

No. 706,394.

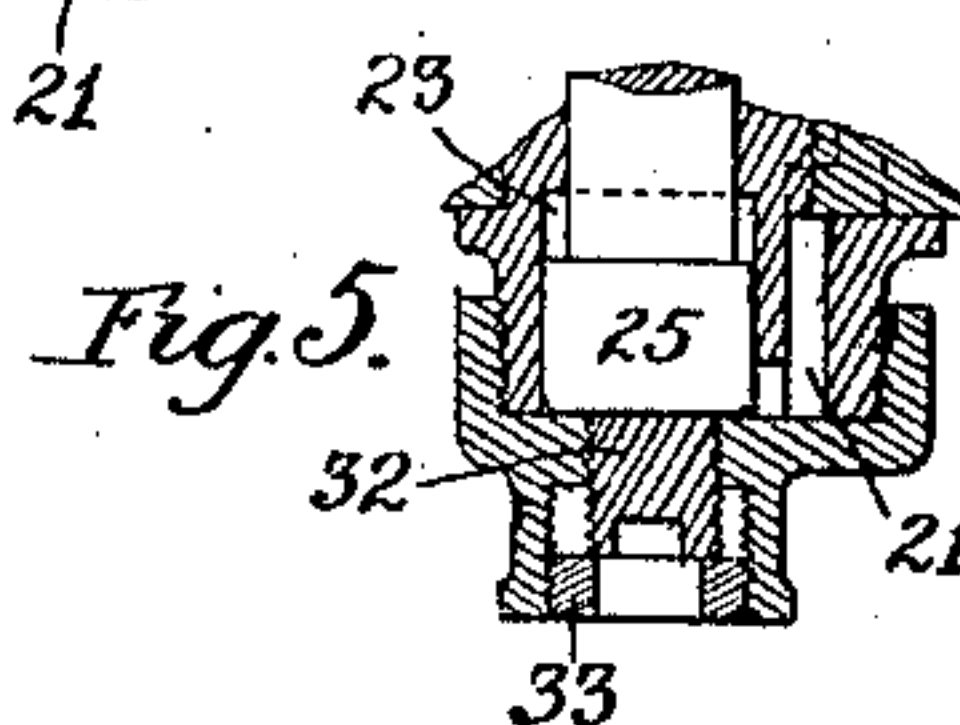
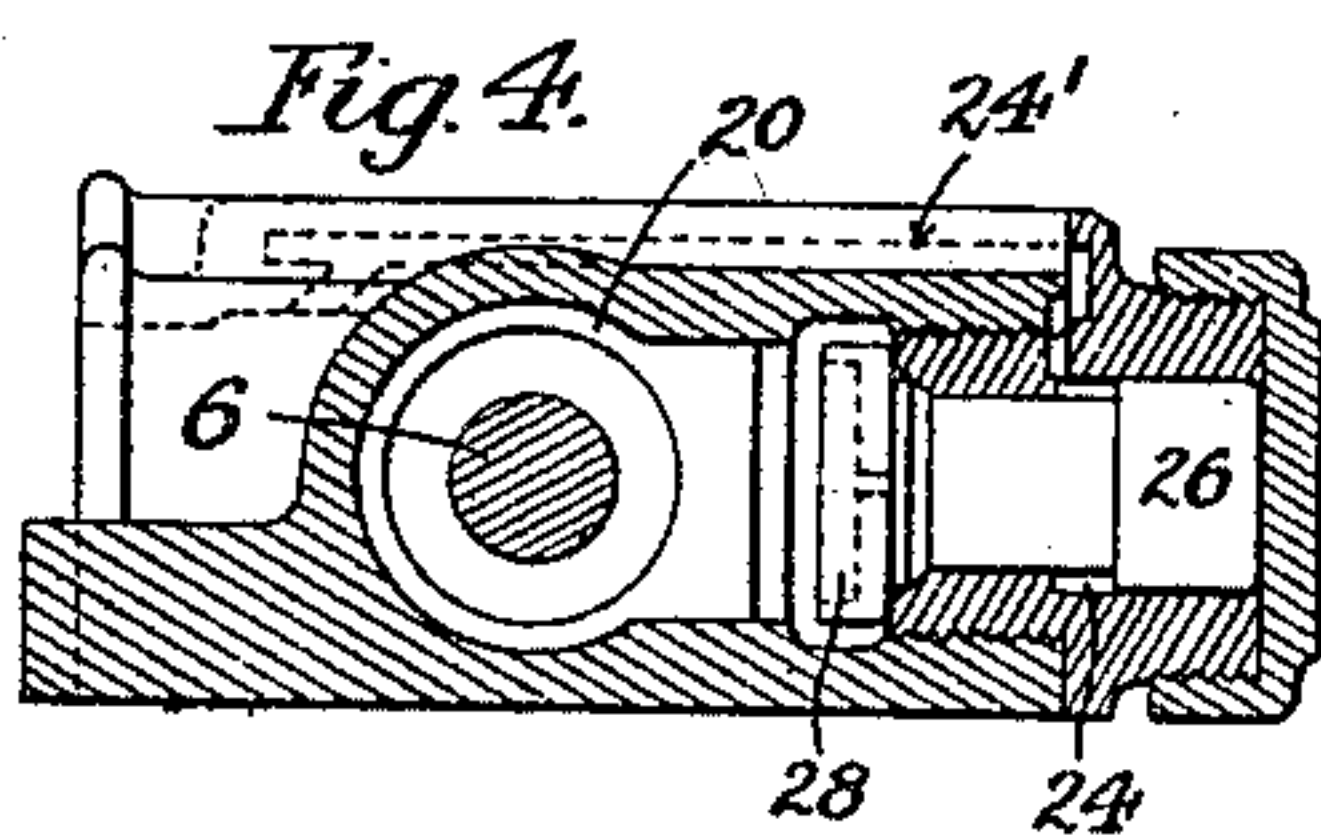
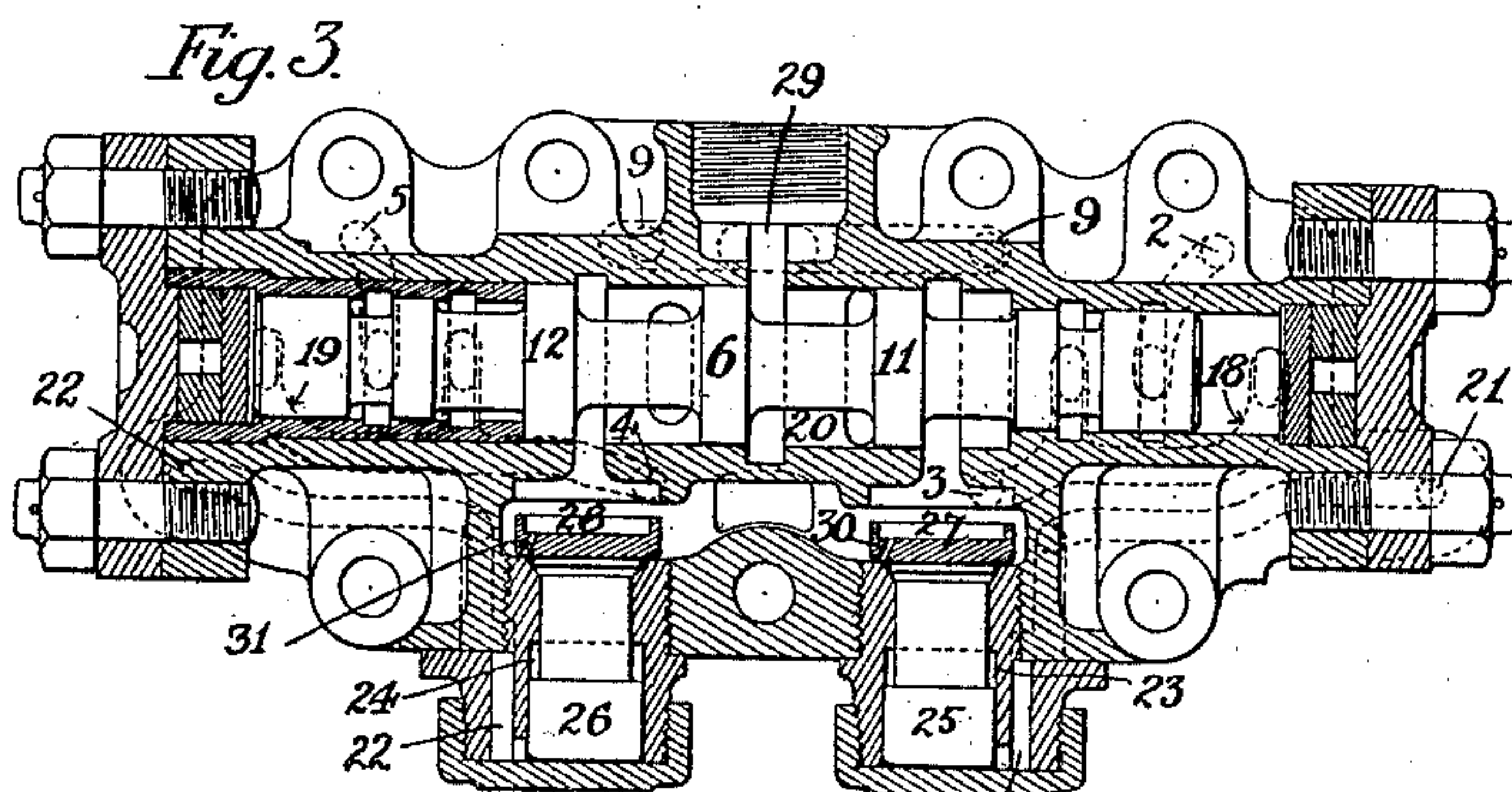
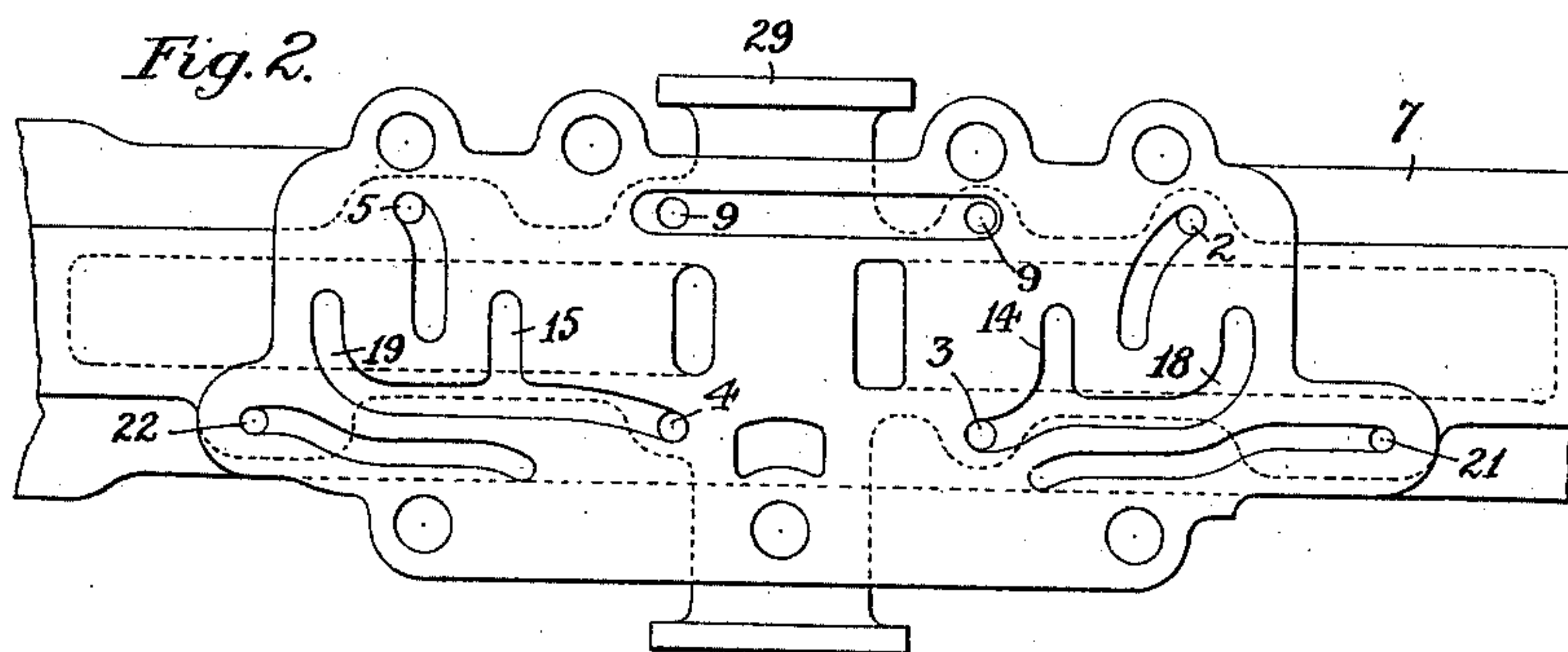
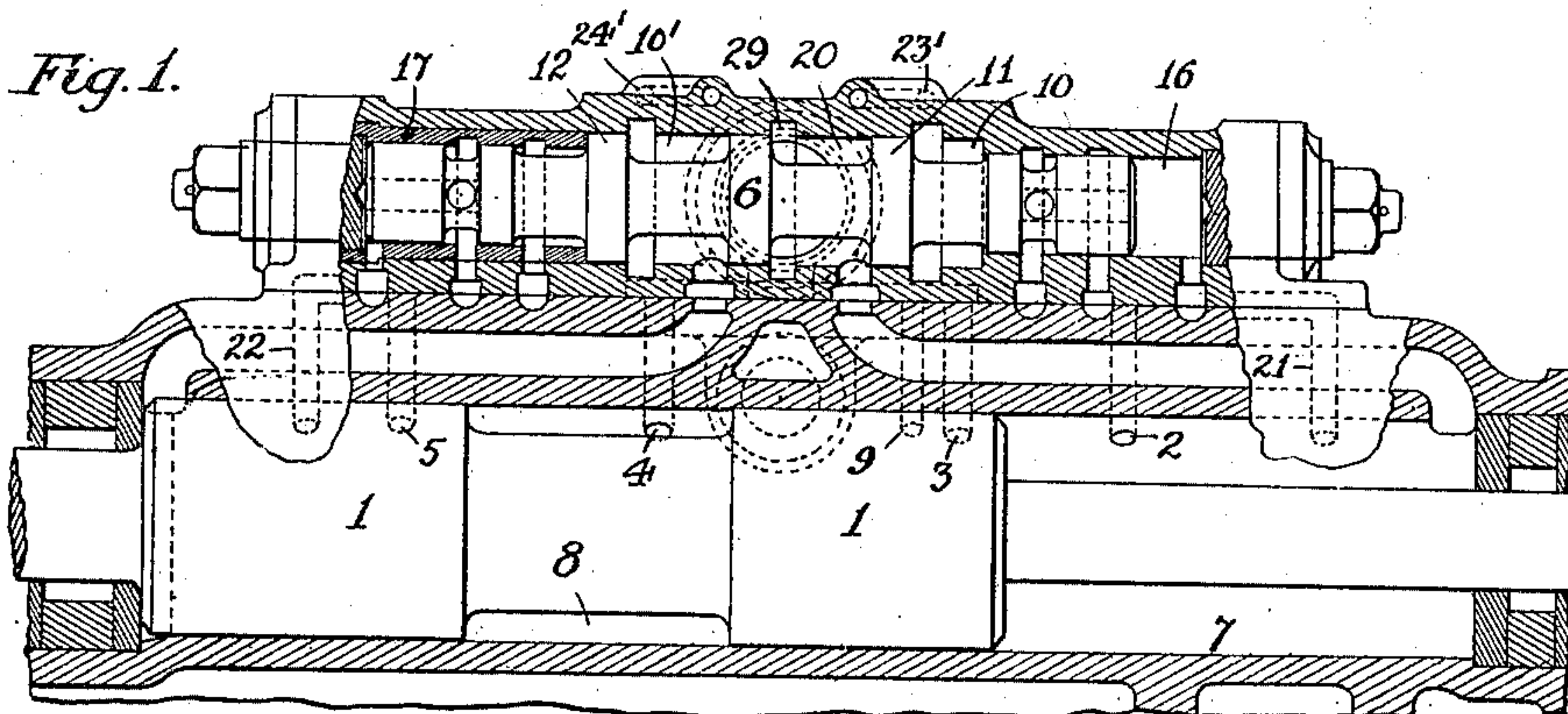
Patented Aug. 5, 1902.

Z. W. DAW.
PERCUSSIVE ROCK DRILL.

(Application filed Jan. 27, 1902.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES:

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3 Sheets—Sheet 2.

Fig. 6.

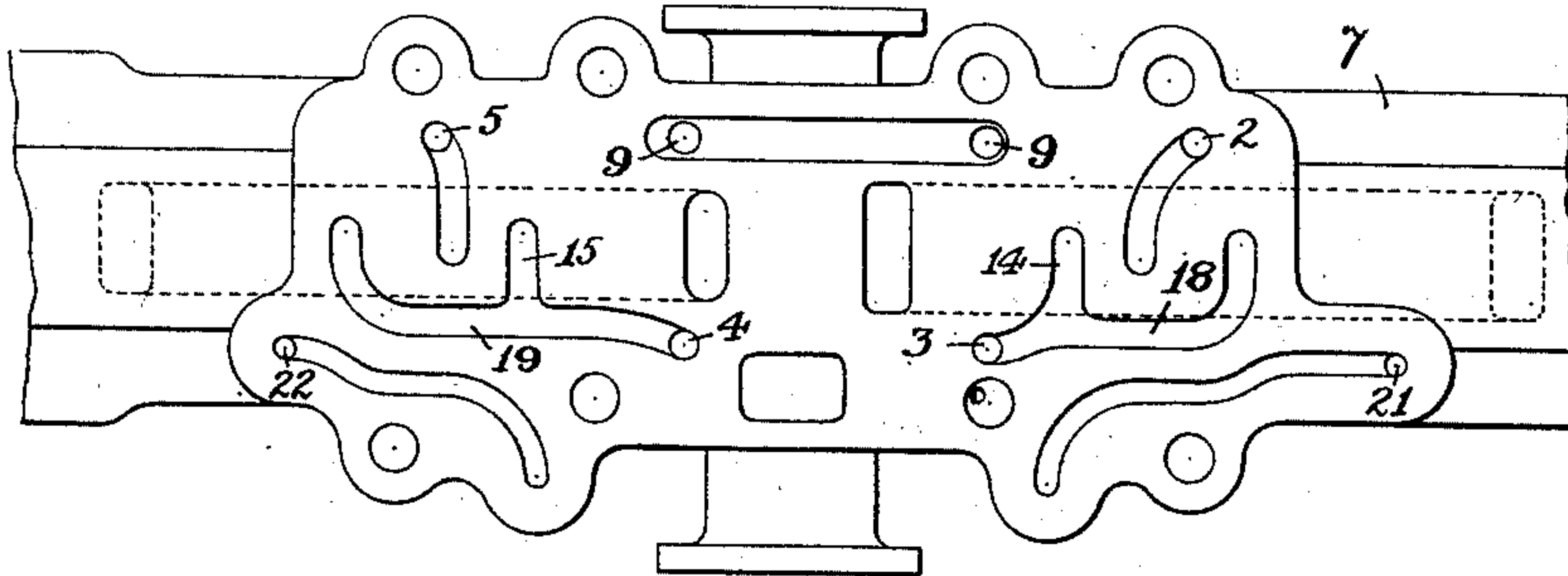


Fig. 7.

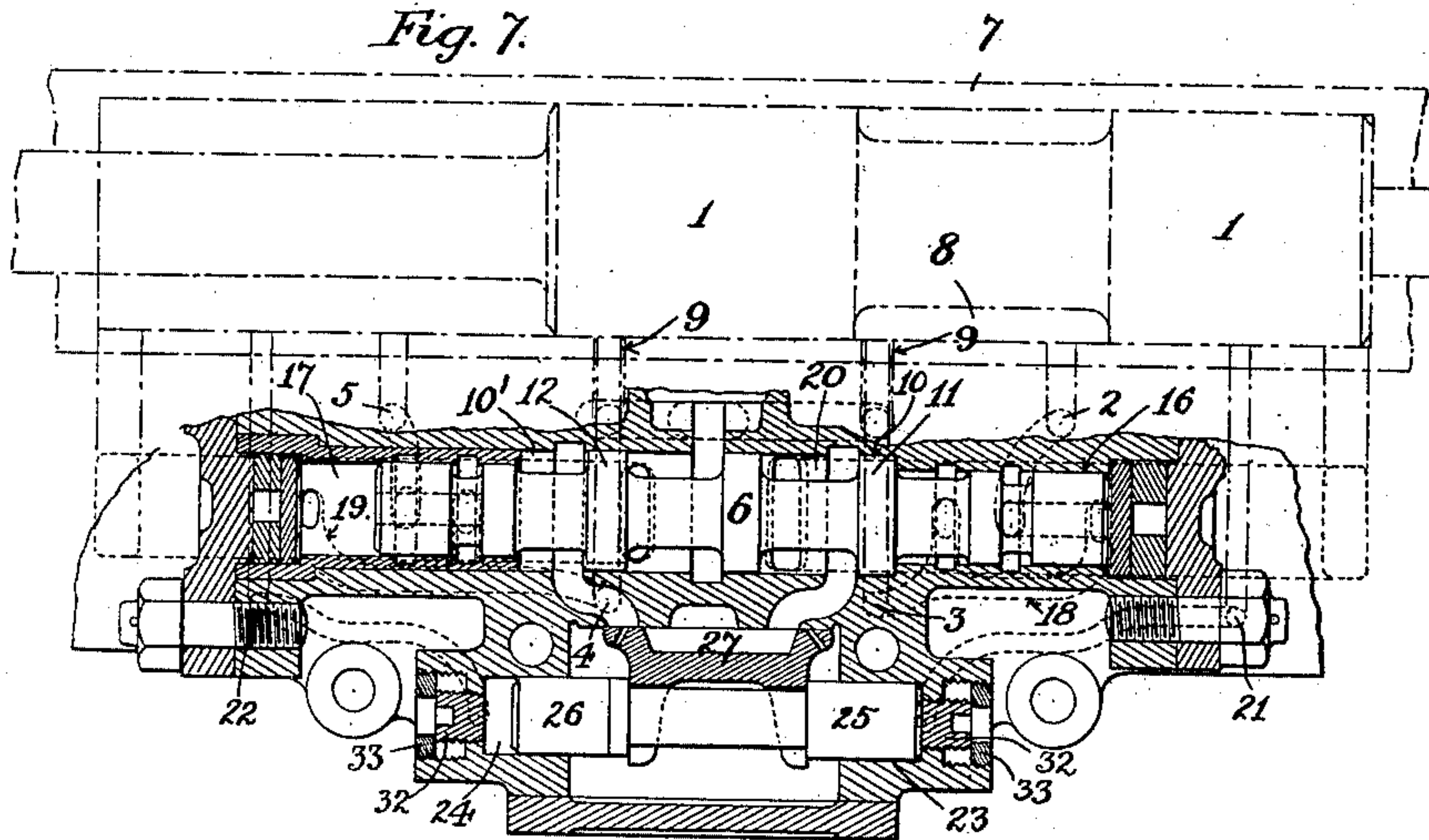
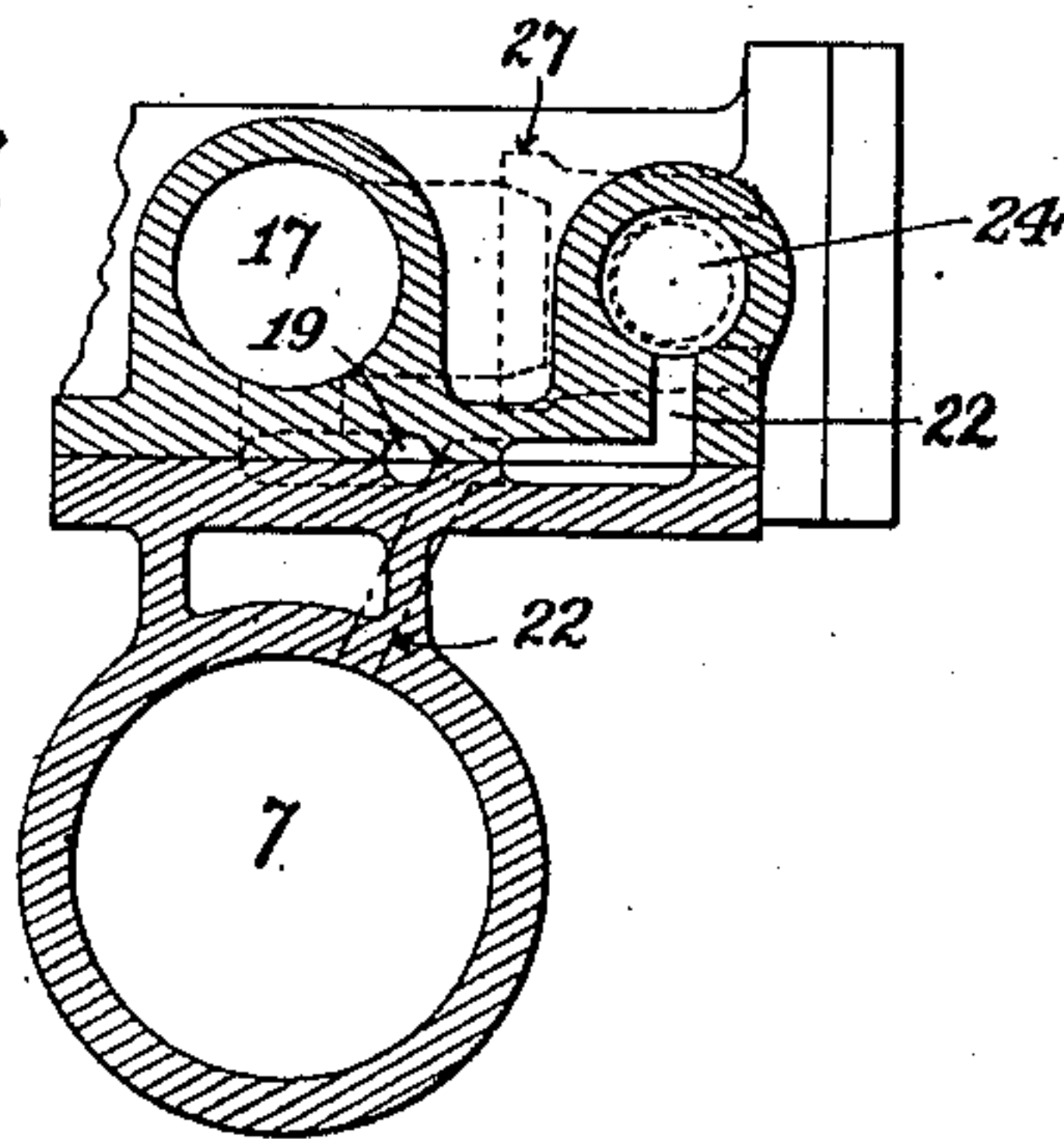


Fig. 8.



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3 Sheets—Sheet 3.

Fig. 9.

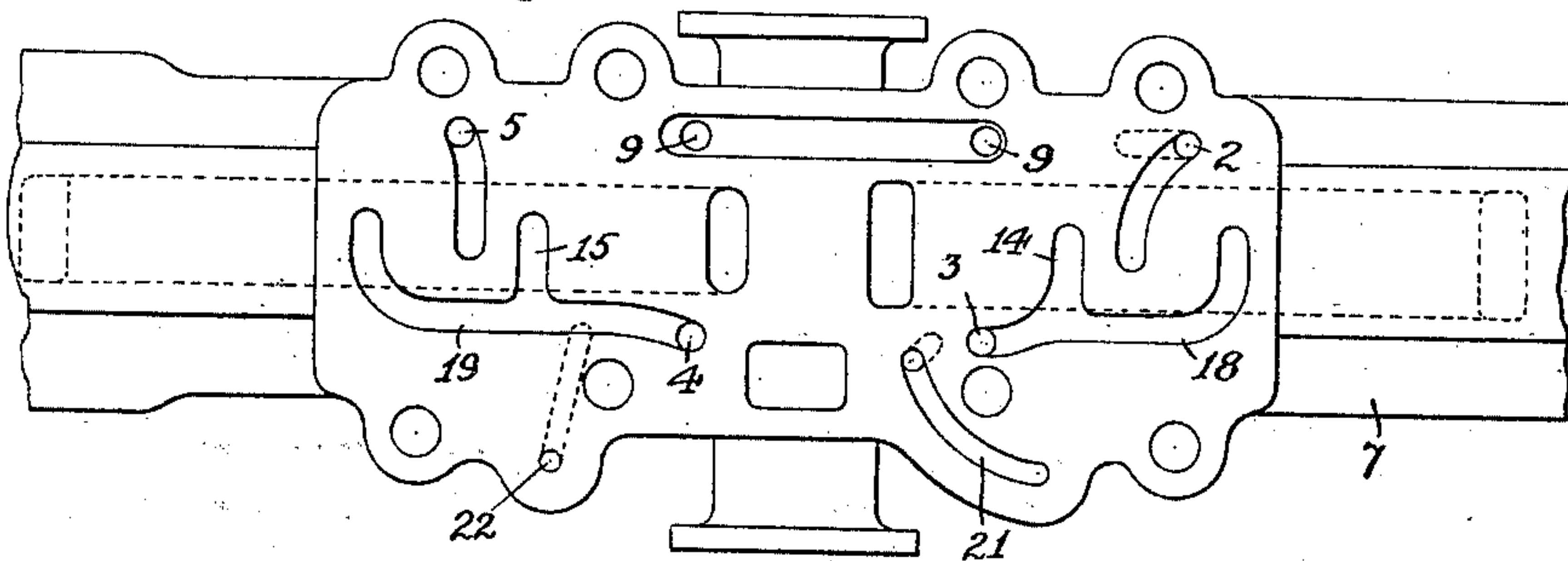


Fig. 10.

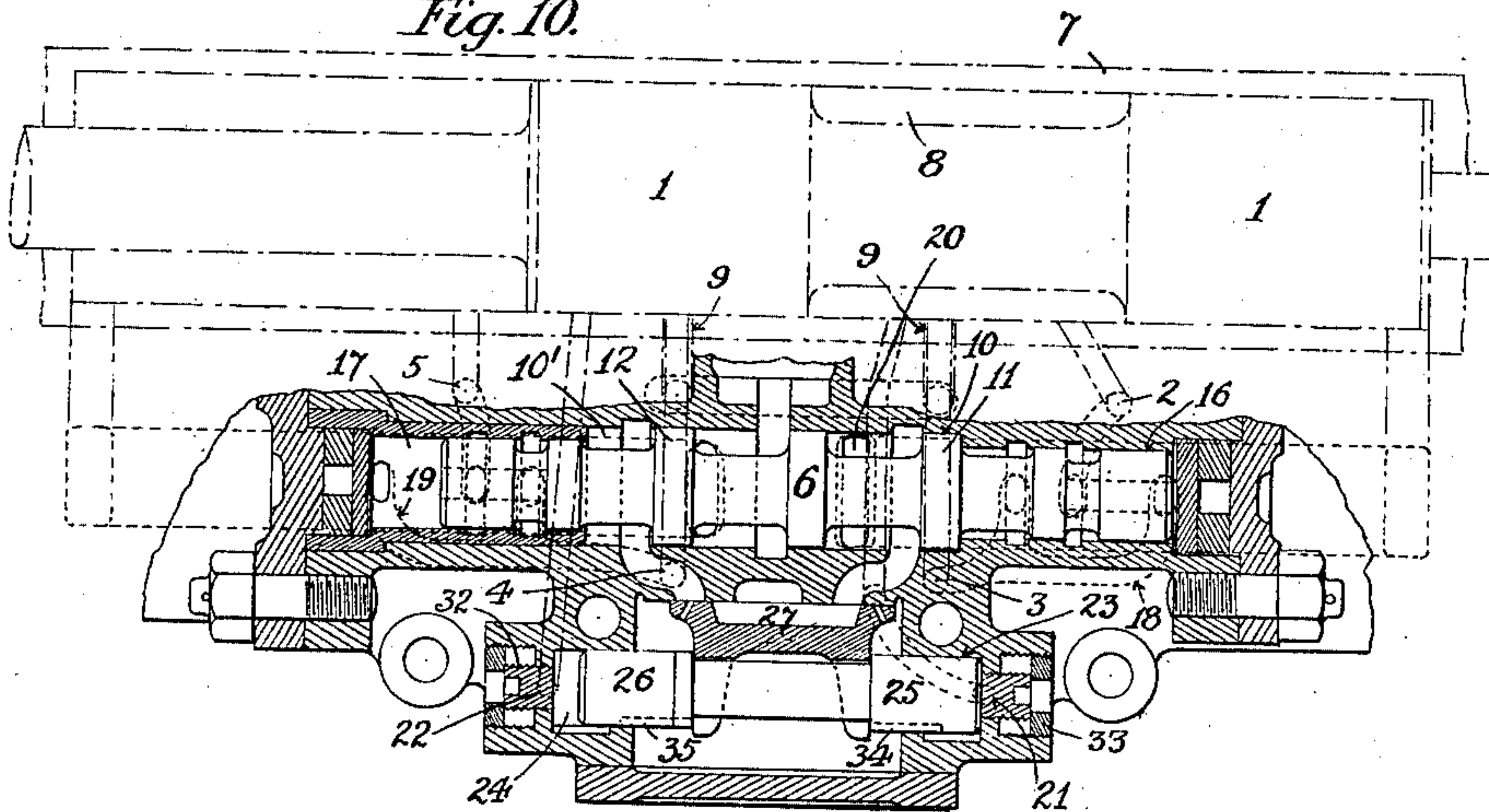
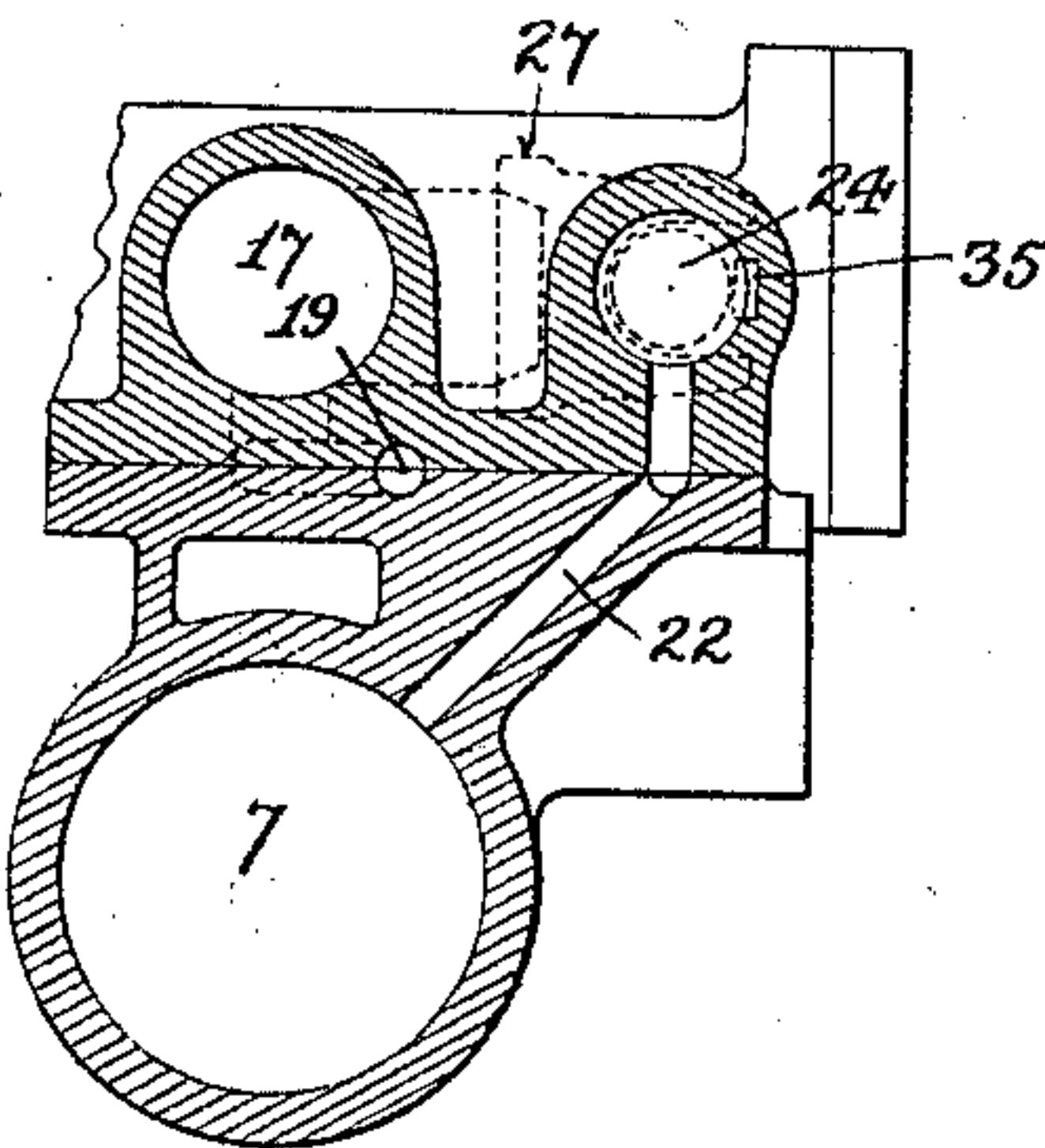


Fig. 11.



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UNITED STATES PATENT OFFICE.

ZACHARIAS WILLIAMS DAW, OF LONDON, ENGLAND.

PERCUSSIVE ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 706,394, dated August 5, 1902.

Application filed January 27, 1902. Serial No. 91,517. (No model.)

To all whom it may concern:

Be it known that I, ZACHARIAS WILLIAMS DAW, a subject of the King of Great Britain, residing at London, in the county of Middlesex, England, have invented new and useful Improvements in Percussive Rock-Drills, Direct-Acting Pumps and Engines, (for which I have made application for Letters Patent in Great Britain, bearing No. 13,277, dated 10 June 29, 1901,) of which the following is a specification.

This invention relates to improvements in percussive rock-drills, direct-acting pumps and engines of that class in which the supply 15 to and the exhaust from the motor-cylinder are governed by a valve actuated by the travel of the motor-piston either through tappets and the like or by the motive fluid through passages leading from such motor-cylinder to 20 a valve-cylinder and which passages are controlled by the travel of the motor-piston, and more especially to that class of engines described in the specifications of the prior patents, No. 456,801, dated July 28, 1891, and No. 25 531,587, dated December 25, 1894.

The object of the present invention is to provide means whereby the supply of the motive fluid to the main cylinder is so controlled as to permit such motive fluid to act 30 expansively.

The drawings show the invention as applied to a drill in which the motor-piston is provided with an annular recess, such recess regulating the exhaust from cylinders in 35 which work supplemental pistons forming part of the controlling-valve, which serve to lock the valve and to assist in actuating the same.

In the accompanying drawings, Figure 1 is 40 a longitudinal section through the main cylinder and valve-chest; Fig. 2, a plan view showing the passages between the main cylinder and the valve-chest; Fig. 3, a horizontal section through the valve-chest and 45 the cylinders of the expansion-valves. Fig. 4 is a transverse section through one of the expansion-valve cylinders; and Fig. 5, a horizontal section through same, showing means for adjusting the throw of the valve so as to 50 regulate the point at which the motive fluid is cut off. Fig. 6 is a plan view of the valve-cylinder, showing the passages between it

and the main cylinder and the expansion-valve cylinder when a single expansion-valve only is used for controlling the expansion on 55 both strokes of the piston. Fig. 7 is a vertical section of same, the main cylinder and the passages between it and the valve-cylinder being shown in broken lines. Fig. 8 is a transverse section through the main cylinder and valve-chest. Figs. 9, 10, and 11 are 60 similar views to Figs. 6, 7, and 8, respectively, and show a modification of the arrangement illustrated in the latter figures.

The piston 1 controls the passages 2 3 4 5, 65 so as to actuate the valve 6, which governs the supply and exhaust to and from the drill-cylinder 7 in the manner set forth in the specifications of the patents above referred to. The piston 1 has an annular groove 8 formed 70 therein, which, through passages 9, serves to place the outer end of the cylinders 10 10', in which work the supplemental pistons 11 12, formed on the valve 6, open to exhaust when the latter has to be reversed, such supplemental piston-cylinders being connected by 75 passages 14 15 to the outer end of the main valve-piston cylinders 16 17 through passages 18 19, so that when the piston-cylinder is open to supply through passage 2 or 5 the motive 80 fluid will pass to the supplemental piston-cylinder 10 or 10' and by acting on the piston 11 or 12 serve to lock the valve in the position to which it has been moved.

For the purpose of cutting off the supply, 85 so as to allow the motive fluid to work expansively, in addition to the passages 2 3 4 5, leading from the drill-cylinder 7 to the valve-cylinder 20, whereby the supply and exhaust is controlled, I provide an additional passage 90 21 22 near each end of the drill-cylinder 7 and leading, respectively, to the rear ends of separate cylinders 23 24, each containing a piston 25 26, on the rod of which is mounted a valve 27 28, which when closed cuts off the 95 valve-cylinder 20 from the main supply.

The action is as follows: When the drill-piston 1 in its travel uncovers the new passage—say 21—the motive fluid, acting on the drill-piston, will pass through such passage 100 to the rear of the piston 25 in the small cylinder 23 and by nearly closing the valve 27 will practically shut off the main supply to the main valve-cylinder 20, so that for the

rest of the drill-piston stroke the motive fluid in the drill-cylinder 7 will act expansively.

When the main valve 6 has been reversed in the manner set forth in the specifications of the hereinbefore-mentioned prior patents, the rear of the piston 25, on the rod of which the shutting-off valve 27 is mounted, will, through the passage 21 leading to the main cylinder 7 and those leading thence to the exhaust 29, be placed open to exhaust. Small openings 30 31 are made through each of the shutting-off valves, and as the rear of such valve 27 is always open to the main supply when the cylinder 23 of the piston 25, actuating the valve 27, is open to exhaust the motive fluid will pass through such openings, and so open the valve, thus permitting said motive fluid to pass through the passage leading to the main cylinder 7 and which is controlled by the main valve 6.

It must be understood that the area of the under side of the valve 27 must be made greater than that of its upper side, so that the pressure of the motive fluid on the former when the space on top of the piston 25 is open to exhaust will overcome the pressure on the top of the valve, and thus permit the valve to open. For this purpose the rod connecting the piston to the valve must be made of sufficient diameter to insure such result.

The opening or openings 30 31 in the case of a rock-drill further serve to maintain pressure on the main piston in the event of the borer sticking fast in the bore-hole.

Instead of the openings 30 in the small valve 27 same might be opened at the requisite time by a spring or other suitable means.

A passage 21 22, leading to a separate small cylinder 23 24, with shutting-off valve 27 28, is arranged at each end of the drill-cylinder 7, and the action is identically the same as that above described for each stroke of the drill-piston 1.

As some of the motive fluid might possibly pass by leakage to the front of the piston 25 or 26 and by the pressure on the upper surface of such pistons interfere with the closing of the valve 27 or 28 at the proper time, a passage 23' 24', Fig. 4, is provided and leads from the cylinders 23 24 in front of the pistons and opens into the main exhaust, so that the space in front of said pistons is always permanently open to exhaust.

In order to enable the opening controlled by the small valve 27 or 28 to be adjusted so as to regulate the amount of fluid which can pass in order to suit varying circumstances, I may employ the arrangement illustrated in Fig. 5, in which, it will be seen, a screw-plug 32 is inserted in the end of the shut-off-valve cylinder 23, and by adjusting the position of such plug the travel of the piston 25 will be limited and the extent of opening of the shut-off valve 27 actuated by such piston be correspondingly increased or diminished, thereby regulating the amount of fluid which can pass to the motor-cylinder 7, and thus vary-

ing the expansion to suit different requirements. By this means the speed, stroke, and blow of the drill may be varied at the will of the operator to suit any given conditions of working, character of the rock, &c.

A locking-nut 33 bears upon the outer end of plug 32, so as to prevent any accidental displacement of such plug. It will be readily understood that any other suitable arrangement might be employed for regulating the opening controlled by the shut-off valve.

Instead of employing two separate shutting-off valves I might, as shown in Figs. 6, 7, and 8, employ a single valve 27 only and actuate same by two pistons 25 26, working in separate cylinders 23 24, each having a passage 21 22, leading, respectively, to the opposite ends of the drill-cylinder 7 and controlled by the drill-piston 1. Again, I might, as shown in Figs. 9, 10, and 11, arrange the passages 21 22, leading to the shutting-off-valve cylinders 23 24, in such positions in the drill-cylinder 7 that they would only serve to place the cylinders 23 24 of the pistons 25 26, controlling valve 27, open to exhaust through the annular recess 8 in the drill-piston 1 and cause the motive fluid from the main supply to leak through small openings 34 35 in the pistons 25 26 to the rear thereof, and when the piston-cylinders 23 24 are open to exhaust the pressure on the outer end of the opposite piston will reverse the valve 27; or, finally, I might employ a tappet or other suitable mechanical means for reversing the shutting-off valve 27 at the required time instead of effecting same through the passages 21 22, controlled by the drill-piston 1, as above described.

It will be readily understood that the valve for controlling the supply and exhaust to and from the motor-cylinder might be actuated by any other suitable means than those above described—such, for example, as by tappets actuated by the motor-piston in its travel, or the passages for actuating the valve might be controlled by a part moved by the motor-piston.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination with the motor-cylinder of a main valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, a motor-piston in said motor-cylinder controlling by its movements the ports which govern the operation of the main valve, and a shut-off valve also controlled by said motor-piston for cutting off or practically cutting off the supply to the motor-cylinder, so as to allow the motive fluid to act expansively therein, all substantially as specified.

2. The combination with the motor-cylinder of a main valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, a motor-piston in said motor-cylinder controlling by its movements the ports which govern the operation of the main valve, and a shut-off valve also

controlled by said motor-piston for each end of the motor-cylinder arranged one to cut off or practically cut off the supply alternately to the opposite ends of the motor-cylinder, substantially as and for the purpose specified.

3. The combination with the motor-cylinder of a main valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, a motor-piston in said motor-cylinder controlling by its movements the ports which govern the operation of the main valve, and a shut-off valve for cutting off or practically cutting off the supply to the motor-cylinder, such shut-off valve being actuated by pistons working in cylinders respectively connected by passages leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, substantially as specified.

4. The combination with the motor-cylinder of a main valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, a motor-piston in said motor-cylinder controlling by its movements the ports which govern the operation of the main valve, and a shut-off valve for each end of the motor-cylinder, each of said valves being actuated by a piston working in a cylinder connected respectively by a passage leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, substantially as specified.

5. The combination with the motor-cylinder of a valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for cutting off or practically cutting off the supply to the motor cylinder, such shut-off valve being actuated by pistons working in cylinders respectively connected by passages leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, said valve being formed with an opening or openings which permit the motive fluid to pass to its under side, substantially as specified.

6. The combination with the motor-cylinder of a valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for each end of the motor-cylinder, each of said valves being actuated by a piston working in a cylinder connected respectively by a passage leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, said valve being formed with an opening or openings which permit the motive fluid to pass to its under side so as to open same, substantially as specified.

7. The combination with the motor-cylinder of a valve for regulating the supply and

exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for each end of the motor-cylinder, each of said valves being actuated by a piston working in a cylinder connected respectively by a passage leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, the space in front of the valve-piston being connected by a passage to the main exhaust, substantially as specified.

8. The combination with the motor-cylinder of a valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for cutting off or practically cutting off the supply to the motor-cylinder, such shut-off valve being actuated by pistons working in cylinders each connected by a passage to the motor-cylinder in such a position that a groove formed in the motor-piston will in its reciprocation alternately place one of the piston-cylinders open to exhaust, while the piston in the other cylinder is open to the pressure of the motive fluid which has leaked through small openings formed in such piston to the rear thereof, and the valve is consequently reversed, substantially as specified.

9. The combination with the motor-cylinder of a valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for cutting off or practically cutting off the supply to the motor-cylinder, such shut-off valve being actuated by pistons working in cylinders respectively connected by passages leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, and adjustment means for limiting the extent of throw of the shut-off valve, substantially as specified.

10. The combination with the motor-cylinder of a valve for regulating the supply and exhaust to and from such cylinder and working in a valve-cylinder, and a shut-off valve for each end of the motor-cylinder, each of said valves being actuated by a piston working in a cylinder connected respectively by a passage leading one to each end of the motor-cylinder and controlled by the reciprocation of the motor-piston, and of a screw or other adjustable device for limiting the extent of throw of the shut-off valve, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ZACHARIAS WILLIAMS DAW.

Witnesses:

E. CURPHEY,
W. M. HARRIS.