

No. 679,859.

Patented Aug. 6, 1901.

J. B. POORE.
STEAM PUMPING ENGINE.

(Application filed Feb. 21, 1901.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.

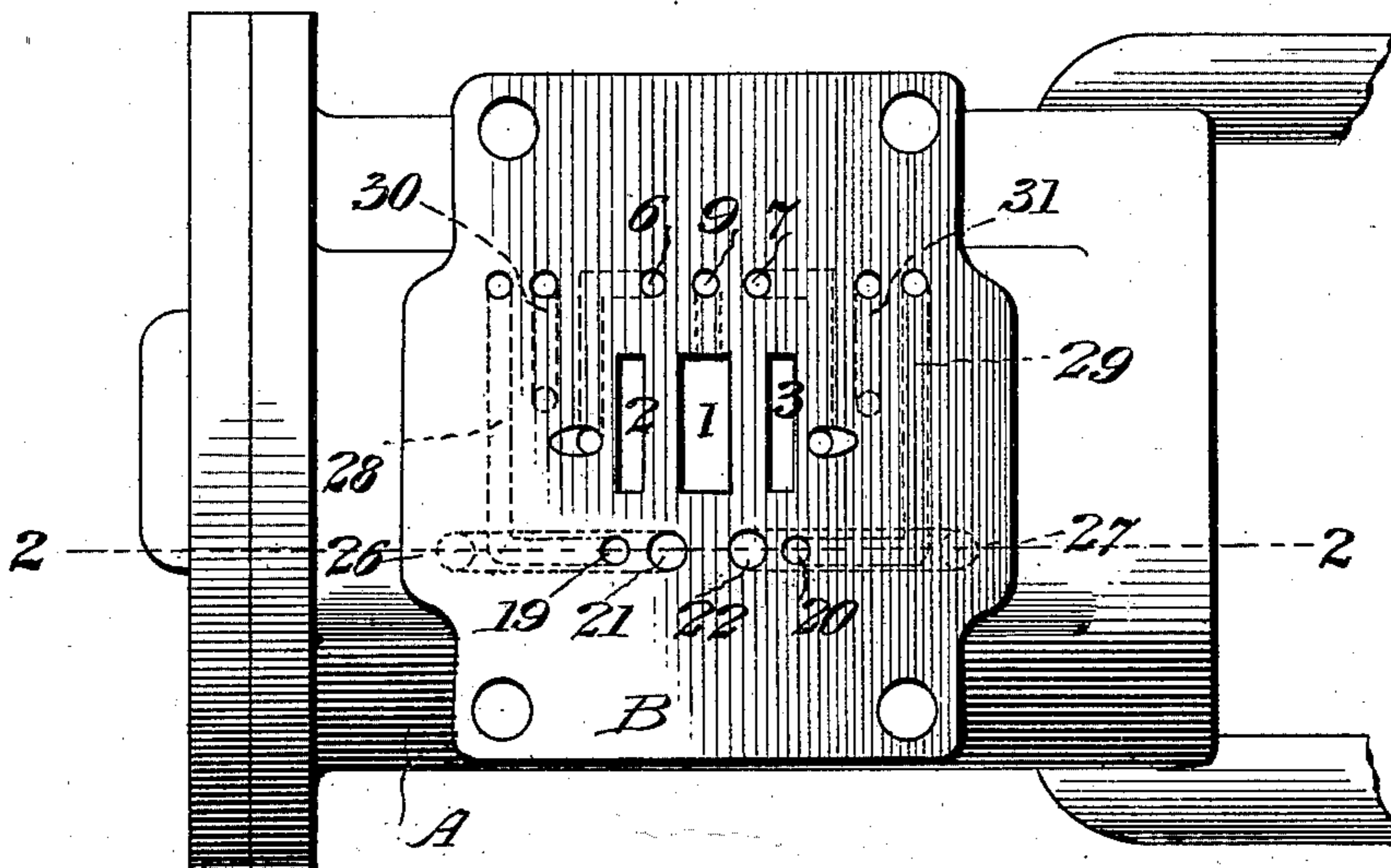


Fig. 2.

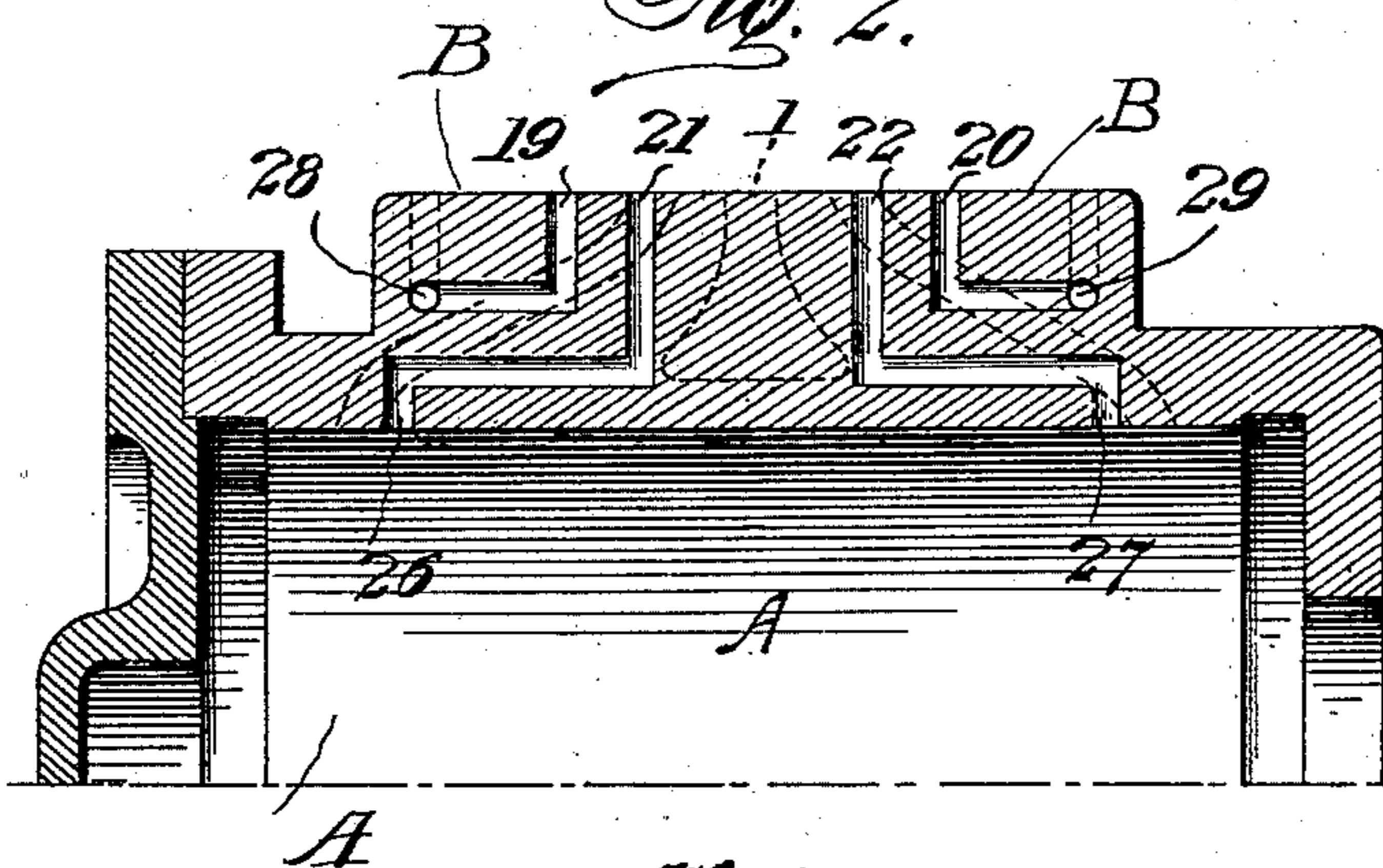
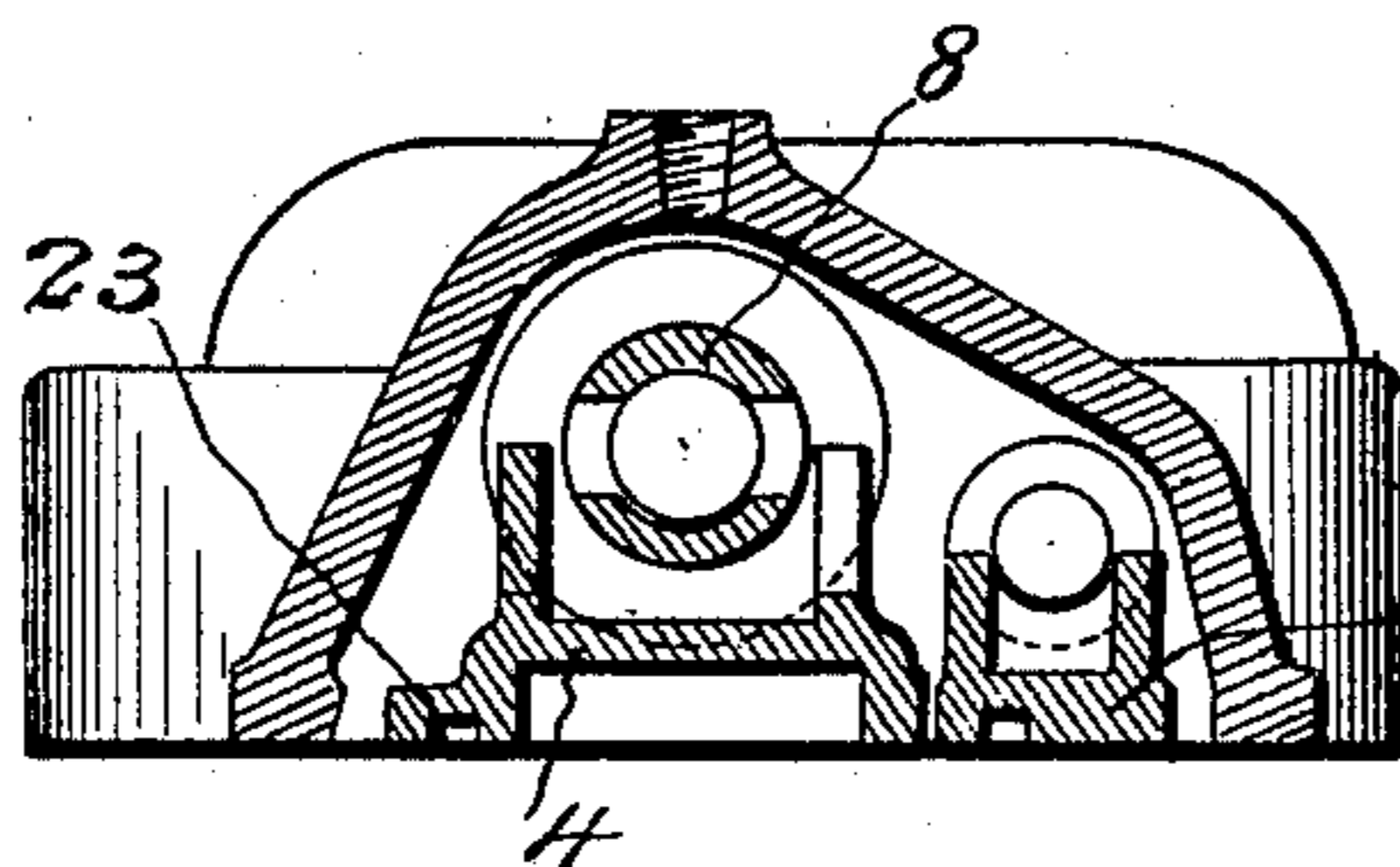


Fig. 3.



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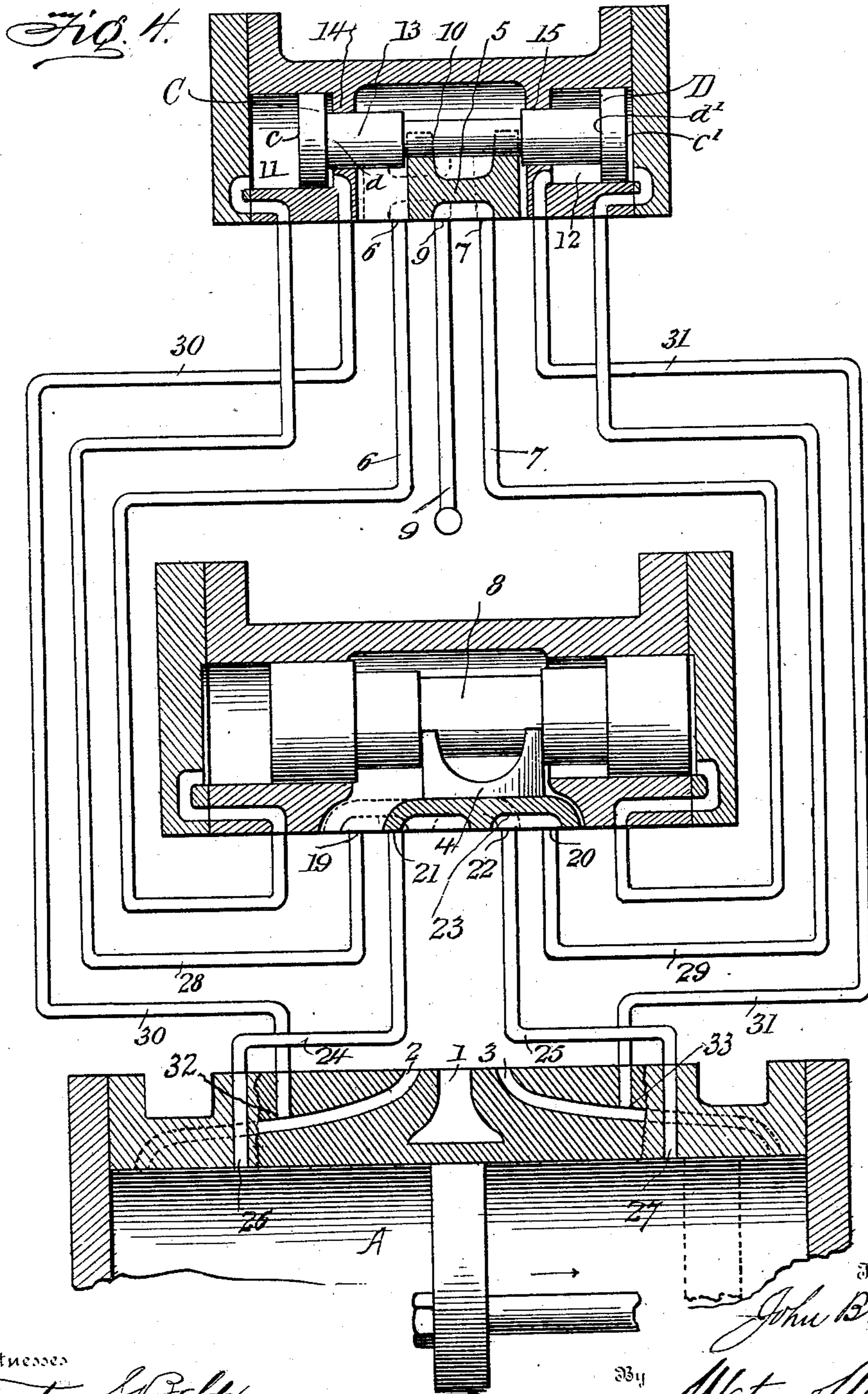
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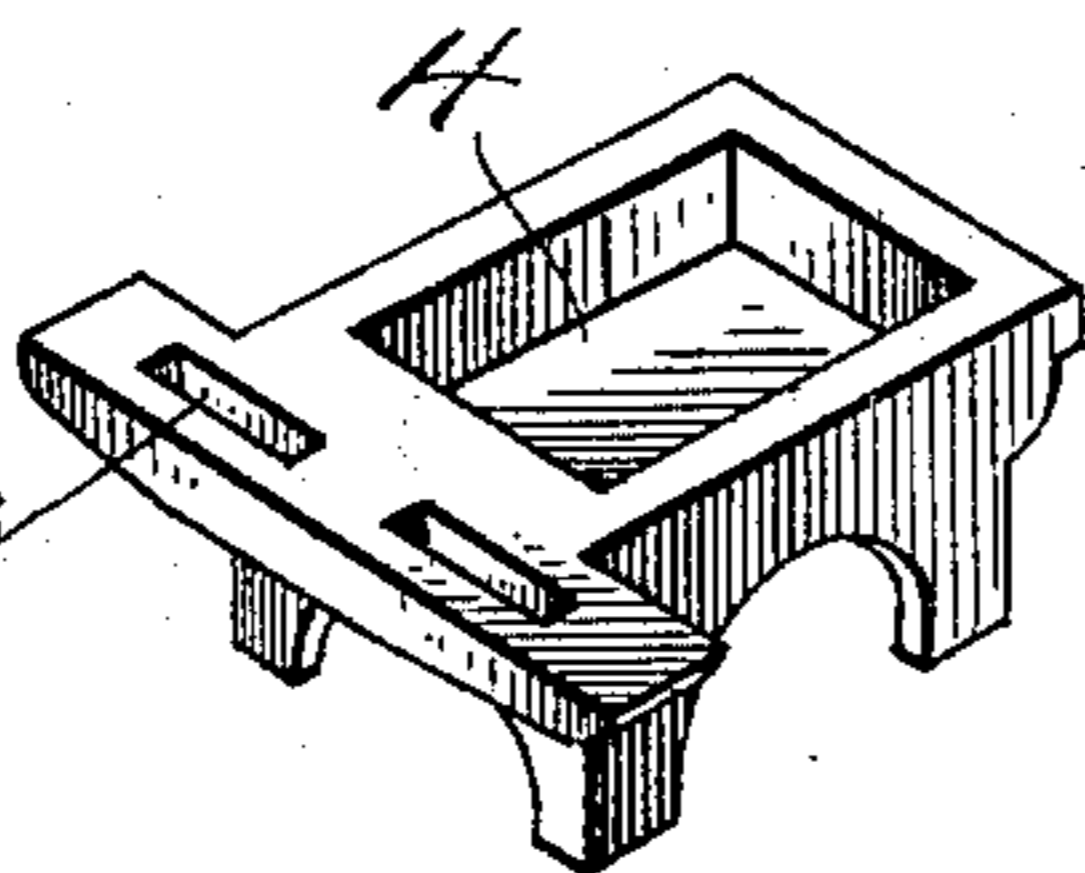
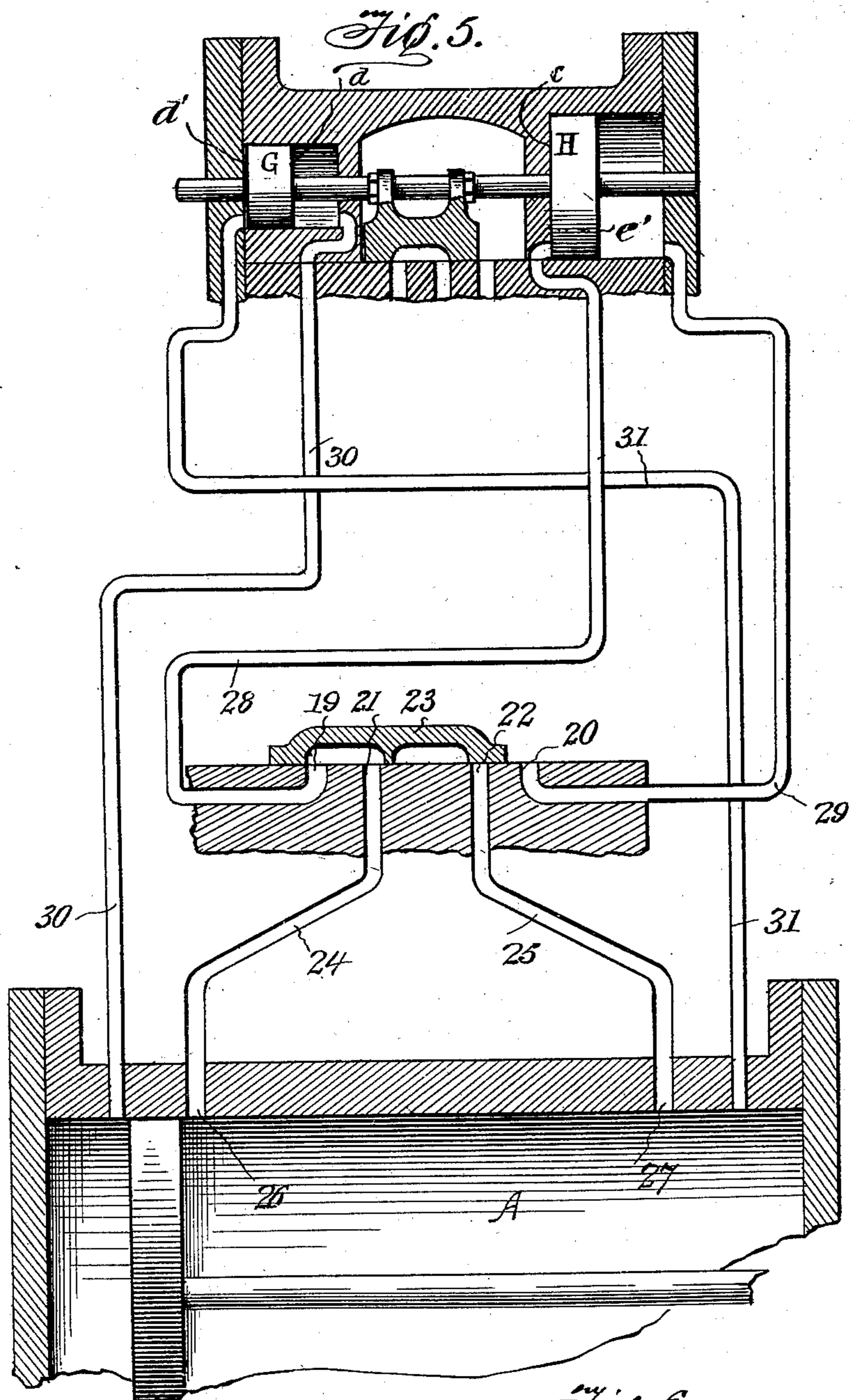
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3 Sheets Sheet 3.



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UNITED STATES PATENT OFFICE.

JOHN B. POORE, OF SCRANTON, PENNSYLVANIA.

STEAM PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 679,859, dated August 6, 1901.

Application filed February 21, 1901. Serial No. 48,303. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. POORE, a citizen of the United States, residing at Scranton, in the county of Lackawanna, State of Pennsylvania, have invented certain new and useful Improvements in Steam Pumping-Engines, of which the following is a specification.

This invention relates to improvements in valve mechanism for steam-pumps whereby the auxiliary valve which controls the ports leading to the main valve is operated automatically by steam-pressure instead of being mechanically operated in the usual manner by means of rods and tappets.

In my improved steam-pump the valves are all operated without mechanical appliances external to the steam-chest, and hence the liability to derangement of the valves from flying fragments of rock in blasting or from rough handling or other causes is eliminated.

In the accompanying drawings, which illustrate the invention, Figure 1 is a plan view of the valve-seat and cylinder. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a cross-section through the steam-chest, showing the relative arrangement of the valves. Fig. 4 shows sections through the steam-chest longitudinally of the main and auxiliary valves and a diagrammatic arrangement of the various steam passage-ways and ports. Fig. 5 is a view of a different form of auxiliary-valve piston and a diagram of the passage-ways leading thereto. Fig. 6 is a perspective view showing the lower side of the main valve and the valve which controls the ports leading to the larger faces of the auxiliary-valve piston.

Referring to the drawings, A indicates the main steam-cylinder of a pump having upon its upper surface a valve-seat B. This valve-seat has the usual exhaust-port 1 and steam-ports 2 and 3, leading to the opposite ends of the cylinder, which ports are controlled by the main valve 4. An auxiliary valve 5 is also provided and adapted to control the steam passage-ways 6 and 7, leading to the opposite ends of the main-valve piston 8 and the exhaust passage-way 9. As shown in Fig. 4, the auxiliary valve 5 is operated by a piston 10, having piston-heads C and D at its opposite ends, said heads being arranged within cylinders 11 and 12, respectively. The

outer faces *c* and *c'* of the piston-heads have greater areas exposed to the action of the steam than the inner faces *d* and *d'*, the connecting portion 13 between the heads being purposely made large enough where it passes through the cylinder ends 14 and 15 and adjoins the heads to considerably reduce the area of the inner faces exposed to the action of the steam. In practice the areas of the outer faces are made about double that of the inner faces; but the proportions may be varied.

As shown, there are four ports 19, 20, 21, and 22 in the valve-seat arranged at one side of the main ports 1 to 3, inclusive, and these ports are controlled by the B-valve 23, which operates simultaneously with the main valve 4. These valves may be formed in one piece, as shown, or they may be made separate and operatively connected together in any suitable manner, so as to be moved by the main-valve piston. The two inner ports 21 and 22 are connected by steam passage-ways 24 and 25, respectively, to the interior of the main cylinder through ports 26 and 27, located near its opposite ends and between the inner ends of the main steam-ports 2 and 3, and the outer ports 19 and 20 are connected by passage-ways 28 and 29 to the outer ends of the steam-chambers 11 and 12, respectively. The valve 23 when in its right-hand position connects the passage-ways 25 and 29, so as to form one continuous passage-way leading from the interior of the main cylinder to the piston-face *c'*, and when in its left-hand position it connects the passage-ways 24 and 28, forming a passage-way leading from the interior of the cylinder to the piston-face *c*. Two valve-controlled passage-ways are thus provided leading from the interior of the cylinder to the larger opposing piston-faces *c* and *c'*. Continuous passage-ways 30 and 31 lead from the inner ends of the chambers 11 and 12, wherein the smaller piston-faces *d* and *d'* are exposed to the steam, to the interior of the main cylinder between the ports 26 and 27 and the ends of said cylinder. As shown in the drawings, said passage-ways 30 and 31 are, for convenience, connected to the main steam-ports 2 and 3 at the points 32 and 33; but they may enter the cyl-

inder directly at any suitable points between the ports 26 and 27 and the ends of the cylinder.

The valve 23 is formed so that when moved into the right-hand position (shown in full lines in Fig. 4) it will uncover the port 19, thereby connecting the passage-way 28 with the interior of the steam-chest and also connecting the passage-ways 29 and 25 through the ports 20 and 22 with the interior of the main cylinder, as previously stated, and when moved to the left, as indicated in dotted lines, the port 20 will be uncovered, thereby connecting the passage-way 29 with the interior of the steam-chest, and the passage-ways 28 and 24 will be connected through the ports 19 and 21. The inner ends of the cylinders or chambers 11 and 12 remain always in communication with the interior of the main cylinder through the passage-ways 30 and 31, so that the smaller piston-faces d and d' are alternately subjected to the pressure of live steam from the main cylinder throughout the stroke.

When the main and auxiliary valves are in the right-hand position, (shown in full lines in Fig. 4,) steam is admitted through the steam-port 2 to the left-hand end of the main cylinder, and the main steam-piston E moves to the right. In this position of the main valve and the valve 23 steam is admitted from the steam-chest through the port 19 and passage-way 28 to the large piston-face c and also through the passage-way 30 from the interior of the main cylinder to the small piston-face d . As the area of the face c is greater than that of the face d , the total pressure upon the face c will be greater than that upon the face d , and the auxiliary valve will be held positively over to the right during the stroke of the main piston. While the main piston is moving to the right and before it has passed the port 27 each of the faces c' and d' will be in communication with the exhaust end of the main cylinder through the passage-ways 31 and 29, the latter passage-way being connected through the valve 23 to the passage-way 25. There will therefore be no tendency for the auxiliary-valve piston to move until the main piston has passed the port 27 in its movement to the right, when live steam from the main cylinder will be admitted through said port and passage-ways 25 and 29 to the face c' . At the moment, therefore, when the main piston passes the port 27 into the position shown in dotted lines full steam-pressure will be applied to the opposing larger faces c and c' and also to the smaller left-hand face d , while the face d' will not be subjected to steam-pressure. The pressure being thus balanced on the faces c and c' , the auxiliary-valve piston will be forced to the left by the pressure against the smaller left-hand face d . For instance, if the steam-pressure be assumed at eighty pounds per square inch and the areas of the faces c and c' to be each four square inches and that of the smaller faces d

and d' to be each two square inches the pressure upon the face c before the piston has passed the port 27 will be three hundred and twenty pounds and upon the face d one hundred and sixty pounds, while there will be no pressure against the faces c' and d' , unless it be a slight pressure from the exhaust-steam, which need not be considered. The auxiliary valve will therefore be held over in the right-hand position with a force of one hundred and sixty pounds, which represents the difference in pressure upon the faces c and d . At the moment when the main piston passes the port 27 in its movement to the right there will be a pressure of three hundred and twenty pounds against each of the larger heads c and c' , acting in opposite directions and equalizing one another. There will be no pressure against the face d' and one hundred and sixty pounds pressure against the face d , which will move the auxiliary-valve piston and auxiliary valve to the left. This movement of the auxiliary valve to the left connects the passage-way 6 with the exhaust passage-way 9 and opens passage-way 7, permitting steam to pass to the right-hand end of the main-valve piston 8 and throw the main valve and valve 23 over to the left into the position shown in dotted lines. The movement of the main valve to the left admits steam through the port 3 to the right-hand end of the main cylinder to move the main piston and thence also through the passage-way 31 to the face d' , and the simultaneous movement of the valve 23 uncovers the port 20, thereby admitting steam from the steam-chest to the passage-way 29 and maintaining full pressure on the right-hand face c' . At the same time communication between the steam-chest and the passage-way 28 will be cut off, and said passage-way will be connected through the valve 23 to the passage-way 24, leading to the interior of the main cylinder at its exhaust end. The moment after the valves are thrown over to the left, therefore, the passage-ways leading to the faces c and d will be connected to the exhaust end of the main cylinder and subjected to little or no pressure, while the pressure from the steam-chest upon face c' will be three hundred and twenty pounds and that upon the face d' from the interior of the main cylinder will be one hundred and sixty pounds, and the valve will be held firmly over to the left by the excess of pressure until the main piston reaches the end of its stroke to the left, when the operation will be reversed, steam being admitted to the face c after the piston has passed the port 26, thus equalizing the pressure on the face c' and permitting the pressure on the face d' to move the auxiliary-valve piston to the right again, which in turn is followed by a movement of the main valve and the main piston to the right. This cycle of operations will be repeated as long as steam is applied to the pump.

The form of the auxiliary-valve piston may

be varied, as well as the arrangement of the passage-ways leading thereto, it being only necessary to provide two opposing piston-faces having continuous passage-ways leading therefrom to the interior of the main cylinder near its ends and two larger opposing piston-faces with valve-controlled passage-ways leading therefrom to the interior of the cylinder at points between the terminals of said continuous passage-ways. In Fig. 5, for instance, the piston is formed with a small head G and a larger head H, arranged within separate cylinders. Steam is admitted to the opposing faces d and d' through the continuous passage-ways 30 and 31 and to the larger opposing faces c and c' through valve-controlled passage-ways 28 and 24 and 29 and 25, respectively. The operation is the same as in the previously-described figure and will be readily understood from an inspection of the drawings. I prefer, however, to form the main piston as shown in Fig. 4, for mechanical reasons, although in referring to the "piston" in the claims I do not wish to limit the meaning of the term to any particular form.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a steam-pump the combination with a main cylinder having main steam and exhaust ports and a piston-operated main valve therefor, of an auxiliary valve controlling the ports leading to the main-valve piston, a pis-

ton for operating said auxiliary valve, said auxiliary-valve piston having two large opposing faces, and two smaller opposing faces, means for admitting live-steam pressure to one of the large faces and an opposing small face during the stroke of the pump; and for admitting live steam to the opposite large piston-face at the end of the stroke.

2. In a steam-pump the combination with a main cylinder having main steam and exhaust ports and a piston-operated main valve therefor, of an auxiliary valve controlling the ports leading to the main-valve piston, a piston for operating said auxiliary valve, said auxiliary-valve piston having two large opposing faces and two smaller opposing faces, passage-ways leading from said smaller faces to the interior of the main cylinder near its opposite ends, valve-controlled passage-ways leading from said larger faces to the interior of the main cylinder between the terminals of the passage-ways leading from the smaller faces, and a valve operated by the main-valve piston adapted to connect said valve-controlled passage-ways alternately with the interior of the main cylinder and with the steam-chest.

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

JOHN B. POORE.

Witnesses:

SAM. B. PRICE,

RUSSELL DIMMICK.