(No Model.) 3 Sheets—Sheet 1.

W. L. CROUCH.

VALVE DEVICE FOR GAS ENGINES.

No. 573,322. Patented Dec. 15, 1896.

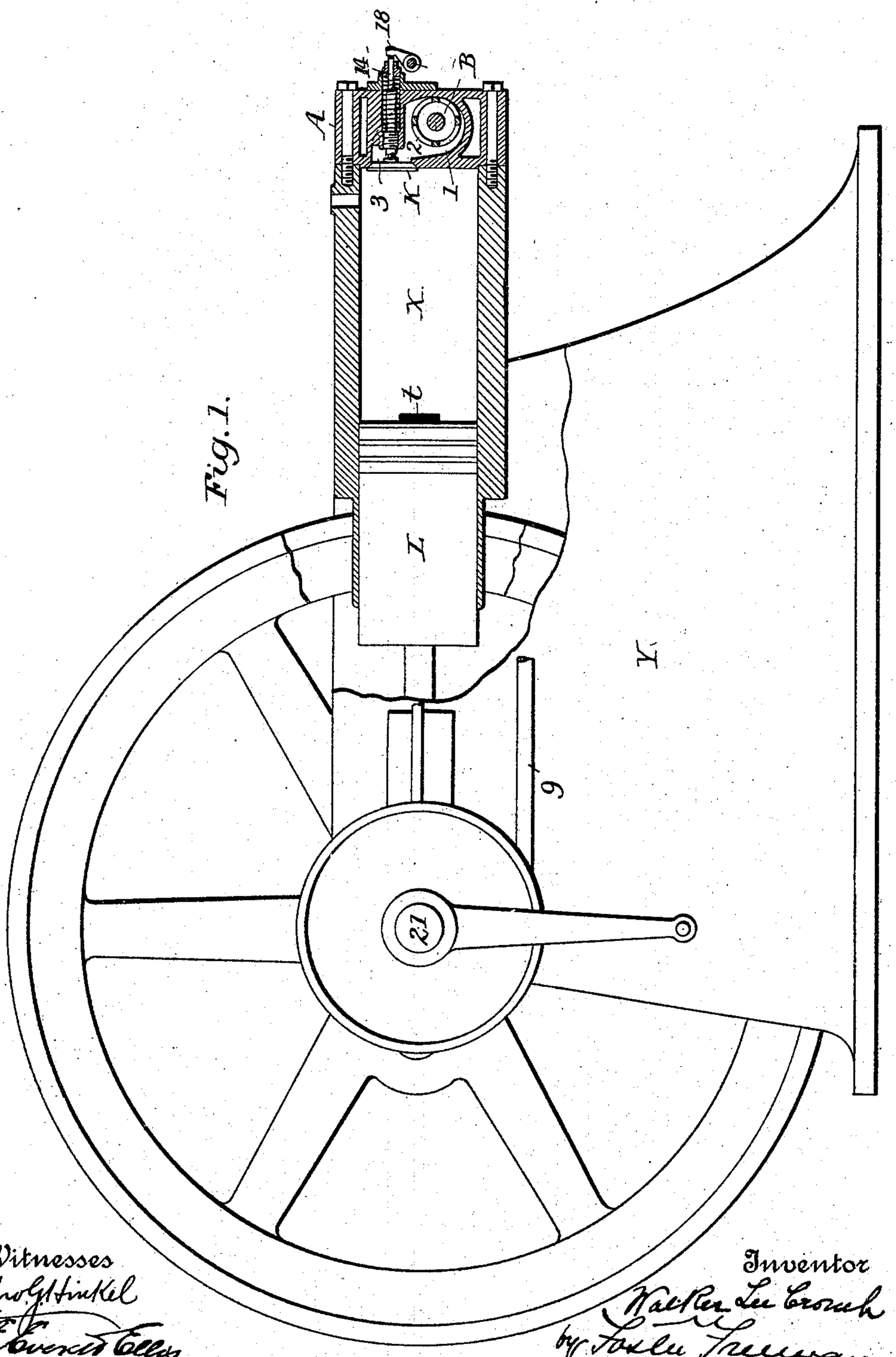

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2

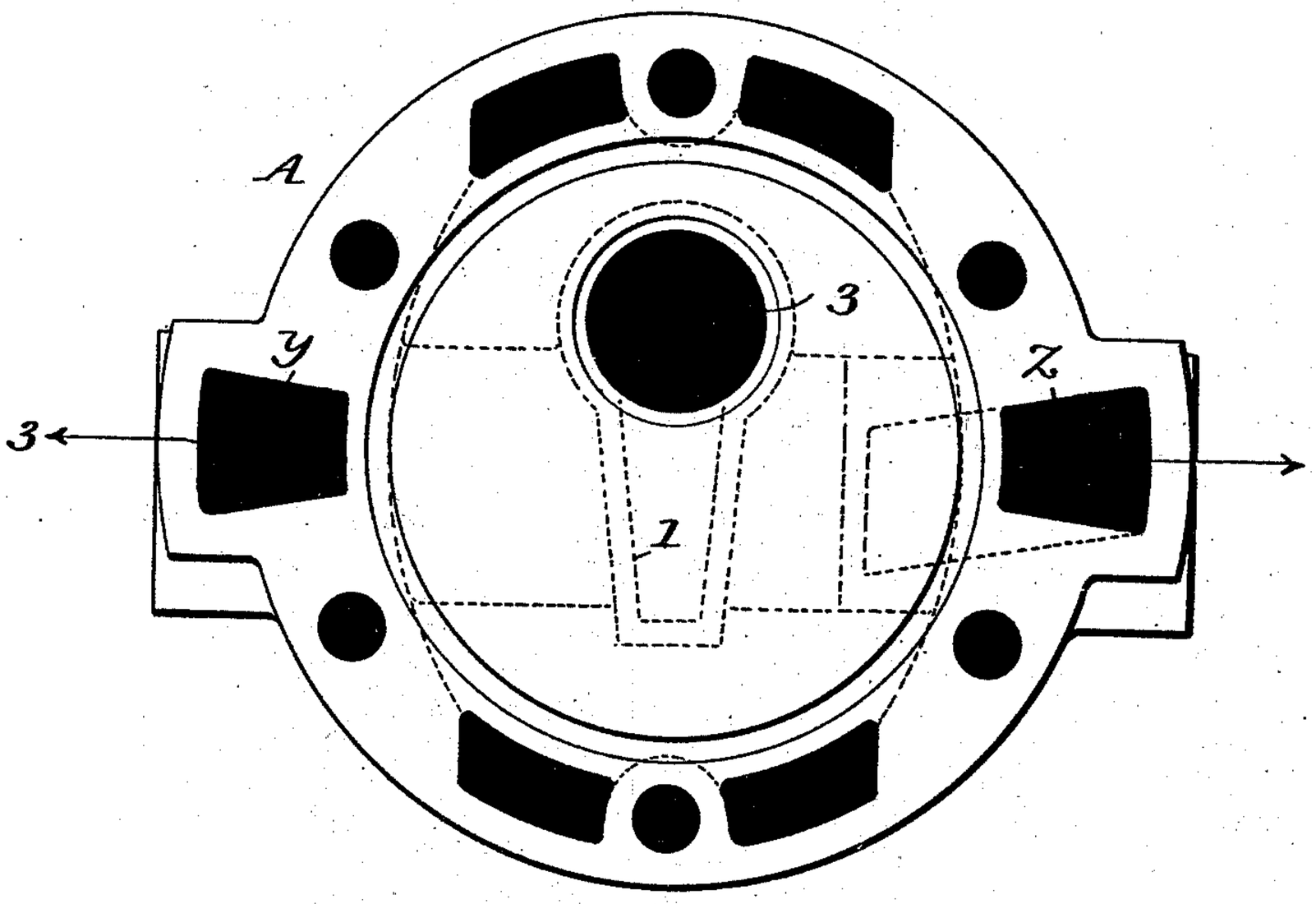
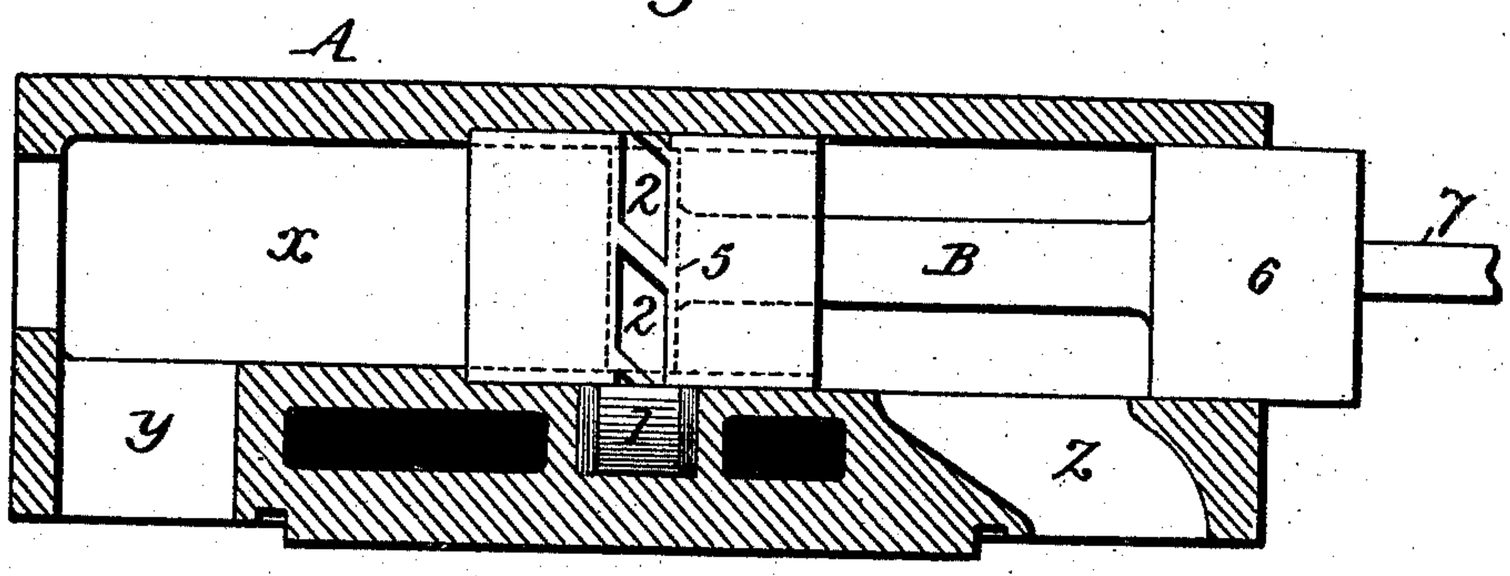


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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VALVE DEVICE FOR GAS ENGINES.

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Fig. 3.

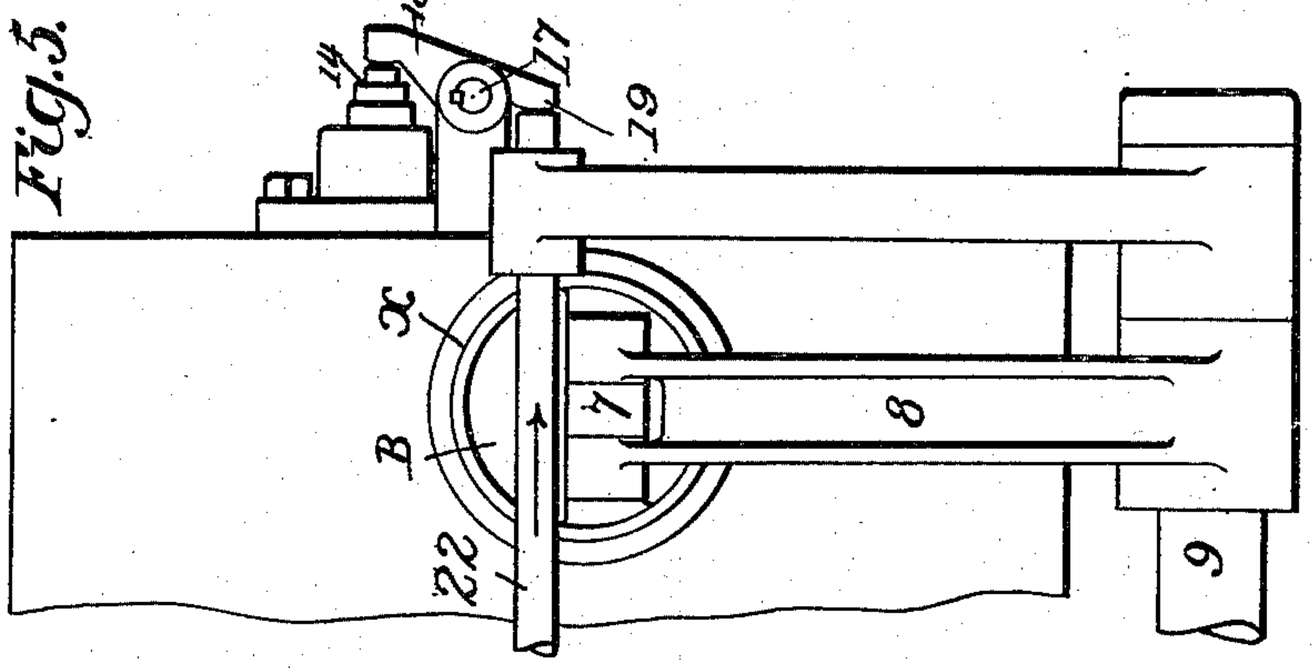
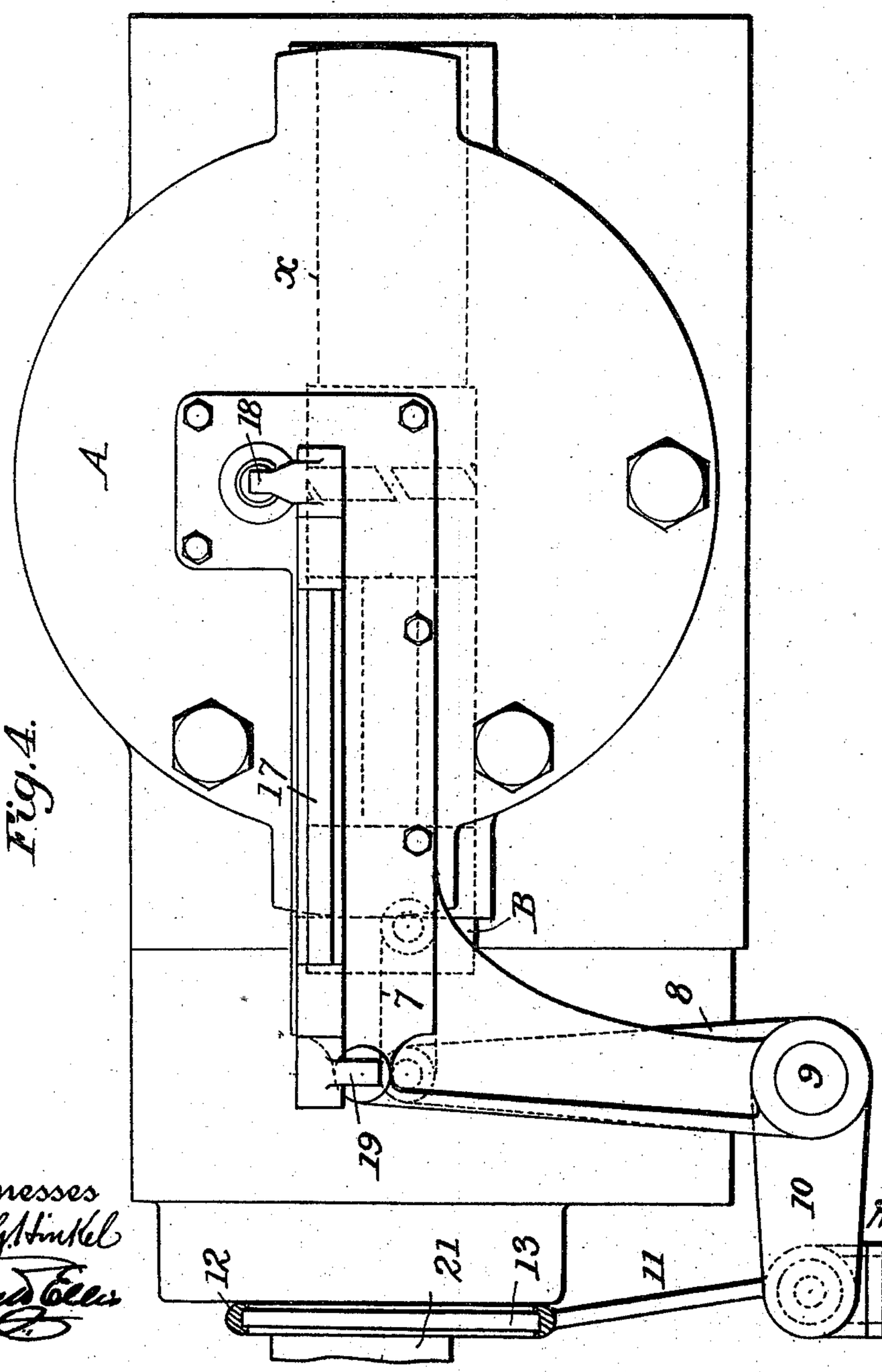


Fig. 4.



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UNITED STATES PATENT OFFICE.

WALKER LEE CROUCH, OF NEW BRIGHTON, PENNSYLVANIA, ASSIGNOR TO THE PIERCE-CROUCH ENGINE COMPANY, OF SAME PLACE.

VALVE DEVICE FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 573,322, dated December 15, 1896.

Application filed November 22, 1895. Serial No. 569,830. (No model.)

To all whom it may concern:

Be it known that I, WALKER LEE CROUCH, a citizen of the United States, residing at New Brighton, in the county of Beaver and State of Pennsylvania, have invented certain new and useful Improvements in Valve Devices for Gas-Engines, of which the following is a specification.

My invention relates to explosive gas-engines; and my invention consists in a gas engine provided with an outlet-port at one end and valve adapted thereto, with means for positively lifting the valve according to the speed of the engine, and a second valve and means for regularly reciprocating the same to control the inlet and discharge, all as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of sufficient of a gas-engine to illustrate my invention. Fig. 2 is a view looking toward the rear head of the cylinder. Fig. 3 is a transverse plan on the line 3 3, Fig. 2. Fig. 4 is a rear end view, and Fig. 5 a side view of the engine at the rear.

The cylinder X of the engine is provided at the rear end with the usual detachable head A, and the frame Y supports the bearings of the usual crank-shaft 21. In the head is a port 3, closed by a valve K, and this port constitutes both the inlet-port for the charge and one of the outlet-ports for the spent gases, there sometimes being a forward exhaust-port *t*, which is uncovered by the piston as it reaches its forward position, and in such cases it is only necessary to lift the valve K to permit the gases to be driven out through the port 3 when it is desired that the next forward movement of the piston L shall exert a drawing or suction action to draw in a new charge. This particular action of the piston is fully set forth in my application, Serial No. 569,829, filed November 22, 1895. In the said engine, however, there are two inlet-ports and two valves, whereas in the present construction there is but a single port 3 and a single valve K, which may be operated regularly or at irregular intervals, as circumstances require and according to the action of the governor. I desire, however, to secure a positive opening and closing of the communication between the port when used as an exhaust-port and the exhaust or discharge outlet or channel of the apparatus and the channel which constitutes the inlet for the gas charge, and to this end I make use of a positively-acting valve, as I will now describe.

In the cylinder-head A is formed a transverse chamber *x* for the piston-valve B, upon the stem of which are two pistons 5 6, and around the opening or valve-chamber *x*, near the center of the same, is a channel 1, which communicates with the valve-chamber through ports 2, and also communicates with the port 3.

The chamber *x* at one end communicates with the exhaust-port *y* and at the other end with the inlet-port *z*, into which the mixture of gas and air may be drawn.

After an explosion the backward movement of the piston L will compress the spent gases left in the cylinder, and on the forward movement these will expand, and this will continue so long as the engine is running in excess of the normal rate of speed. When, however, the speed decreases below the proper normal speed, the introduction of fresh explosive charges should begin, and therefore the valve K upon one of the inward movements of the piston is lifted, so that the piston will force the spent gases through the port 3, the channel 1, the ports 2, and into the chamber *x* and to the exhaust-port *y*, the valve B being shifted to the right, so as to uncover the ports 2. Upon the next outward movement of the piston the valve B will be shifted to the left, so as to occupy a position between the ports 2 and the port *y*, and the exhausting action of the piston will therefore draw in a charge of gas and air through the ports *z*, chamber *x*, and ports 2 and 3, the valve K being held open by the valve-controlling mechanism and is not seated until the exhausting or suction stroke is nearly complete. This makes no negative work on the piston of the engine in having to force valves open by pressure or lift them from their seats by suction. Upon the next backward movement of the piston the valve K will seat itself, the charge will be compressed and then ignited and exploded, and these operations will continue until the speed of the

engine becomes excessive, when a positive lifting of the valve K on the backward movement of the piston will be arrested and the valve will remain in its seat and the spent gases will not be discharged through the port 3, but will remain in the cylinder and no further explosions will take place.

Various means may be used for moving positively the valve K to open it whenever the engine slows down. As shown, there is a rock-shaft 17, provided with an arm 18, which bears against the end of the spindle 14 of the valve K, and with another arm, 19, which bears against the end of the rod 22, which is controlled by the governor and which is moved outward in the direction of its arrow at each alternate backward movement of the piston until the speed of the engine becomes excessive, when the backward movement of the rod 22 ceases, as set forth in my aforesaid application, it therefore not being necessary in this application to specify the particular means for imparting this movement to the rod. The action of the governor also arrests the backward movement of the rod 22 whenever the speed becomes excessive.

A regular reciprocating movement is imparted to the valve B from any moving part of the apparatus in any suitable manner. As shown, the said valve is connected by a link 7 with an arm 8 upon a rock-shaft 9, an arm 10 of which is connected by a rod 11 with a strap 12 upon an eccentric 13 on the crank-shaft 21.

It will be seen that the ports *y z* are alternately put in communication with the channel 1, leading to the port 3, so that the latter is alternately the inlet-port and the outlet-port, and that these movements of the valve B are positively and regularly controlled; but that the inlet of the new charges and the discharge of the gas within the cylinder depend upon the movement of the valve K, which when lifted on the backward movement of the piston causes the contents of the cylinder to be discharged, so that the next forward movement of the piston causes an exhaust action, drawing in a new charge, while the failure to lift the valve K maintains the spent gases within the cylinder, so that the engine runs wholly by its momentum until its speed is reduced.

Without limiting myself to the precise arrangement and construction of parts shown or described, nor to any special means for moving either of the valves, I claim as my invention—

1. A gas-engine having its cylinder provided at the rear with a port serving both for the admission of gases to and their discharge from the cylinder, inlet and exhaust passages communicating with said port and a valve constructed to close the communication between both passages and said port when in mid-position and to open communication between said port and one of said passages according to the direction in which the valve is shifted, substantially as described.

2. The combination with the cylinder of a gas-engine of a port, a valve K fitted to said port, a spring for holding the valve in its position to close the port, means for operating the valve positively to open the port during the backward movement of the piston, inlet and exhaust ports, and a valve and means for positively operating the same to put the said inlet and exhaust ports alternately in communication with the port closed by the valve K, substantially as set forth.

3. The combination of a piston-cylinder having a transverse valve-chamber *x* communicating at opposite ends with inlet and discharge ports, and intermediate ports 2, a valve having two pistons sliding in said chamber, and means for positively reciprocating said valve, a port 3 communicating with the ports 2, and a valve K adapted to the port 3, a spring for keeping the valve in its seat, and means for lifting the said valve, substantially as set forth.

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

WALKER LEE CROUCH.

Witnesses:
E. H. THOMAS,
IRVIN K. CAMPBELL.