

No. 688,426.

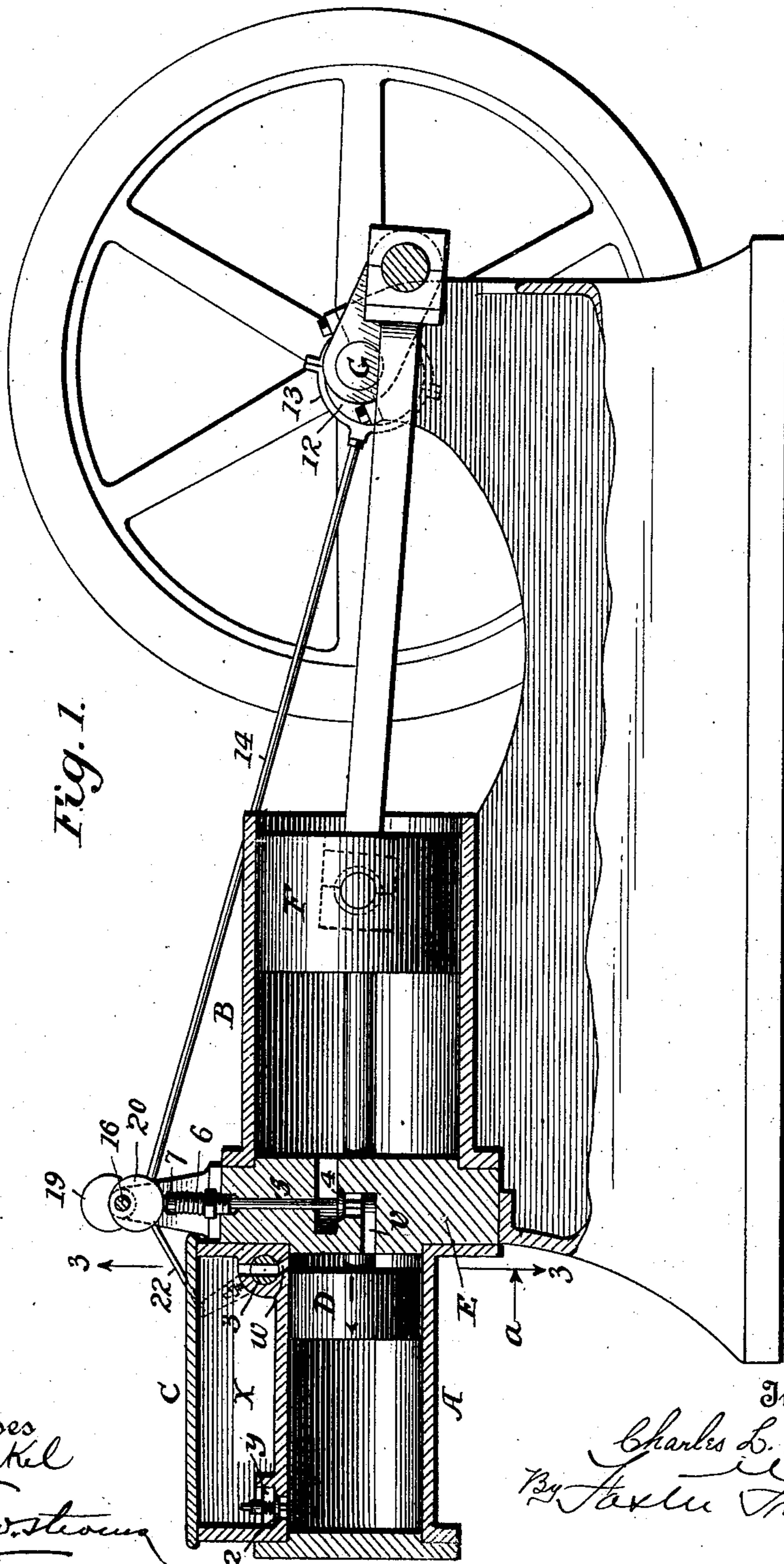
Patented Dec. 10, 1901.

C. L. MAYHEW.  
GAS ENGINE.

(Application filed Aug. 11, 1896.)

(No Model.)

3 Sheets—Sheet 1.



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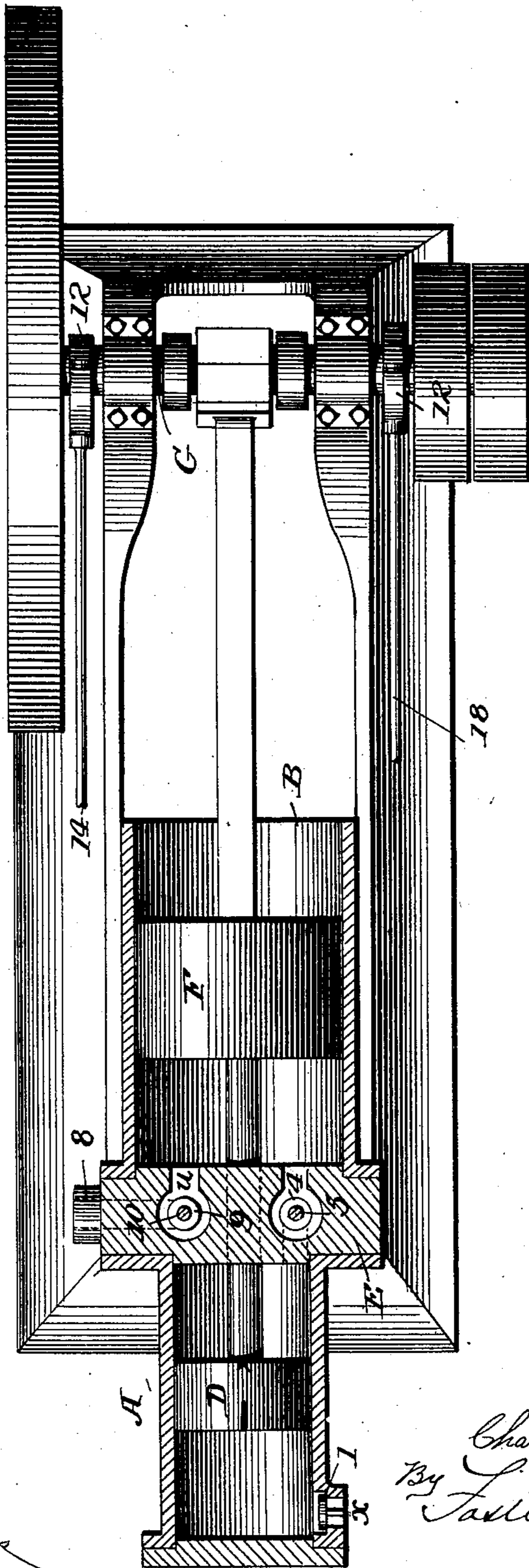
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3 Sheets—Sheet 2.

Fig. 2.



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Fig. 3.

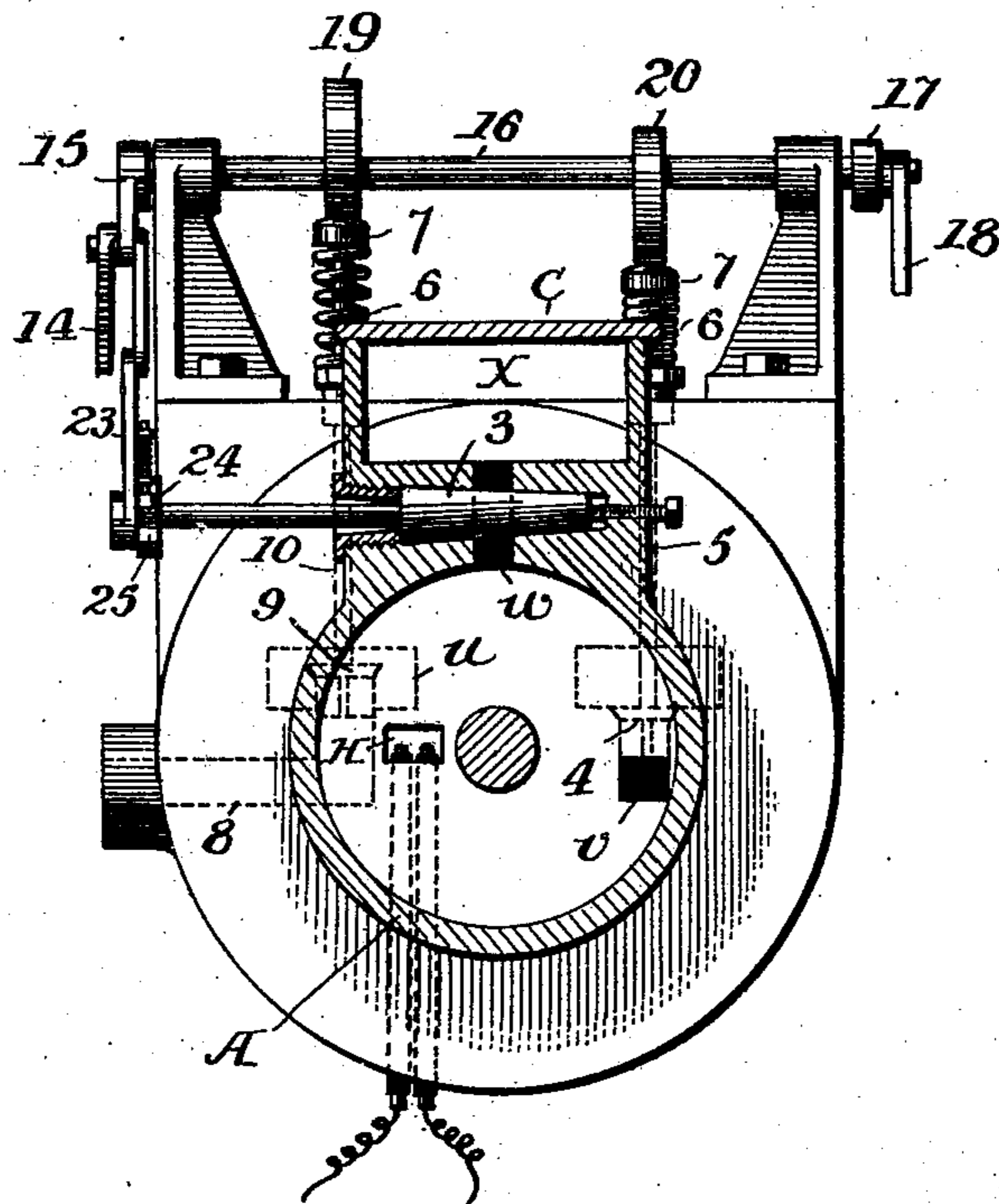
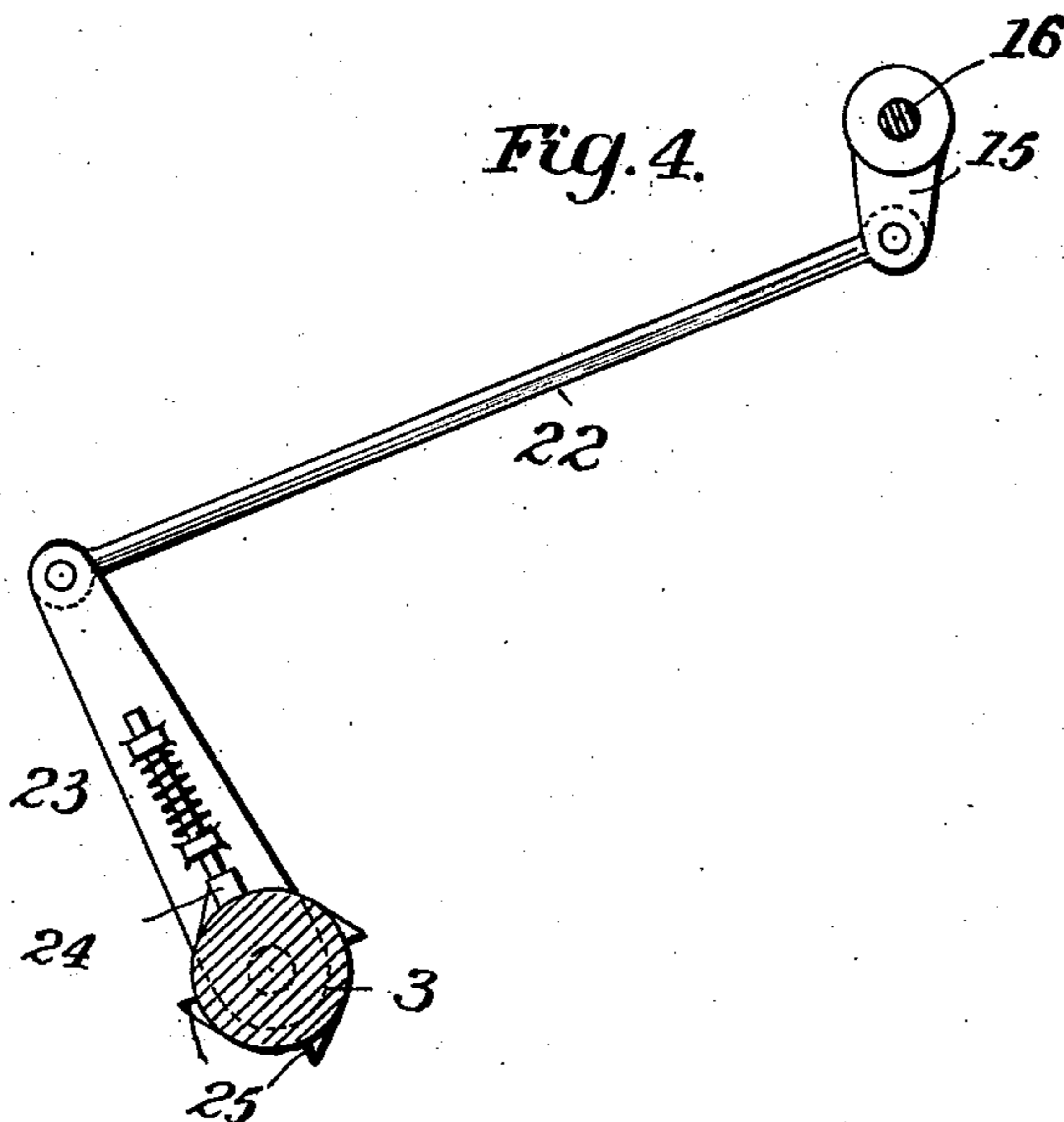


Fig. 4.



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# UNITED STATES PATENT OFFICE.

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## GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 688,426, dated December 10, 1901.

Application filed August 11, 1896. Serial No. 602,437. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES L. MAYHEW, a citizen of the United States, residing at Saratoga Springs, in the county of Saratoga and State of New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to certain improvements in gas-engines; and it consists in means of utilizing the gases after they have acted explosively to move a piston in one direction, as fully set forth hereinafter and as illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a gas-engine embodying my improvements. Fig. 2 is a plan in longitudinal section. Fig. 3 is a transverse section on the line 3 3, Fig. 1, looking in the direction of the arrow *a*. Fig. 4 is a detached view of one of the valve-operating devices.

In carrying out my improvement I make use of two cylinders A B, which may be in line with each other, as shown, or they may be one alongside of the other. Adjacent to the cylinder A is a casing C, containing a chamber X, and in the cylinder A reciprocates a piston D.

The cylinder A is provided with an inlet-port *x*, into which is drawn the charge of mixed air and gas or carbureted air, a valve 1 opening freely to admit the entrance of this charge when the piston moves in the direction of the arrow, Fig. 2.

Between the cylinder A and the chamber X is a port *y*, closed by a spring-seated valve 2, so that when the piston D moves in the direction of its arrow, Fig. 1, the charge is forced into and compressed in the chamber X. A port *w*, between the chamber X and the forward end of the cylinder A, is closed by any suitable valve 3, a plug-valve being shown.

The cylinder A communicates with the cylinder B through a channel *v*, provided with a valve 4, a puppet-valve being shown upon a stem 5, passing through the valve-casing E, to which the heads of both cylinders A B are bolted, and above the top of said casing the stem 5 is surrounded by a spring 6, which bears upon a head 7 on the valve-stem and tends to lift the valve. Another port *u* in the valve-casing E extends through the same, communicating with the interior of the cylin-

der B and with the exhaust-pipe 8, and this port is closed by a puppet-valve 9, the stem of which extends through the casing and, like the stem of the valve 4, is provided with a spring 6 and head 7, so that the spring normally lifts the valve.

The piston F of the cylinder B is connected to the crank of the crank-shaft G, and an eccentric 12 upon the latter is encircled by a strap 13, from which a rod 14 extends to an arm 15 on a shaft 16. At the opposite end of the shaft 16 is another arm 17 at right angles to the arm 15, and this is connected by an arm 18 with the strap of a second eccentric arranged upon a shaft G at right angles to the eccentric 12. The reciprocation of the rods 14 18 imparts a rotary motion to the shaft 16, which carries two cams 19 and 20, that serve to depress the stems of the valves 4 9 to close them at proper times, the cams being constructed to hold the valves closed during the proper intervals. The valve 3 is operated from one of the arms 15 or 17 through the medium of a rod 22, connecting with an arm 23, which swings upon the stem of the valve 3. The arm 23 has a spring dog or pawl 24, which on the backward movement of the arm 23 engages one of four lugs 25 on the valve-spindle, so that at each backward movement of the arm 23 the valve 3 is turned so that it is opened for an instant. This occurs when the piston D is in the position shown in Fig. 1, so that a charge of explosive mixture passes through the port *w* into the cylinder A forward of the piston. After the valve 3 closes the charge is exploded by any suitable igniter, an electrical igniter H being shown with two separated terminals across which a spark may be caused to pass in any suitable manner.

The backward movement of the piston D in the direction of the arrow, Fig. 1, compresses a certain amount of material in the chamber X, and as the piston reaches the limit of its backward movement the valve 4 is opened. On the opening of the valve 4 the exploded gases in the cylinder A flow through the port or channel *v* into the cylinder B. As will be seen, the cylinder B is larger in diameter than the cylinder A, preferably having a piston of double the area of the piston D, so that there is a preponderance of pressure upon the piston F proportional to the difference in area

between the two pistons, and the piston F therefore moves forward under the pressure of the gases, carrying with it the piston D. When the pistons reach the limit of their forward movement, the valve 9 is opened, permitting the contents of the cylinder B to exhaust to the atmosphere, while the piston D, carrying with it the piston F, is carried forward under the explosion of a fresh charge.

It will thus be seen that I make use of each charge of gas and air, first, to propel the pistons in one direction under the explosion of the charge, and, secondly, to propel them in the opposite direction under any expansive action that the gas may have and also owing to the difference in the areas of the pistons.

While I have shown the cylinder A as combined with a chamber X, this is not absolutely necessary, as the cylinder A may be supplied with charges in any suitable manner. So, also, while I have shown certain forms of valves and certain devices for operating the same these are not essential and may be modified or changed, as may be desired.

Without limiting myself to the precise construction and arrangement of parts shown, I claim as my invention—

1. The combination in a gas-engine, of a high-pressure cylinder, a low-pressure cylinder, a valve-casing between adjacent ends of the cylinders, said casing having a passage affording communication between the adjacent ends of said cylinders, and also having an exhaust-port leading from the low-pressure cylinders, valves controlling said passage and

port, a chamber for containing an explosive mixture under pressure having communication with the end of the high-pressure cylinder adjacent the valve-casing, a valve to control such communication, and means for positively and independently actuating each of said valves, substantially as set forth.

2. In a gas-engine, the combination of high and low pressure cylinders arranged tandem, a valve-casing between the adjacent ends of the said cylinders, said casing having a passage affording communication between the cylinders and also having an exhaust-port leading from the low-pressure cylinder, valves controlling said passage and port, pistons in said cylinders connected to move together in either direction, a chamber supported adjacent to the high-pressure cylinder and having valved passages affording communication with each end of the latter, the valve remote from the said valve-casing, being automatic in its operation, and means for independently and positively operating the valves in said passage between the two cylinders, the exhaust-port and the passage between the chamber and the end of the high-pressure cylinder adjacent to the valve-casing, substantially as set forth.

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

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