

No. 746,343.

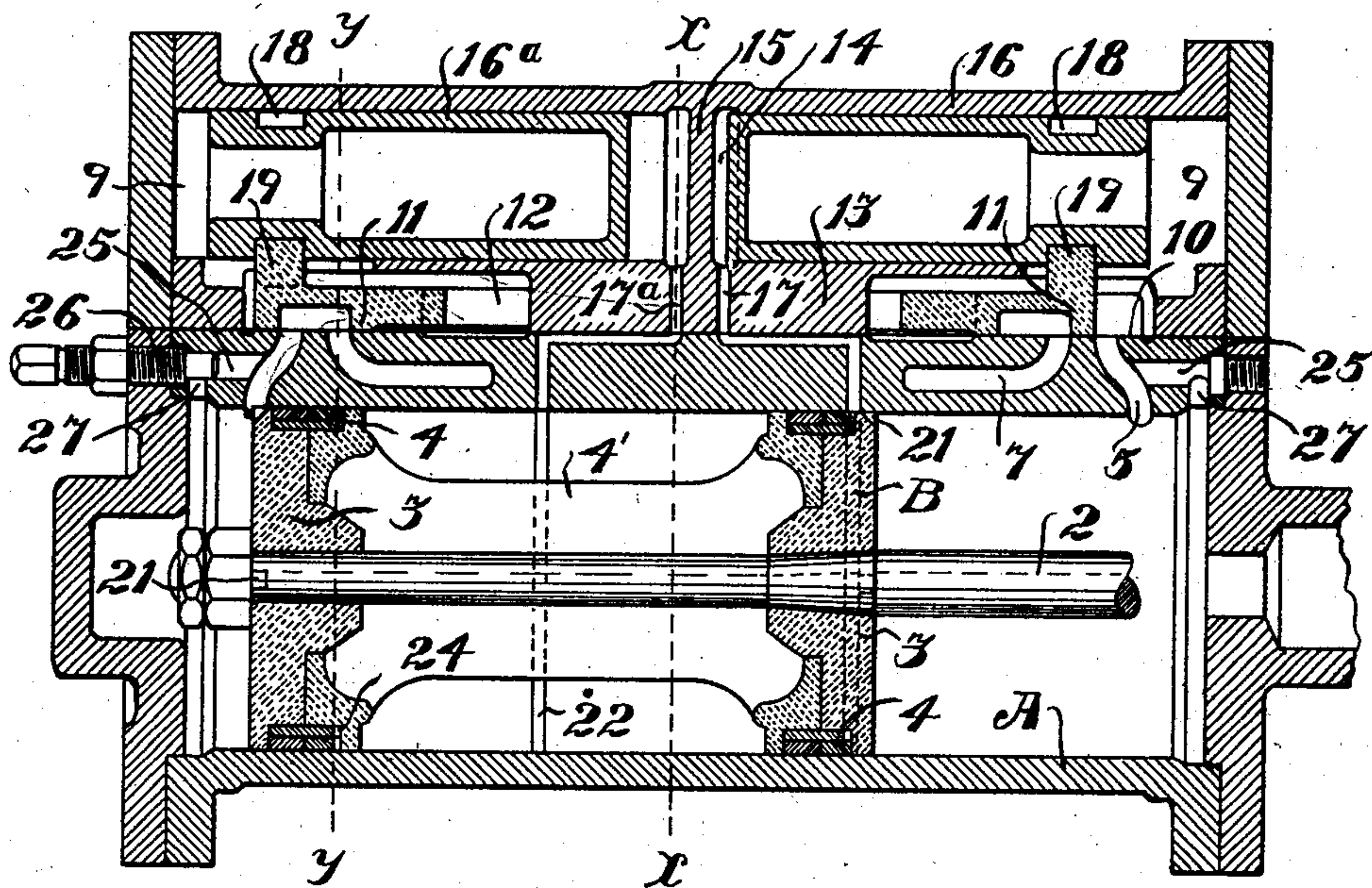
PATENTED DEC. 8, 1903.

G. A. KROHN.  
PUMPING ENGINE.

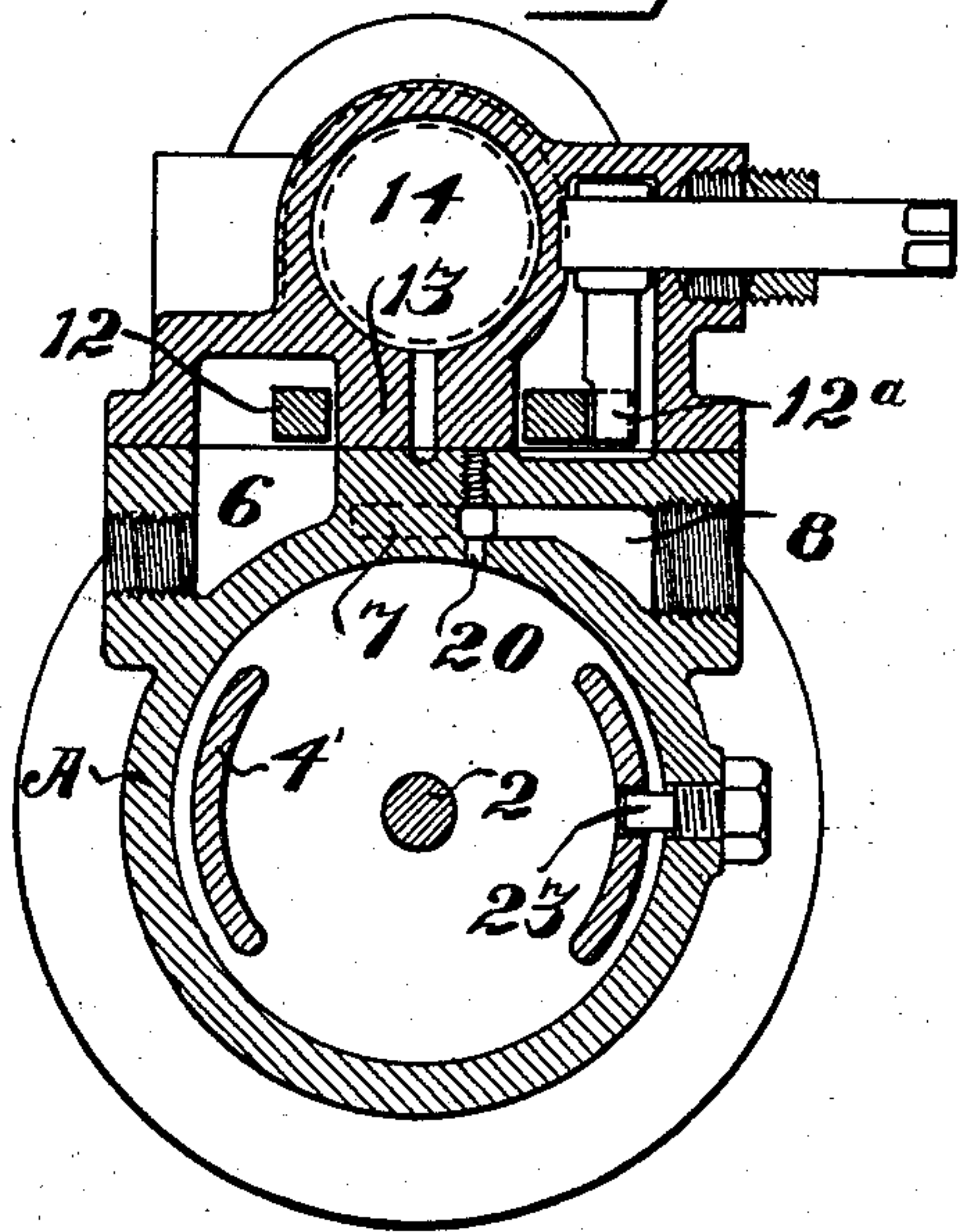
APPLICATION FILED MAR. 6, 1903.

NO MODEL.

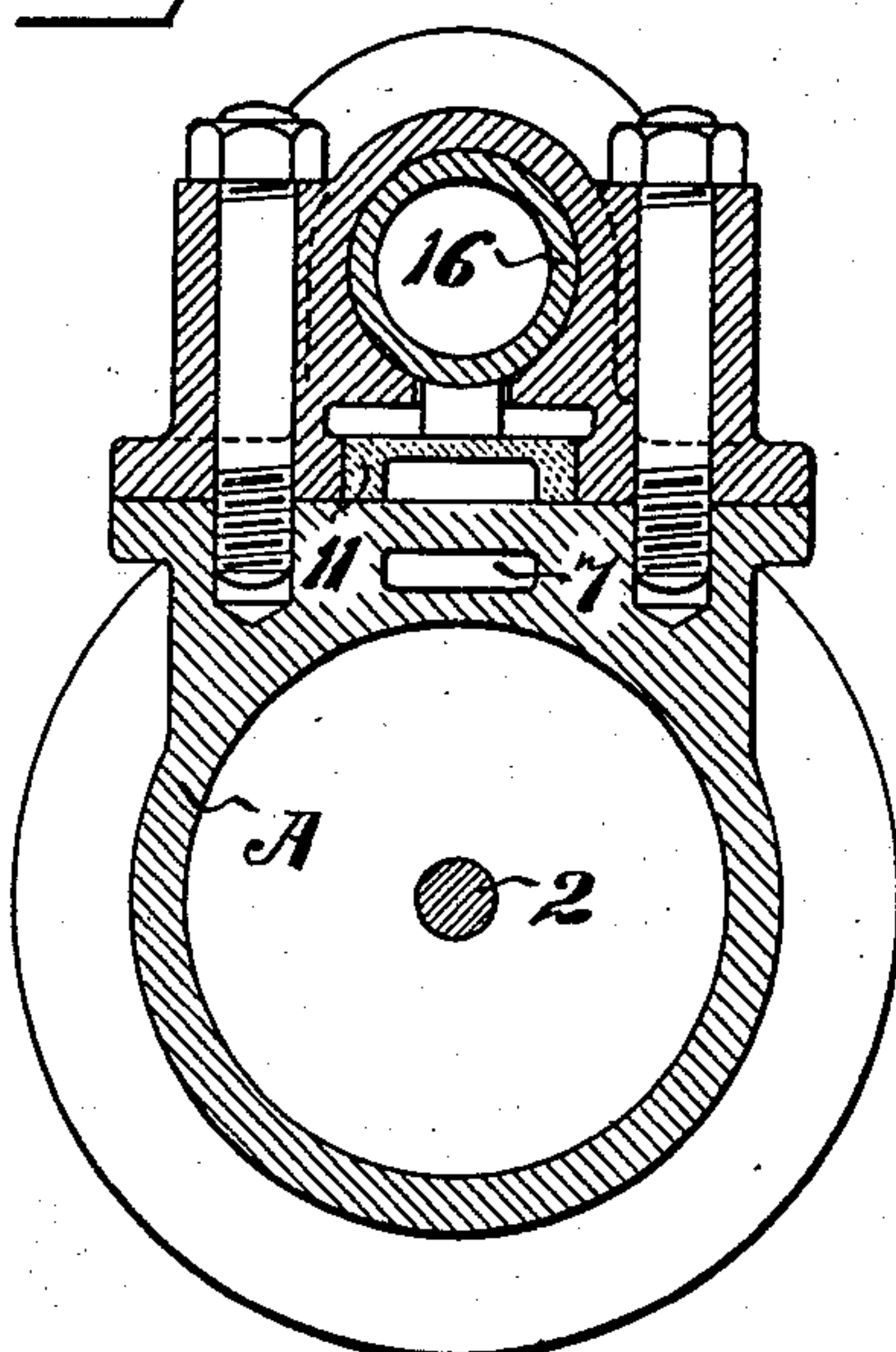
*Fig. 1.*



*Fig. 2.*



*Fig. 3.*



Witnesses,  
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By *Geo. H. Strong* atty



# UNITED STATES PATENT OFFICE.

GUSTAVE A. KROHN, OF COARSEGOLD, CALIFORNIA.

## PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 746,343, dated December 8, 1903.

Application filed March 6, 1903. Serial No. 146,504. (No model.)

*To all whom it may concern:*

Be it known that I, GUSTAVE A. KROHN, a citizen of the United States, residing at Coarsegold, county of Madera, State of California, have invented an Improvement in Pumping-Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in reciprocating engines, and particularly in that class having internally-actuated valves and which are employed for pumping and like purposes without cranks or revoluble shafts.

It consists in a novel construction of connected valves located at opposite ends of the cylinder and of independent separately-actuated plungers by which the connected valves are alternately moved.

It also consists in connections by which the plungers are alternately actuated to change the valves at the end of each reciprocation of the piston and means for exhausting the propelling medium from the plunger-chambers through the main piston to the exhaust-passage.

My invention also comprises details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical central section of my engine. Fig. 2 is a transverse section on line *x x* of Fig. 1. Fig. 3 is a transverse section on line *y y*, Fig. 1.

It is the object of my invention to reduce the number of working parts in this class of engines, to economize the use of the propelling medium, and to make the main piston serve in the place of independent valves in the operation of the valve-actuating plungers.

As shown in the accompanying drawings, A is the main cylinder, having a piston B reciprocable therein. This piston is fixed to a piston-rod 2, which when employed in conjunction with a pump located in line therewith may be connected with the pump-plunger in the usual or any suitable manner. The piston has two ends 3, each provided with packing-rings, as at 4, to form close working joints with the interior of the cylinder A. The central portion of the piston is reduced in size, as shown at 4', and

this reduced portion serves as a receiver and conductor connecting the exhaust-passage of the engine alternately with the ends of the plunger-chambers for the escape of the propelling medium which has previously been employed to force the plungers to the ends of their chambers and to thus move the valves, as will be hereinafter described.

The cylinder is provided with inlet-ports 5 at each end, connecting with an inlet-passage 6, (shown plainly in the transverse section,) and with exhaust-ports 7, which connect with an exhaust-passage 8. These ports 5 and 7 extend up into the valve-chamber 9 through a valve-seat 10, sufficiently raised above the bottom of the valve-chamber to afford clearance, so that the valves will move upon the face without forming ridges at the end of the travel. The valves are made with hollow arched interior spaces, which during the movements of the valve are caused to cover the ports 5 and 7 alternately, so that as the piston reciprocates the inlet-ports 5 will first be opened to admit the propelling medium to the cylinder at one end, while the valve at the other end is so positioned as to allow the propelling medium from that end of the cylinder to escape through the exhaust port and passage.

The valves 11 are connected by an open-centered yoke 12, which stands astride of the vertical central portion 13, which extends upwardly to the cylindrical plunger-chambers 14, located above and parallel with the cylinder A. These chambers are separated from each other by a diaphragm, as at 15, and the plungers 16, suitably packed by water-grooves or equivalent packing, are adapted to reciprocate in the chambers 14. These plungers are made separate and independent from each other, as shown, and steam to alternately actuate them is admitted at the proper time through the ports 17 and 17<sup>a</sup>. In order to transmit the movements of these pistons to the valves and also to connect the pistons so that they move in unison with each other as well as with the valves, I have shown the plungers having grooves formed around them, as at 18, and lugs 19 extending upwardly from the valves to enter these grooves. It will thus be seen that when either of the plungers is moved within its chamber it acts, through the



lug 19, to move the valve, and this, acting through the connecting-yoke 12, will move the valve at the other end, and through the corresponding lug will engage and move the plunger at that end.

The ports 17 and 17<sup>a</sup> are so formed as to connect with the interior of the cylinder A at such points that when the piston has moved to one end of the cylinder the opposite end of the piston will open communication with the port 17 at the receiving end of the cylinder, and the medium which has driven the piston to the end of its stroke will be admitted through the port 17 into the chamber at the inner end of one of the plungers 16. This medium acting upon the plunger immediately moves the valve 11 so as to cut off further supply of the propelling medium to that end of the cylinder and to open communication between the admission and exhaust ports at that end, as previously described. This movement of the plunger 16, being communicated as before described, returns the other plunger, and with it changes the position of the opposite valve so as to admit the medium under pressure to return the piston. At the same time that these changes take place the central reduced portion of the main piston is in such position as to admit the exhaust from the second plunger 16<sup>a</sup>, which is being returned toward the center, and from this central piston-chamber the medium is allowed to pass through a passage 20, which connects the interior of the main cylinder with the exhaust-passage 8. This passage 20 is never uncovered by the piston in its reciprocations, and the interior of the piston connecting with it thus provides all the means for alternately exhausting the medium from the plunger-chambers without the use of any supplemental valves for this purpose.

In order to insure the proper admission of the propelling medium to operate the plungers 16 16<sup>a</sup>, I have shown the end of the piston beveled or cut away, as shown at 21. These cut-away portions may be in the form of one or more slots around the periphery of the piston ends, and in order to insure communication with the plunger-chambers the cylinder may have shallow grooves or channels made in its interior, as shown at 22, so that these grooves or channels will coincide with the slots or cut-away portions 21 when the piston has reached the extreme end of its stroke in either direction, and thus insure the admission of the propelling medium through the ports 17 to the inner ends of the plunger-chambers, as previously described.

In order to maintain the piston in its proper position and prevent its revolving or the slots 21 becoming displaced in case there is no groove in the cylinder, I have shown guide-pins 23 projecting through openings in the side of the cylinder and entering grooves or channels formed longitudinally in the central portion of the piston, and in order to prevent the packing-rings at the ends of the piston

from turning in their seats I have shown pins 24 extending into the piston ends and in such a manner that half of each pin lies in the body of the piston end and the other half in a groove or channel made in the rings.

25 represents passages extending outwardly from the inlet-ports 5, and 26 represents screw-plugs entering these passages from the outer end and capable of moving the inner ends into or out of the passages 25. These passages 25 are connected by short radial passages 27 with the interior of the cylinder A at each end in such a manner that when the inlet-port is covered just previous to the arrival of the piston at that end of the cylinder the propelling medium will not be allowed to pass through this supplemental port from the end of the cylinder, and it thus forms a cushion to prevent the piston striking the cylinder-head. The amount of cushion is regulated by turning the screw 26, so as to cause the inner end to extend more or less across the passage 27. Thus the passage 27 may be partially closed to limit the admission of steam and reduce the cushion, or by turning the screw-plug it may be closed so as to form a full cushion when the engine is running at high speed.

The counterbore at the outer ends of the plunger-chambers 14 extends sufficiently beyond the valve-chamber to make an absolute cushion for the plungers at the outer ends, and only the two central ports 17 17<sup>a</sup> are necessary in the operation of these independent plungers, the main piston acting, as before described, as a valve to control these ports.

The yoke 12 may be provided with lugs 12<sup>a</sup>, which serve for the introduction of a starting-bar in case such a device should be necessary to first move the valve and set the apparatus into operation.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination in a reciprocating engine of a cylinder and a piston movable therein, connected valves at opposite ends of the cylinder, independent plungers and a vertical centrally-located diaphragm extending from the cylinder and forming separate chambers in which said plungers are movable axially in line and parallel with the movement of the main piston, said valves parallel with and interposed between the plungers and cylinder and having lugs connecting the valves with each of the pistons and said cylinder having separate ports connecting it with the ends of the plunger-chambers.

2. A reciprocating engine consisting of a main cylinder and a piston reciprocable therein, said cylinder having a radial diaphragm extending from it and forming separate chambers axially in line above and parallel with the main cylinder, plungers movable therein having grooves or channels in their outer surfaces, valves interposed between the plun-



gers and cylinders and coincident with inlet and outlet ports at each end of the main cylinder, said valves having lugs projecting into the grooves of the plungers, and an open center yoke or connection standing astride the said diaphragm and by which the valves are united.

3. An engine consisting of a main cylinder, a piston reciprocable therein, inlet and outlet ports in close proximity with the ends of the cylinder and a valve-chamber with which said ports connect, slide-valves controlling the ports at each end of the cylinder, said cylinder having a centrally-located diaphragm extending across the valve-chamber and an open-center yoke standing astride the diaphragm and by which said valves are connected to move in unison, separate plunger-chambers formed by the said diaphragm and disposed axially in line and parallel with the main cylinder, independent plungers reciprocable in said chambers and lugs by which they are connected with the valves, whereby the valves and plungers are moved in unison, ports connecting the inner ends of the plunger-chambers with the main cylinder and entering said cylinder at such points that they are uncovered by the movements of the main piston to alternately admit the propelling medium into the plunger-chambers and exhaust it therefrom.

4. An engine consisting of a main cylinder having a centrally-located diaphragm extending radially from it, separate plunger-chambers parallel therewith and axially in line with each other, said diaphragm forming a closed partition between the inner ends of said chambers, plungers in said chambers, inlet and exhaust ports connecting with opposite ends of the cylinder and valves parallel with and interposed between the plungers and the main cylinder, and controlling said ports and connected to move in unison, connections between each of said valves and the plungers, supplemental ports connecting the contiguous ends of the plunger-chambers with the interior of the main cylinder, a piston movable in main cylinder having the ends packed to form tight movable joints, and an intermediate chambered portion, said piston acting to alternately admit a propelling medium through one of the supplemental ports to propel its plunger and to connect the other plunger-chamber with the intermediate chamber of the piston and a port connecting said intermediate chamber with the main exhaust-passage of the engine.

5. An engine consisting of a main cylinder, separate plunger-chambers axially in line and parallel with the main cylinder and plungers reciprocable therein, a plurality of valves, and inlet and outlet ports at opposite ends of the cylinder controlled by said valves, connections between the valves and connections between each valve and one of the plungers whereby the valves and plungers are movable

in unison, closed cushion-chambers at the outer ends of the plunger-chambers, ports connecting the inner ends of the plunger-chambers with the main cylinder, a piston movable in said cylinder chambered to alternately connect said ports with the source of supply of the propelling medium and with the main exhaust-port of the engine.

6. In an engine of the character described, a main cylinder having a radially-extending diaphragm forming at each side thereof parallel with the main cylinder a plunger-chamber, plungers operatable in said chambers and ports connecting the inner ends of the chambers with the main cylinder at points near the end of the inward travel of the receiving ends of the piston, and a piston movable in the cylinder, having an intermediate chamber connecting the inner ends of the plunger-chambers with the main exhaust-passage, said piston having grooves or slots on the outer ends whereby communication is made through the said ports with the inner ends of the plunger-chambers at the end of each reciprocation of the piston.

7. In an engine of the character described, a main cylinder, having a centrally-located radially-extending diaphragm forming a closed division between axially-aligned plunger-chambers, independent plungers in said chambers valves beneath the plungers and parallel therewith and with the main cylinder said valves connected and movable in unison, a piston movable in the main cylinder and having packed ends and an intermediate chamber connecting the plunger-chambers with the main exhaust-passage, grooves or slots on the outer ends of the piston whereby communication is made through the interior ports with the inner ends of the plunger-chambers at the ends of each reciprocation of the piston, and circumferential grooves interior to the main cylinder positioned to coincide with the plunger valve-ports and with the piston-slots at the end of the piston-stroke.

8. An engine consisting of a main cylinder, a diaphragm forming a closed partition between the inner ends of the chambers, plunger-chambers parallel therewith and axially in line, independent plungers movable in said chambers, valve-ports and valve-chambers and ports connecting the ends of the main cylinder with said chambers, valves controlling said ports, connected together and with the plungers, and a piston having circular ends adapted to form tight joints and an intermediate chamber connecting the main exhaust-port with the plunger-chambers.

9. A reciprocating engine consisting of a main cylinder, a piston packed at both ends and having a centrally-inclosed chamber, ports at opposite ends of the cylinder and valve-chambers with which the ports communicate, said cylinder having a centrally-located radial diaphragm forming a closed division between the valve-chambers and



axially-alined plunger-chambers, valves slidable in each chamber and controlling the inlet and outlet ports, and connections between the valves, plungers and separate chambers  
5 axially in line in which the plungers reciprocate parallel with the cylinder, ports connecting the interior of the cylinder with the inner ends of the plunger-chambers whereby said ports are controlled by the main piston,

and connections between the valves and the 10 plungers.

In witness whereof I have hereunto set my hand.

GUSTAVE A. KROHN.

Witnesses:

S. H. NOURSE,

JESSIE C. BRODIE.