(No Model.) 2 Sheets—Sheet 1.

L. H. NASH.

GAS ENGINE.

No. 312,496. Patented Feb. 17, 1885.

Fig. 1.

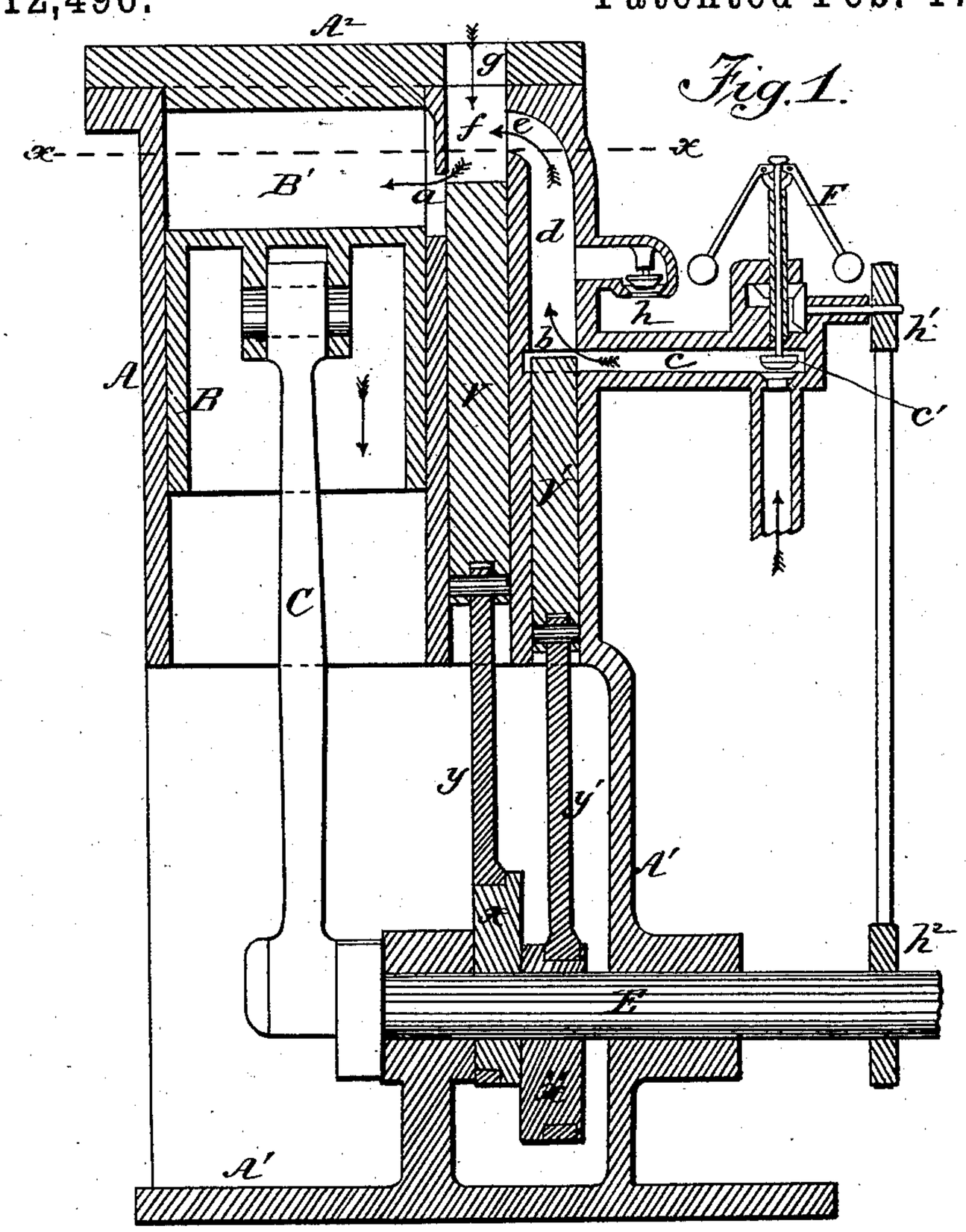


Fig. 2.

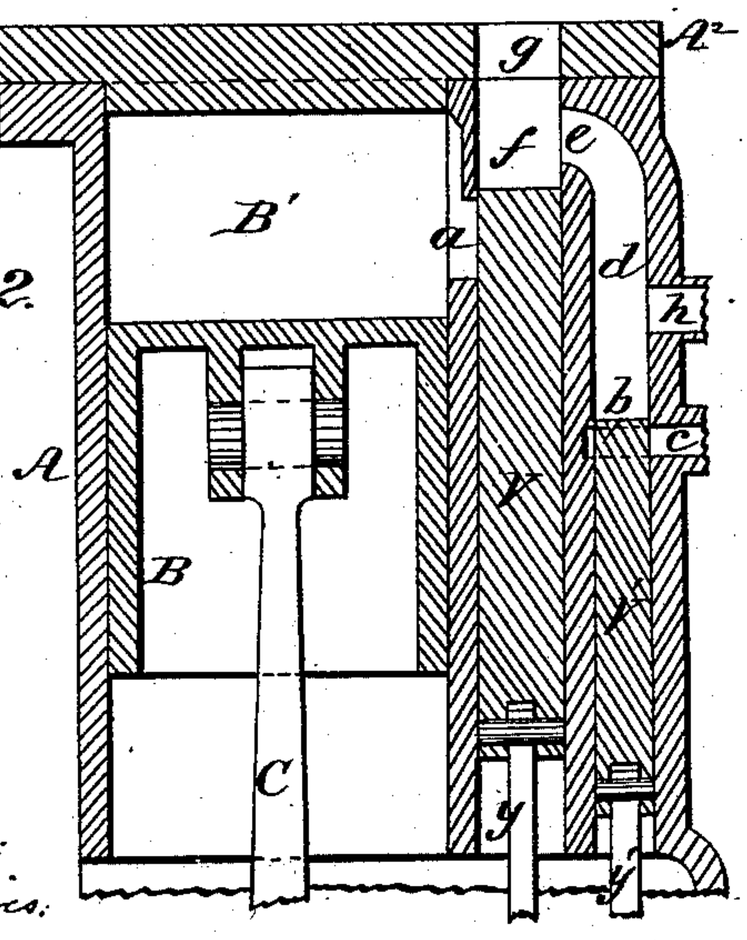
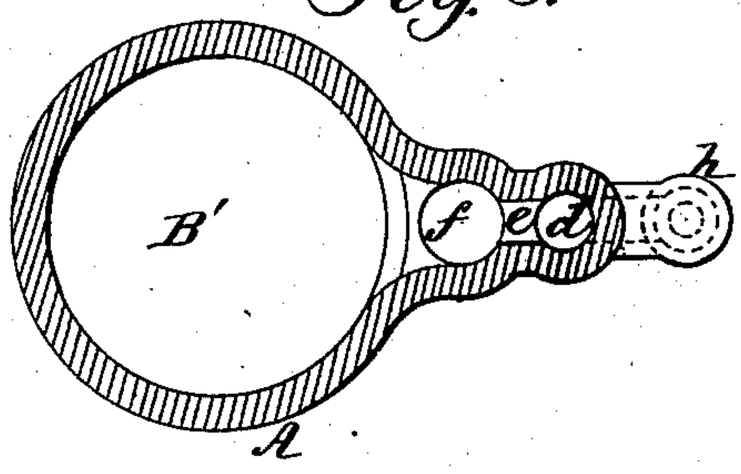


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 5.

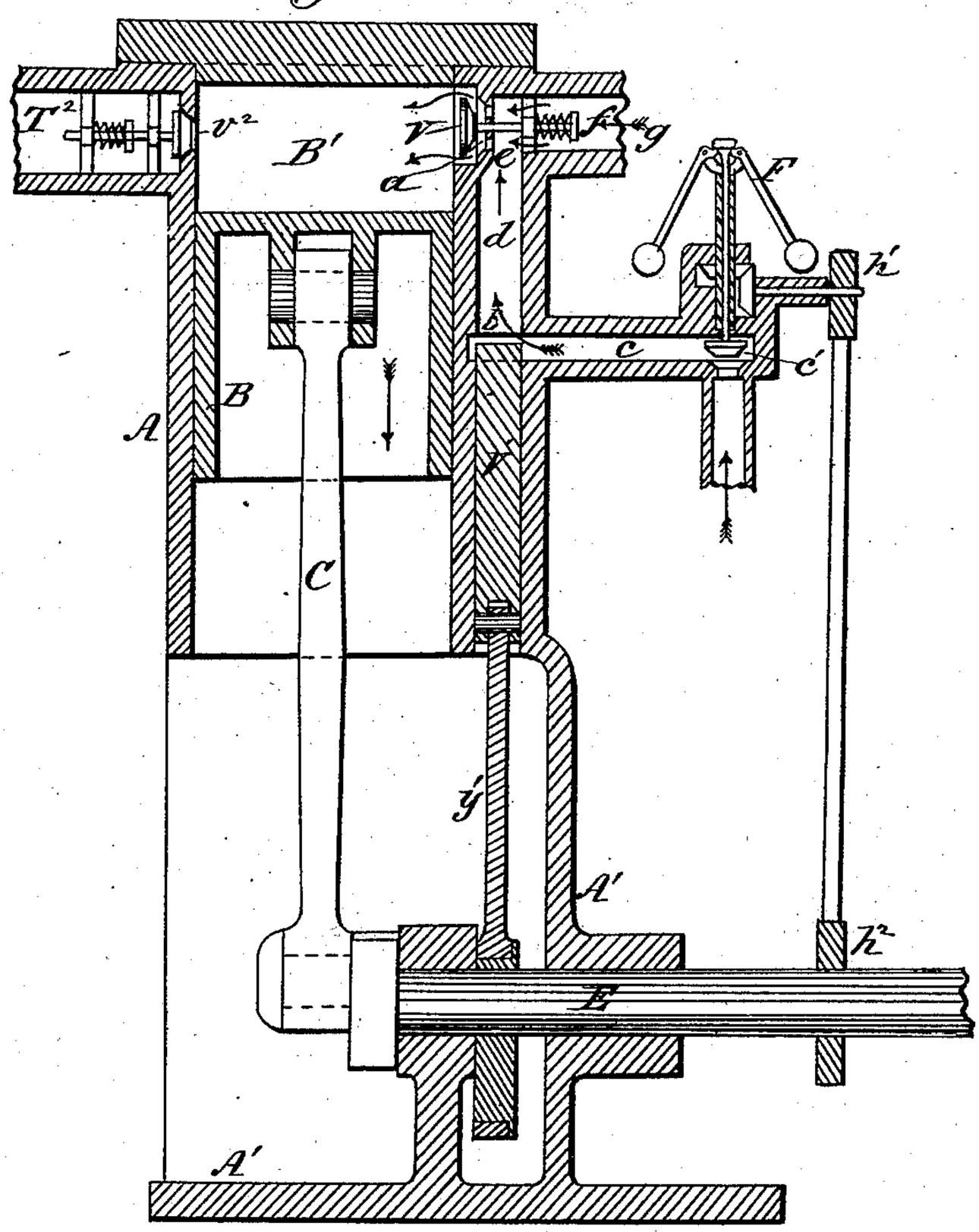
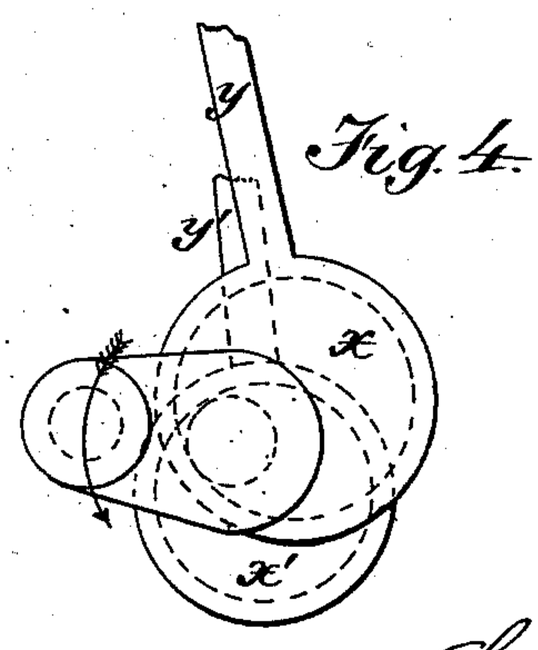


Fig. 4.



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UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 312,496, dated February 17, 1885.

Application filed May 8, 1884. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings, and State of New York, have invented new and useful Improvements in Gas-Engines, of which the following is a specification.

The object of my invention is to provide for supplying the engine with gaseous fuel in such a manner that the amount will not be influenced by suction caused by the rapid running of the engine; to prevent the fouling of the gas-supply pipe by leakage from the cylinder during the combustion of the charge or when the engine is developing power; and in providing for conducting the gaseous fuel into the entering air before the latter has passed through the engine-valves, thus supplying fuel to the engine by a method in which, when the engine begins to draw in its charge of air, the gas is allowed to issue into the open air-passage in such a way that it is also drawn into the cylinder with the air. In this method of operating a gas-engine provision is made for isolating the fuel-supply passage from direct communication with the cylinder, and thus allow the gaseous fuel to always flow out through the fuel-supply pipe under the pressure in the gas-main or source of fuel-supply, and, mixing with the inflowing air, be drawn into the cylinder instead of being forcibly sucked out of the gas-main by the action of the piston. In this isolation of the fuel-supply passage provision is made for allowing the free escape direct into the air of the leakage of gas from the cylinder while developing power, and thus keep the gas-supply pipe always clear and free of the foul gases which leak by the engine-valves under back-pressure.

It is essential in the operation of a gas-engine that the quantity and quality of the fuel supplied thereto should be constant and regular. In the usual method of admitting the gaseous charge wherein the suction of the piston causes an increased flow of gas, a sudden increase of speed caused by a decrease of the load upon the engine will cause an increased suction of the piston, and hence an increase in the amount of fuel supplied just at the time when the engine requires less fuel, while a sudden lessening of the speed by an increased load will reduce the suction of the engine and thereby lessen the amount of fuel supplied just when the engine requires a greater supply of fuel. If a governor be used to regulate this supply, the above action will work against the governor and give it greater work to do, thereby making it quite difficult to properly regulate an engine so supplied with fuel. As the suction caused by the engine is variable and uncertain, the action of an engine supplied in the usual manner will be more or less irregular and spasmodic, to correct which a large fly-wheel is employed. By my method of admitting the gaseous fuel into the inflowing charge of air under the constant pressure of the fuel-supply, the operation tends to assist the action of the governor, for if the speed of the engine be increased suddenly, the amount of the fuel received at each stroke will be less, and the governor-valve will only have to close enough to admit the amount of gas flowing under the pressure of the main required by the work the engine is doing. If the speed of the engine is suddenly decreased by a greater load, the quantity of gas supplied at each stroke will be greater, as required by the engine, and the governor will only have to increase the supply sufficiently to restore the speed of the engine to that required, and in this way easily regulate the operation of the engine. Again, in order to preserve a pure supply of gas in an engine in which the back-pressure is borne by the fuel-supply valves, it is necessary that the said valves should be perfectly tight to prevent leakage from the cylinder into the fuel-supply pipes, which condition it is difficult to secure in practice, and my method of supplying the charge of air and gas provides for the escape of the foul gases from leakage direct into the air away from the fuel-supply pipe.

I have shown my invention as applied to a single form of engine using a charge at atmospheric pressure, and also as applied to the compression-pump of a gas-engine operating to compress its charge; and referring to the drawings illustrating such application, I will now proceed to describe the same preparatory to a specific designation of the improvements which I claim as new.

Figure 1 represents a vertical section of a

gas-engine receiving the charge at atmospheric pressure. Fig. 2 represents a vertical section of the engine cylinder and valves, showing the position of the latter when the engine is developing power. Fig. 3 represents a section on the line *x x* of Fig. 1. Fig. 4 represents a detail of the crank and valve controlling eccentrics. Fig. 5 represents a vertical section of a compression-pump of a gas-engine, adapted to receive the gas and air by my improved method and compress the charge for the engine.

The cylinder A, the piston B, and the connection C of the latter, with the crank-shaft E, may be constructed in any suitable manner, the type shown being that of a single-acting engine, supported upon a vertical frame, A′. The engine has a main cylindrical valve, V, which is operated by the rod *y* and the eccentric *x* on the crank-shaft so as to control the inlet of the air and gas into the cylinder, and the discharge of the gaseous products therefrom. A gas-supply valve, V′, of cylindrical form, is similarly connected and operated by the rod *y′* and the eccentric *x′*, the two valves being placed side by side, and operating in chambers communicating with the air, the gas-supply main, and the cylinder.

In the example shown in Fig. 1 the chamber of the valve V is extended through and opens at the top of cylinder-head A^2 at *g*, and into the cylinder-chamber B′ by the side port *a*, which is operated by said valve, while the gas-supply valve V′ works in a chamber which is extended to near the cylinder-head, opens at *e* above the upper end of the valve V, into the side of the extension *f* of its chamber, and forms the gas-passage *d*, isolated from direct communication with the cylinder-chamber B′. The valve V′ operates a port, *b*, at the bottom of the gas-passage *d*, which port communicates with an outside gas-supply pipe or main, *c*, provided with a governor, F, and valve *c′*, for controlling the fuel-supply, the governor being operated by the pulleys *h′* h^2 from the crank-shaft and connecting-gear. By this construction the isolated gas-supply passage *d* opens directly into the open air-supply passage *f*, which separates said gas-passage from the cylinder-port *a*, while the gas-inlet port *b* is so far removed from the cylinder-port *a* as to allow the sucking action of the engine to draw in atmospheric air through said air-passage *f*, and prevent the suction of the engine from sucking its charge of fuel from the gas-supply. The piston B being shown as on its forward stroke, the air is drawn in by the suction of the piston through the passage *f* and port *a*, and the valve V′ has opened the gas-inlet port *b*, admitting the gas into the passage *d*, which opens at *e* into the air-passage. In this open passage *f* the gas enters under pressure from the main, mixes with the inflowing air, and is drawn with it from said passage through the port *a* into the combustion-chamber B′. The valves V, V′ now close ports *a* and *b*, and the charge is ignited while the piston is doing its work, as seen in Fig. 2. In this position of the valves it will be seen that if there should be any leakage of gas through the port *a* by reason of an imperfect fit of the valve V, such leakage would escape through the passage *f* into the air at *g*. When the piston has completed its forward stroke, the valve V again opens port *a*, while port *b* remains closed by its valve, and the waste gases are discharged through the passage *f* and opening *g*. In this discharge the port *a* remains open until the piston is again in position shown in Fig. 1, so that as soon as the piston begins its forward stroke again air will again be drawn into the passage *f*, and the port *b* being opened at this instant the gas will again be supplied to the open passage *f* and drawn with the air into the cylinder.

To further relieve the inflowing gas in the supply-passage *d* from the influence of the suction of the engine, I may provide an opening, *h*, in the side of the supply-passage *d* to equalize the pressure in said passages *d* and *f*, and the said opening *h* may be provided with an inwardly-opening check-valve to prevent the escape of the inflowing gas out of this opening; but in general the opening *h* may not be required.

As thus described my invention is applied to a low-pressure engine; but in Fig. 5 I have shown my invention as applied to the air-compression pump of a gas-engine. In this application of my improved method of operating a gas-engine the pump-cylinder is provided with an inlet-valve, V, and a gas-outlet valve, v^2. The inlet-valve V communicates with a pipe, *f*, which opens to the outer air and crosses the gas-supply passage *d*, while the outlet-valve v^2 opens outwardly into a pipe, T^2, which is connected with and conveys the compressed gases to the power-cylinder.

In the operation of the compressor air is sucked into the cylinder-chamber B′ through the inwardly-opening valve V, and the gaseous fuel is admitted into the supply-passage through the pipe *c* by the valve V′, opening the port *b*, and entering the air-inlet pipe *f*, passes with the air into the cylinder when the piston is advancing and drawing in the charge; but upon the backward stroke of the piston the flow of the gas is cut off by the valve V′ until the piston has begun its next forward stroke, when the port *b* is again opened by the valve, admitting a fresh charge of gas. In this compression-cylinder the valve V is open while the air and gas are being drawn into the cylinder, and the valve v^2 is closed, and during the compression of the charge the valve V is closed and the valve v^2 is opened and the compressed charge forced into the power-cylinder of the engine. The ignition of the charge may be effected by the electric spark, or by any approved method.

When my improvement is applied to the power-cylinder, as in Fig. 1, the valve V is

cylindrical and is operated by an eccentric; but when my improvement is applied to a compression-cylinder communicating with the power-cylinder, the cylinder-port *a* is controlled by a spring conical valve opened under the suction force of the piston and closed by the spring on the valve-stem; but the functions of these valves are the same in both cases.

I claim—

1. The method herein described of operating a gas-engine, which consists in conducting the gaseous fuel into the entering stream of air before the air has passed the admission-valves, and drawing both the air and gas into the engine-chamber through a passage open to the atmosphere, substantially as described, for the purpose specified.

2. The method herein described of operating a gas-engine, which consists in admitting the gaseous fuel into the entering charge of air before the air has passed the admission-valves, controlling the gas-supply by a valve operated by the engine, and drawing both the air and gas into the engine-chamber through a passage open to the atmosphere, substantially as herein set forth.

3. The method herein described of operating a gas-engine, which consists in drawing into the cylinder the charge of air direct from the atmosphere, admitting the gas into the entering charge of air before the latter has passed the admission-valve, and controlling the gas-supply by a valve and governor operated as described, whereby the charge of gas is drawn into the cylinder through a passage open to the atmosphere, and the gas-supply passage isolated from the influence of the suction caused by the rapid running of the engine.

4. The method of supplying a gas-engine with fuel, which consists in admitting the fuel into a supply-passage having perpetual communication with a supply-passage open to the atmosphere, whereby the action of the piston will draw the air charge through said opening and the gas charge with it, and prevent the suction of the engine from extending to the gas-supply main, substantially as herein set forth.

5. The combination, with the cylinder and an inlet-valve, V, of a gas-supply pipe, *c*, an air-inlet passage open to the atmosphere communicating directly with said gas-supply pipe, and a gas-supply valve, V′, arranged to operate free from the influence of the suction of the engine, substantially as described.

6. The combination, in a gas-engine, of a fuel-supply valve having no direct communication with the cylinder, with a separate passage for the fuel, having free communication with the external air and with an air-supply passage external to the inlet-valve of the cylinder, substantially as herein set forth.

7. The combination, with the cylinder having an air-inlet passage open to the outer air and a gas-supply passage opening into said open air-passage, of a valve for controlling the gas-supply, and a valve for admitting the air and gas into the cylinder through said open air-passage, substantially as herein set forth.

8. The combination, with the cylinder, of the valves V V′, the gas-inlet port *b*, passage *d*, and the open air-inlet passage *f*, the said port *b* and air-passage communicating with each other outside of the cylinder inlet-valve, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:
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CHRISTOPHER C. WHITTEMORE.