, the combination with a hammer or ram cylinder, an air-pump cylinder, a piston working in each of said cylinders, and connections between the cylinders above and below the pistons therein, of an air-inlet valve arranged on the air-pump cylinder at such a point that the valve will be closed by the lowering pump-piston about at the beginning of the raising motion of the hammer-piston to prevent the drawing in of air during the quick raising motion whereby an air-cushion below the ram-piston is prevented, a connection 20 between the cylinders, and a valve 24 in said connection opening toward the hammer-cylinder, said valve 24 having a bore and an orifice 29 communicating with said bore and the casing for said valve having orifices adapted to be placed in communication with the bore of the valve in the manner and for the purpose specified.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

CONRAD PRUNER.

Witnesses:
WILHELM BERGER,
ALVESTO S. HOGUE.