No. 681,704. Patented Sept. 3, 1901.

M. W. JAMIESON.

GAS ENGINE.

(Application filed May 31, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

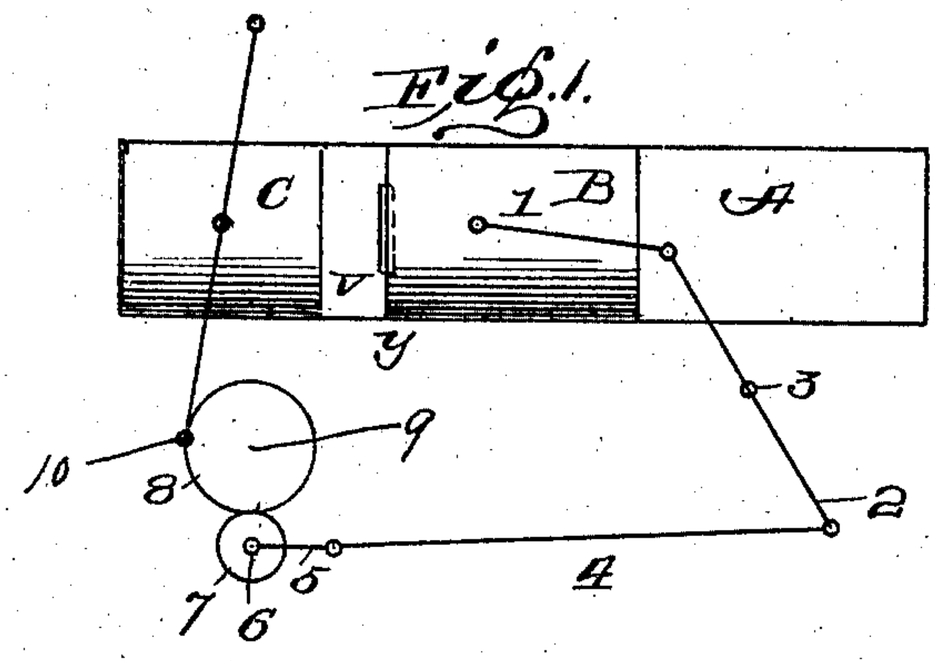


Fig. 2.

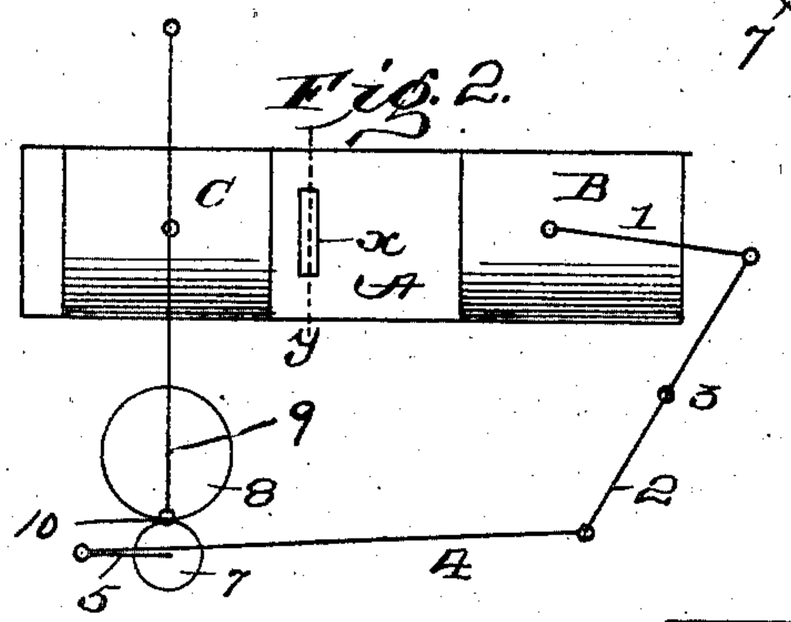


Fig. 3.

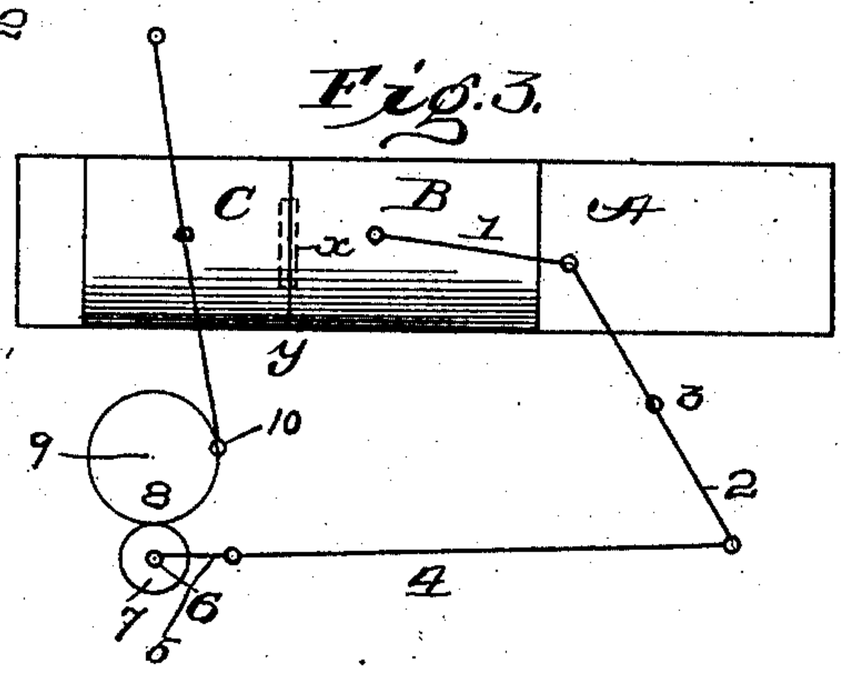
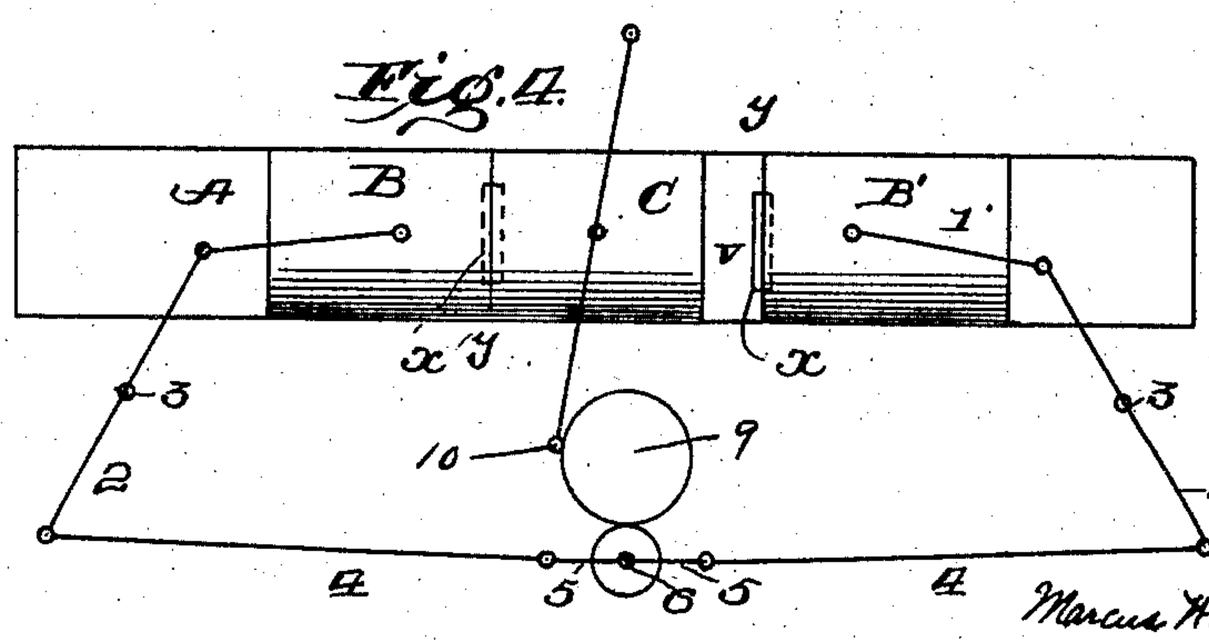


Fig. 4.



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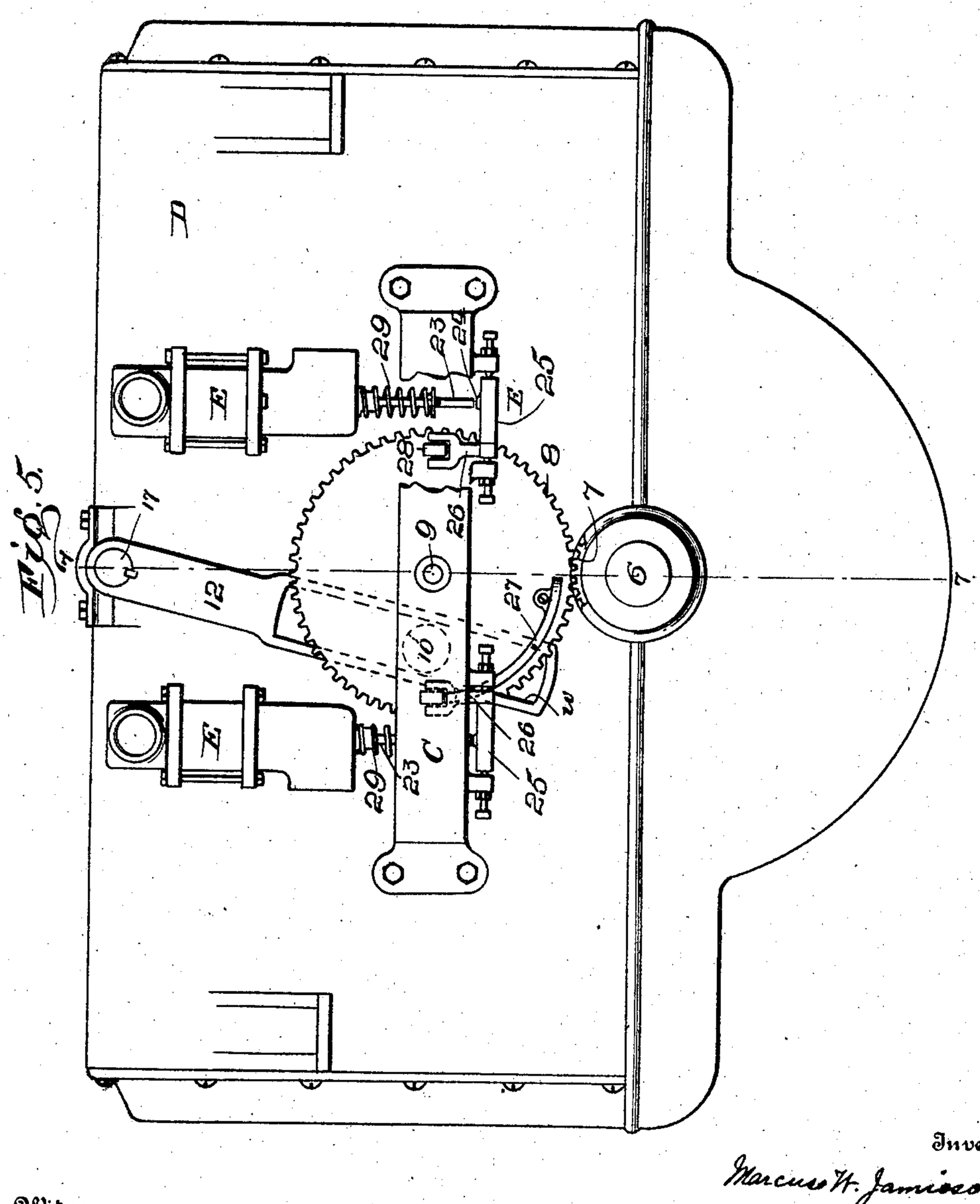
4 Sheets—Sheet 2.



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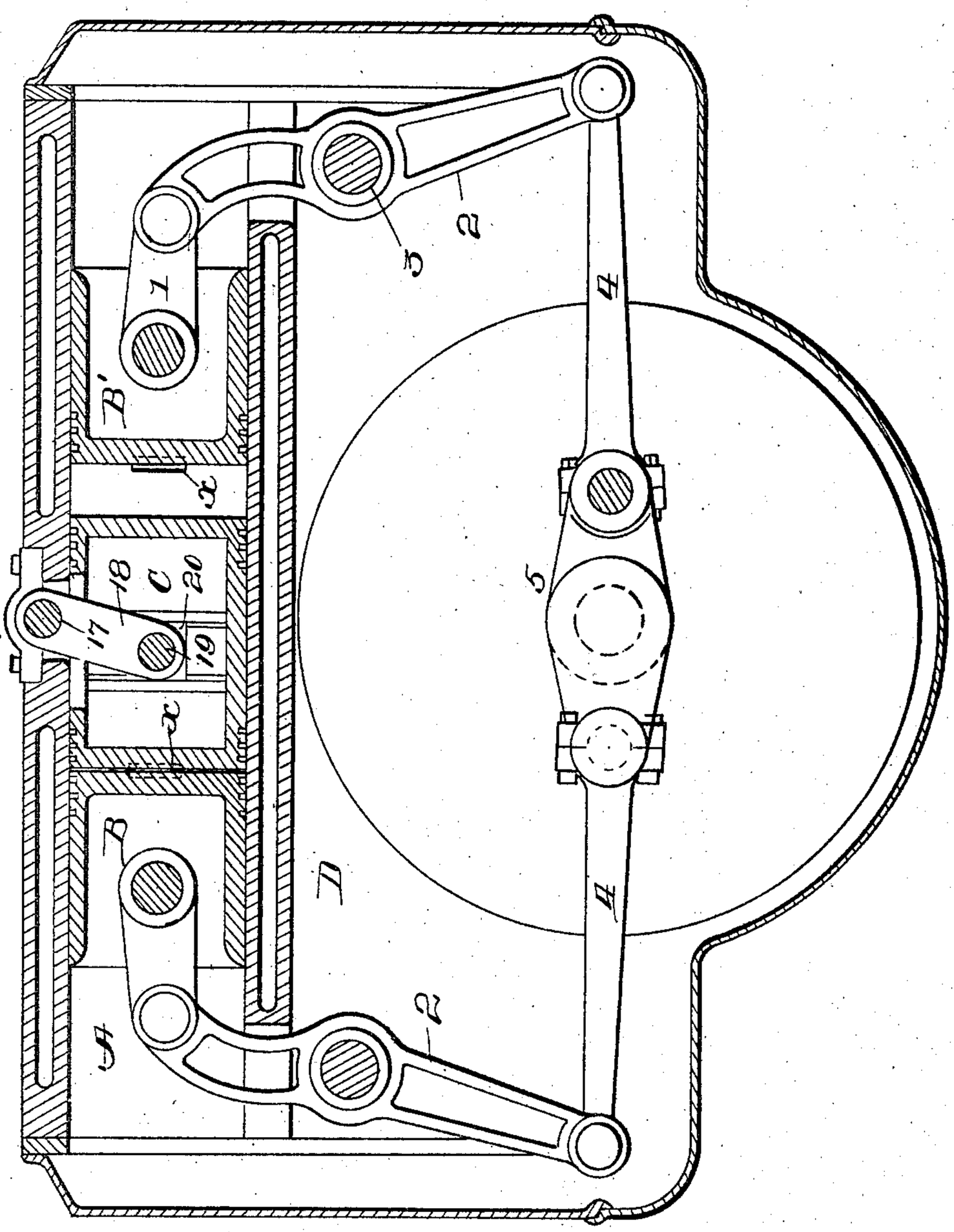
(Application filed May 31, 1900.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 6.



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4 Sheets—Sheet 4.

Fig. 8

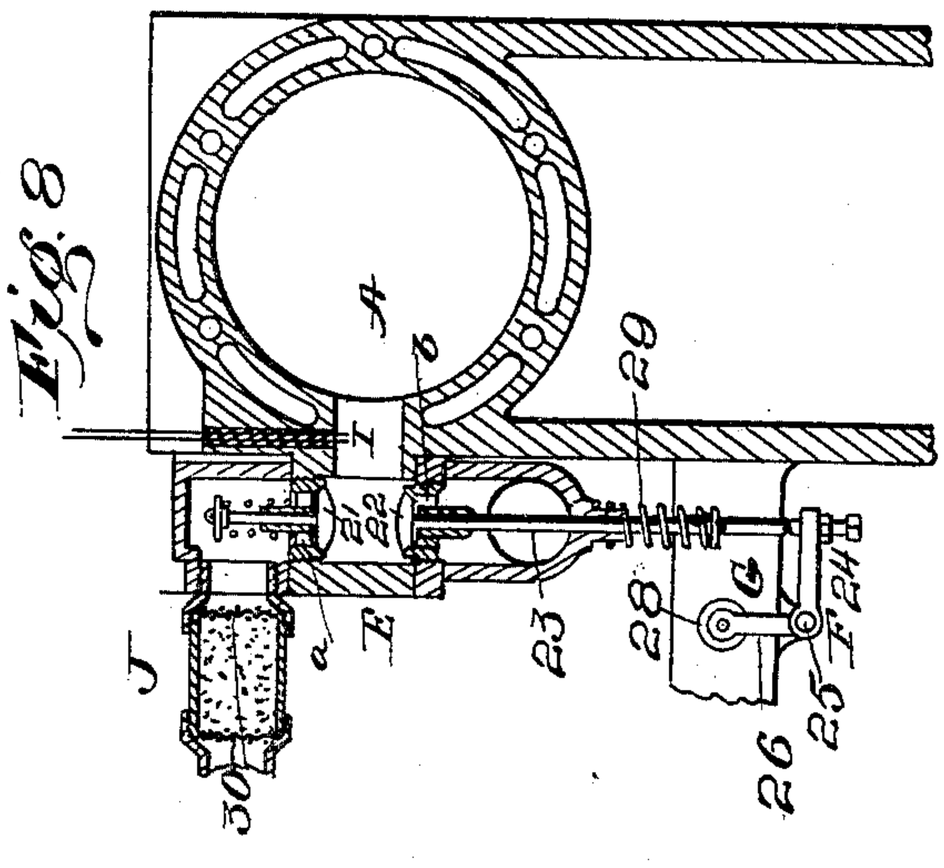
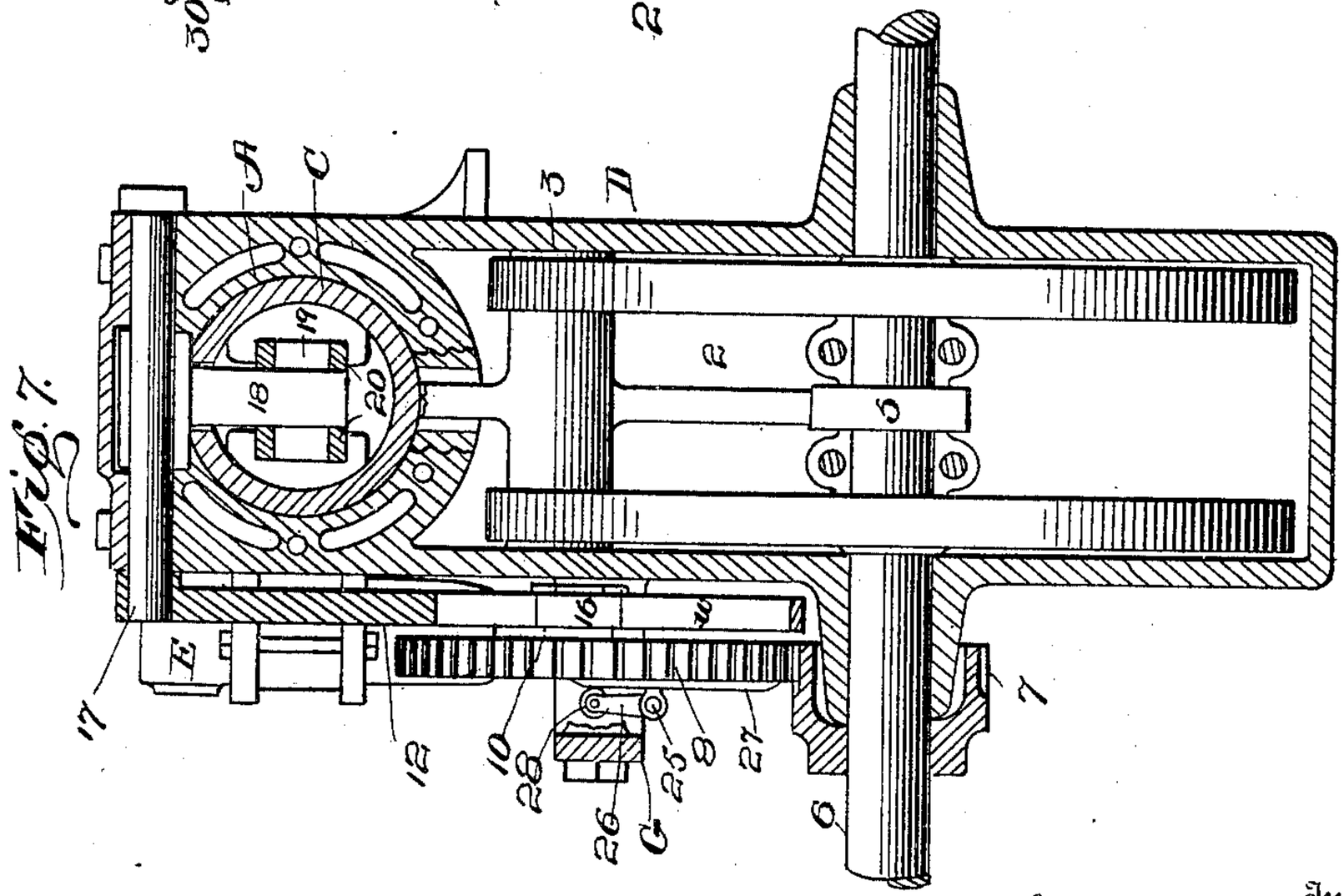


Fig. 7.



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UNITED STATES PATENT OFFICE.

MARCUS W. JAMIESON, OF WARREN, PENNSYLVANIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 681,704, dated September 3, 1901.

Application filed May 31, 1900. Serial No. 18,606. (No model.)

To all whom it may concern:

Be it known that I, MARCUS W. JAMIESON, a citizen of the United States, residing at Warren, in the county of Warren and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas-engines—that is, to that class of engines in which there are a cylinder and piston to which movement is imparted by the burning or explosion of a mixture of air and gas or vapor; and my invention consists of an engine in which a peculiarly-operated plunger is combined with one or two pistons, as fully set forth hereinafter, so as to secure a greater rapidity in filling and discharging the cylinder with greater ease of compression, maintain the pressure at a higher efficiency during the outward movement of the piston or pistons, and completely exhaust the cylinder after each explosion, as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which—

Figures 1 to 4 are diagrams illustrating the operations of the plunger and piston or pistons in the working of the engine. Fig. 5 is an exterior side view of the engine; Fig. 6, a longitudinal section; Fig. 7, a transverse section on the line 7 7, Fig. 5; Fig. 8, a transverse section through the valve-casing.

Before referring to the mechanism reference will be made to the diagrams, Figs. 1 to 4, in which A represents the cylinder, which may or may not be closed at one or both ends and in which reciprocates a piston B, or in some cases two pistons B B′, and a plunger C.

In Figs. 1, 2, and 3 the diagrams illustrate a construction in which there are a single piston B and plunger C, and in the operative engine these parts are combined with any suitable appliances which impart to the same the movements hereinafter described; but for illustration the piston B is assumed to be connected by a connecting-rod 1 to a lever 2, pivoted at 3 to the frame and connected by a rod 4 to the crank 5 of the main crank-shaft 6. The latter drives in a suitable manner, as by gears 7 and 8, a counter-shaft 9, the gear 8 having a crank-pin 10, entering a slot in a lever 12, connected to vibrate the plunger C. The shafts 6 9 are geared so that there will be two rotations of the crank-shaft and one of the counter-shaft. In the cylinder is a port $x\,x'$, which may constitute both the inlet and the outlet port, and the piston B and plunger C each reciprocate in a separate portion of the cylinder on opposite sides of a plane y, centrally intersecting this port, so that the piston never passes into that part of the cylinder in which the plunger moves, while the plunger never passes said plane in that part of the cylinder in which the piston moves. In the operation of an apparatus having these features, starting with the plunger and piston in contact, as shown in Fig. 3, the plunger will move toward the left and the piston toward the right, the piston, however, moving to a greater extent than the plunger, and the charge is thus drawn into the cylinder between the piston and the plunger. On the inward movement of the piston the plunger also moves in the same direction, but to a less extent than the piston and away from the port x, so that by the time the charge is compressed the inner end of the piston will have passed and partly covered the port, while the plunger will have moved away, affording an intermediate space v, containing the compressed charge. When the parts are in this position, ready for the ignition of the charge, it will be seen that the crank 5 and the wrist-pin 10 each is on the dead-center, so that when the charge is ignited there will be no tendency from the force of the explosion to rotate either shaft, and the strongest possible abutment is afforded by both the piston and the plunger. The piston B is driven to the right or outward by the expansion of the gases, but owing to the connections between the piston and the plunger the latter is also at the same time, but to a less extent, carried to the right, and in proportion to this movement of the plunger the pressure of the gases is maintained to a greater degree or for a greater extent of time with a corresponding increase in the efficiency of the engine over what would result if the plunger remains stationary or was carried in the opposite direction during this movement of the piston. On the return movement of the piston B the plunger C is reversed in its movement, so that both the piston and plunger simultaneously move toward the port x, increasing the rapidity with which

the spent gases are discharged, until finally the approximate ends of the piston and plunger meet upon the central plane of the port, thereby completely discharging the spent gases from the cylinder, and thus avoiding that detrimental dilution and fouling of the new charge which results when any portion of the same is retained in the cylinder. As the piston and plunger separate the new charge is drawn into the port *x* until the parts are in the position shown in Fig. 2. In the operation of the plunger in connection with two pistons there are two ports *x x'*, as indicated in Fig. 4, and each end or side of the plunger is carried to and from the adjacent port and the operations are the same as before described, the plunger moving to one side during a complete outward and inward reciprocation at that side and then to the other side during a complete outward and inward reciprocation of the piston at that side.

I have referred to the advantage of the arrangement whereby the crank 5 and wrist-pin 10 are on the dead-center when the parts are in position for ignition of the charge. The timing or relative connection of the crank-shaft and crank counter-shaft may, however, be altered, so that the ignition takes place when each shaft has turned to a further extent or before it reaches the said point, which will slightly alter the timing of the movements before described and which may be an advantage where it is desired to differently time the functions.

Various different connections, valve arrangements, and details of construction may be employed in an engine having a plunger and one or two pistons operating as above described, and I have illustrated in the remaining figures of the drawings one arrangement and combination of parts available for such purpose by pointing out that whatever may be the construction of these minor features the operations above set forth result in an increased rapidity of charging and discharging the cylinder, in compressing the charge with a gradual easy action, preventing shocks and strains in maintaining the pressure after explosion, and in a complete clearing of the cylinder of said gases prior to taking in each new charge.

The frame D of the engine supports the cylinder A, which is provided with the usual water-jacket, and also supports the bearings for the fulcrum-pins of the levers 2 2 or for the fulcrum-pin of one lever when but one piston is used and the bearing for the crank-shaft 6, having double cranks when there are two pistons, as shown, being trunk-pistons and the cylinder open at the ends. Upon the frame is also the counter-shaft 9 or a stud, upon which turns the gear 8, having the wrist-pin 10, and the latter turns in a block 16, sliding in a slot *w* in the lever 12, which is connected to a rock-shaft 17, turning in bearings at the upper part of the cylinder and provided with an arm 18, extending through an opening in the top of the cylinder and recessed to receive a cross-pin 19, each end of which carries a block 20, sliding between guides at the sides of the plunger C, which is hollow and has an opening in the top for the passage of the arm 18, as shown.

Opposite each port of the cylinder A is a valve-casing E, having an upper port *a*, to which is fitted a spring-seated valve 21, opening inward. This port communicates with an inlet-pipe, (not shown,) through which a charge of proper mixture of air and gas or vapor is carried from any suitable source of supply. In the casing E is also a port *b*, constituting the exhaust-port, and in which is fitted a valve 22, and with the latter I combine any suitable means for opening it positively as the plunger and piston begin to approach each other to expel the contents of the cylinder. In the construction shown the spindle 23 of the valve 22 extends downward and is in contact with the arm 24 of a bell-crank lever F or of a rock-shaft 25, parallel to the line of the cylinder and rocking in bearings upon a bracket G, bolted to the side of the frame and supporting the stud or counter-shaft 9. The other arm 26 of the rock-shaft 25 extends to a position to make contact with a cam projection 27 upon the face of the gear 8 and is preferably provided with an antifriction-roller 28, so that the said cam will rock the shaft in one direction to lift the valve 22, while the spring 29, bearing on the collar of the valve-rod 23, serves to depress the latter and close the valve.

In the port *x* and in both ports *x x'* when two are used is arranged any suitable igniter I. Merely for the purpose of illustration I have shown two electrodes so arranged that a spark may jump across the space between them; but a wiping contact may be used or a tube-igniter or flame-igniter may be employed, as desired.

In order to prevent accidental back-firing from the port and valve-casing into the supply-pipe, I provide a chamber above the valve-casing or at any suitable point of the line of supply, and in this chamber I place a body of metallic substance in a filimentary condition. Thus a casing J is arranged opposite the inlet-port of the casing E, and between perforated partitions 30 is arranged a mass of filimentary metallic substance—as, for instance, fine iron or brass turnings. Such metallic filimentary substance results in intermediate passages of a more tortuous character than can be obtained by the use of the usual filling of wire-gauze and affords increased safety, and, further, it effects a more perfect and intimate mixture of the air and gas in passing to the inlet-port from the supply-pipe.

While I have referred to the ports *x x'* as being both inlet and outlet ports, it will of course be recognized that there may be separate inlet and outlet ports.

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

1. A gas-engine having a cylinder, a piston, a plunger, and connections whereby the direction of travel of the plunger during admission of the charge is opposite to the direction of travel of the piston, and the direction of travel of the plunger during compression is the same as the direction of travel of the piston, substantially as set forth.

2. A gas-engine having a cylinder, a piston, a plunger, and connections whereby the direction of travel of the plunger during admission of the charge is opposite to the direction of travel of the piston, the direction of travel of the plunger during compression is the same as the direction of travel of the piston, and the direction of travel of the plunger during expansion is the same as the direction of travel of the piston but in a direction opposite to the travel during compression, substantially as set forth.

3. A gas-engine having a cylinder, a piston, a plunger, and connections whereby the direction of travel of the plunger during admission of the charge is opposite to the direction of travel of the piston, the direction of travel of the plunger during compression is the same as the direction of travel of the piston, the direction of travel of the plunger during expansion is the same as the direction of travel of the piston but in a direction opposite to the travel during compression, and the direction of travel of the plunger during expulsion is opposite to the direction of travel of the piston and toward each other, substantially as set forth.

4. A gas-engine provided with a cylinder, piston and plunger, a port, and means for reciprocating the piston and plunger to and from a plane intersecting the port and for moving both piston and plunger from each other at different rates of speed during the admission of the charge, substantially as described.

5. A gas-engine provided with a cylinder, piston and plunger, a port, and means for reciprocating the piston and plunger to and from a plane intersecting the port and for moving both piston and plunger from each other at different rates of speed during the admission of the charge and for moving said piston and plunger in the same direction at different rates of speed on compression of the charge, substantially as described.

6. A gas-engine provided with a cylinder, piston and plunger, a port, and means for moving the piston and plunger to and from a plane intersecting the port and for moving both the piston and plunger from each other at different rates of speed during the admission of the charge and for moving said piston and plunger in the same direction at different rates of speed on compression of the charge and for moving the piston and plunger in the same direction at different rates of speed on expansion but in a direction opposite to the direction of compression, substantially as described.

7. A gas-engine provided with a cylinder, piston and plunger, a port, and means for moving the piston and plunger to and from a plane intersecting the port and for moving both the piston and plunger from each other at different rates of speed during the admission of the charge and for moving said piston and plunger in the same direction at different rates of speed on compression of the charge and for moving the piston and plunger in the same direction at different rates of speed on expansion but in a direction opposite to the direction of compression, and for moving said piston and plunger toward each other at different rates of speed on expulsion, substantially as described.

8. A gas-engine provided with a cylinder, pistons, and intermediate plunger, and with independent ports and means whereby to move each piston and the plunger to and from a plane intersecting each port, substantially as set forth.

9. A gas-engine provided with a cylinder, pistons, intermediate plunger, and means whereby to move each piston, and the plunger outward during the explosion of the gases between them to carry them toward each other in exhausting and compressing and from each other in receiving the charge, substantially as set forth.

10. A gas-engine provided with a cylinder, two pistons, an intermediate plunger and means for compressing, exploding and discharging the gases on opposite sides of the plunger alternately, substantially as set forth.

11. In a gas-engine a cylinder having two pistons, and an intermediate plunger combined with means for reciprocating the pistons and plunger, each in a separate part of the cylinder for drawing in, compressing and displacing the gases on opposite sides of the plunger alternately, substantially as set forth.

12. The combination in a gas-engine, of a cylinder, two pistons, an intermediate plunger and means for reciprocating the piston and plunger to move the plunger toward one end of the cylinder during the outward and inward movement of the piston at that end, and toward the other end of the cylinder during the outward and inward movement of the piston at that end, substantially as set forth.

13. The combination of a gas-engine of a cylinder, pistons, intermediate plunger, a shaft having cranks connected with the pistons, and a counter-shaft having a crank connection with the plunger and means for imparting one rotation to the counter-shaft to each two rotations of the crank-shaft, substantially as set forth.

14. A cylinder having two pistons and an intermediate plunger, means for reciprocating the pistons and plunger as set forth, independent ports and valve-casings connected therewith and means for operating the valves to supply and exhaust the portions of the cyl-

inder at opposite ends of the plunger, substantially as set forth.

15. The combination with the cylinder, its plunger and piston and operating means, of a port, valve-casing communicating therewith and provided with an exhaust-valve, rock-shaft parallel to the cylinder having an arm connected with the exhaust-valve and a rotating cam and arm on the rock-shaft arranged to make contact with said cam, substantially as set forth.

16. The combination with the cylinder, plunger, pistons, and valve-casings communicating with cylinder-ports and provided with exhaust-valves, of rock-shafts parallel to the cylinder, provided with arms connected with the exhaust-valves, and a rotating cam arranged to make contact with the other arms of both rock-shafts to lift the exhaust-valves alternately, substantially as set forth.

17. The combination of the cylinder, pistons, and intermediate plunger, crank-shaft and counter-shaft, of a rock-shaft having an arm operated from the counter-shaft and another arm connected to operate the plunger, substantially as set forth.

18. The combination of the cylinder, pistons, plunger, levers connected with the pistons, an arm connected with the plunger, of a crank-shaft connected with the piston-lever, with a counter-shaft for operating the arm connected with the plunger and gears upon the crank-shaft and counter-shaft, substantially as set forth.

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

MARCUS W. JAMIESON.

Witnesses:
E. WARRENER,
W. CLARENCE DUVALL.