(No Model.) 4 Sheets—Sheet 1.

J. S. WOOD.

GAS ENGINE.

No. 300,294. Patented June 10, 1884.

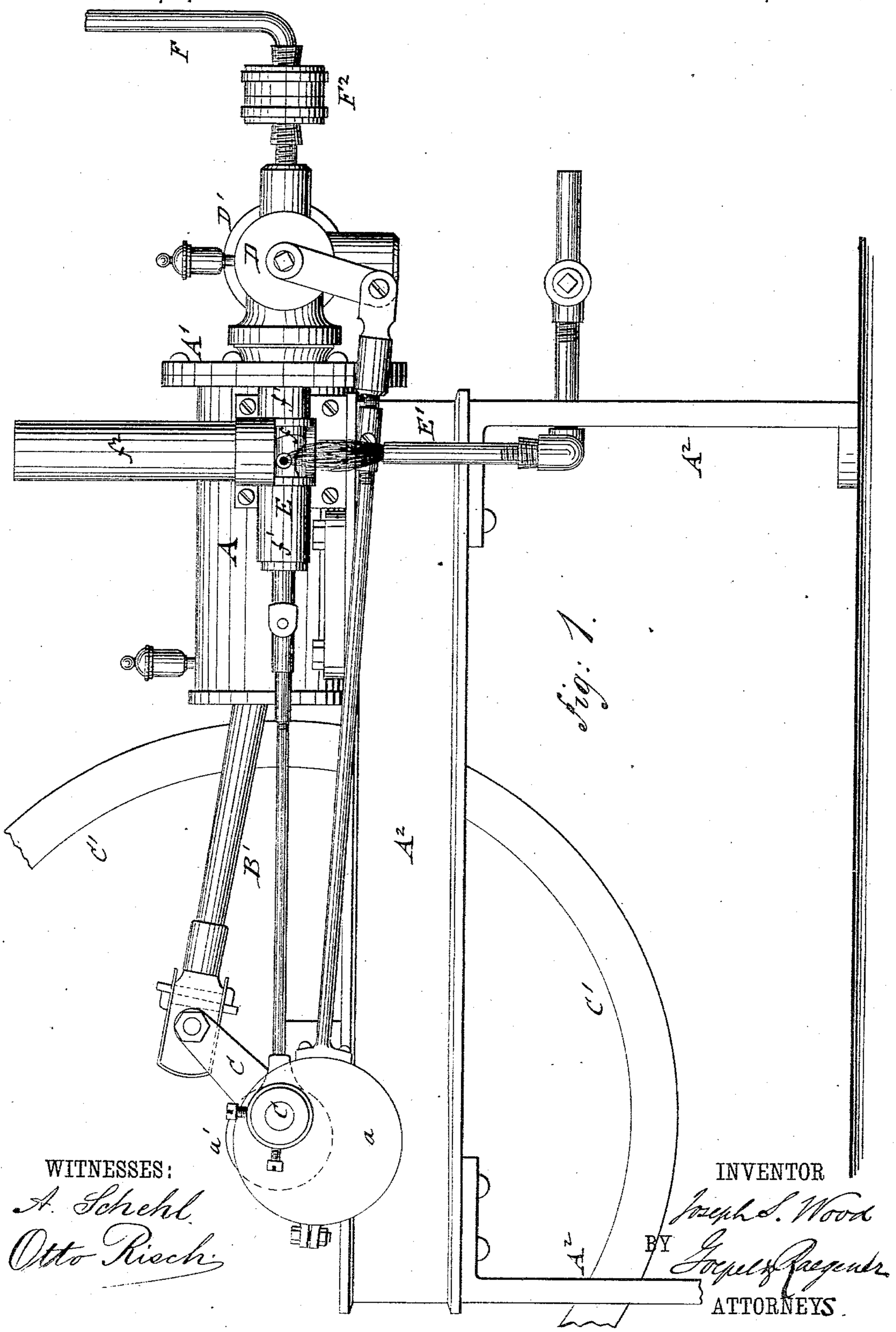

Fig. 1.

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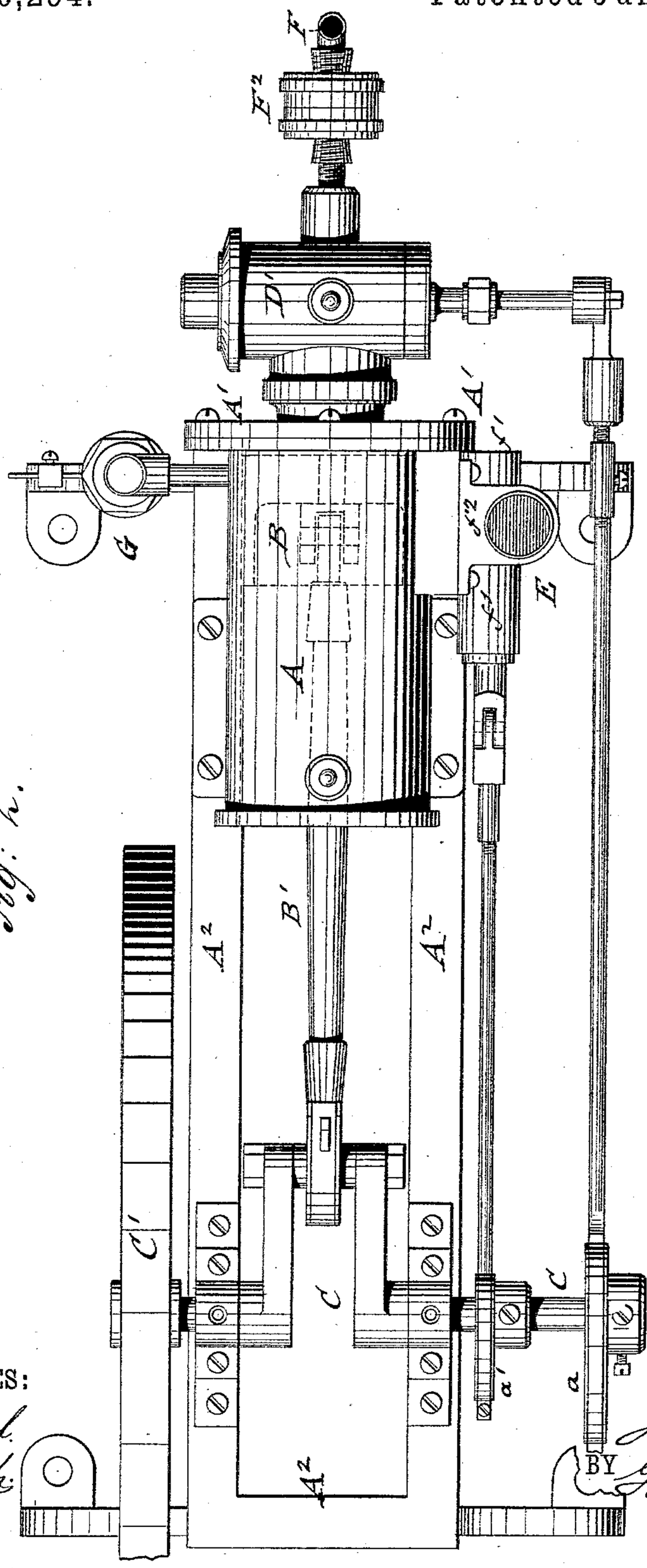

Fig. 2.

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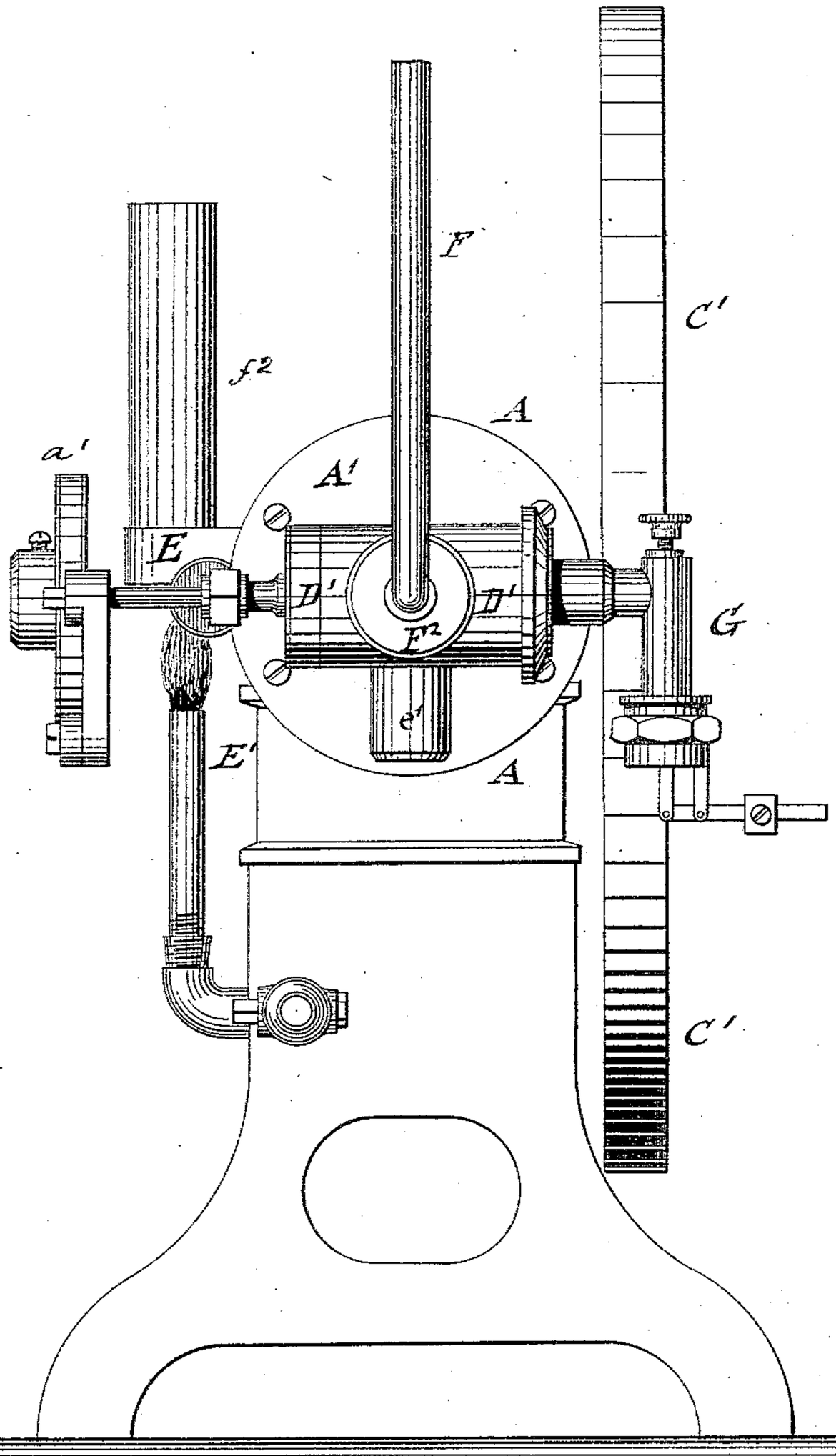
Fig. 3.



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GAS ENGINE.

No. 300,294. Patented June 10, 1884.

Fig. 4.

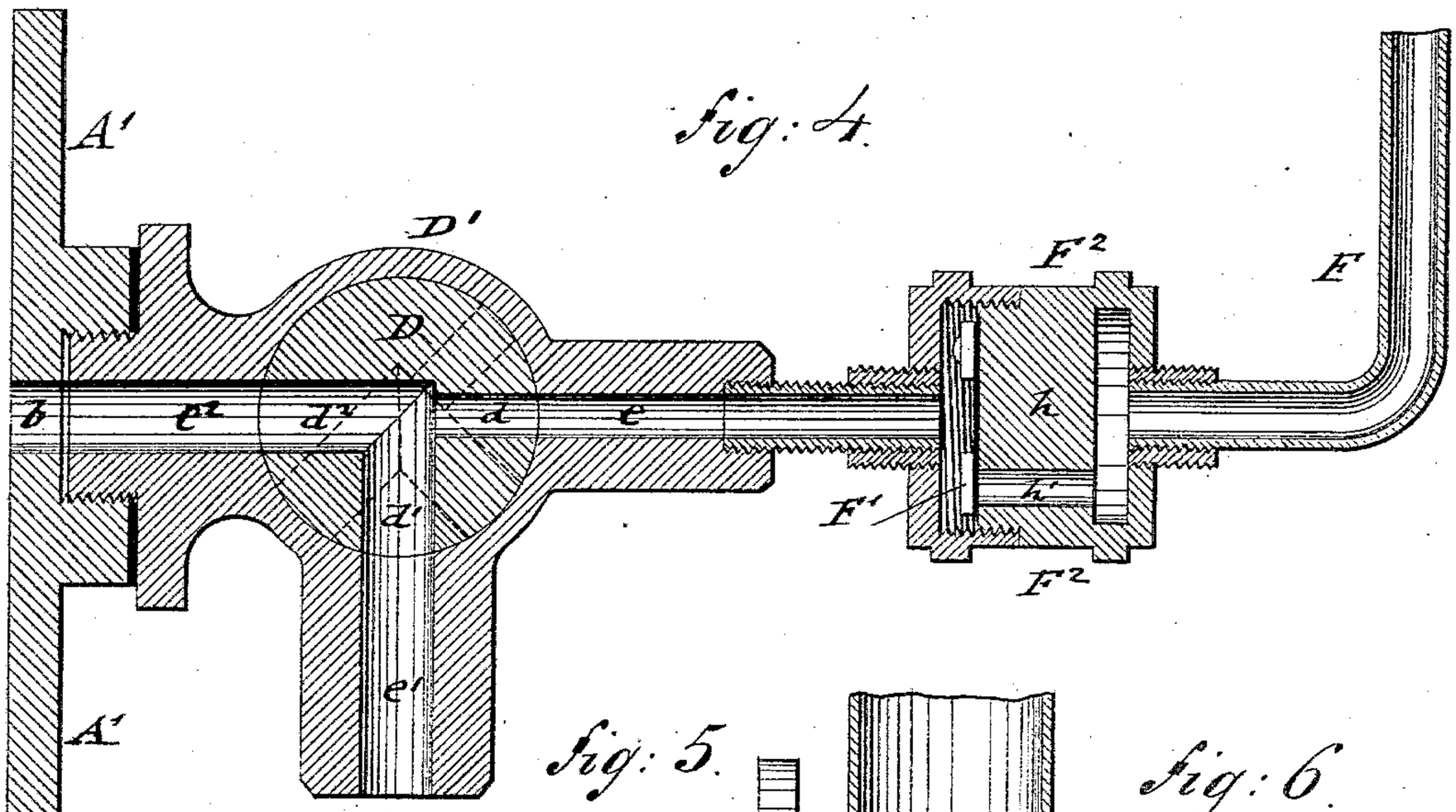


Fig. 5.

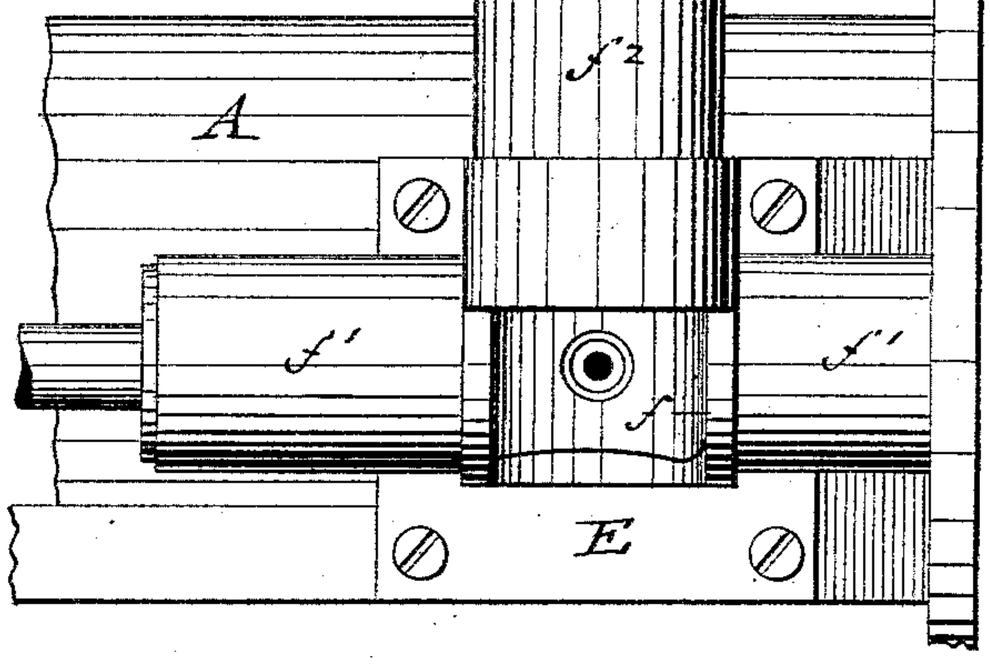


Fig. 6.

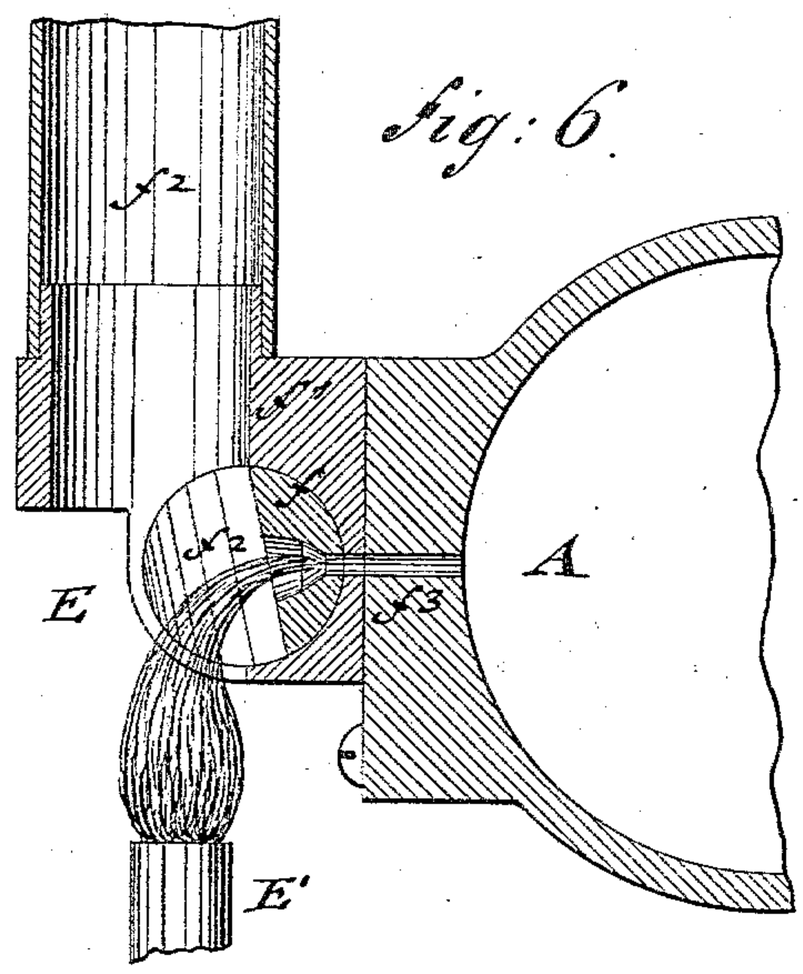


Fig. 7.

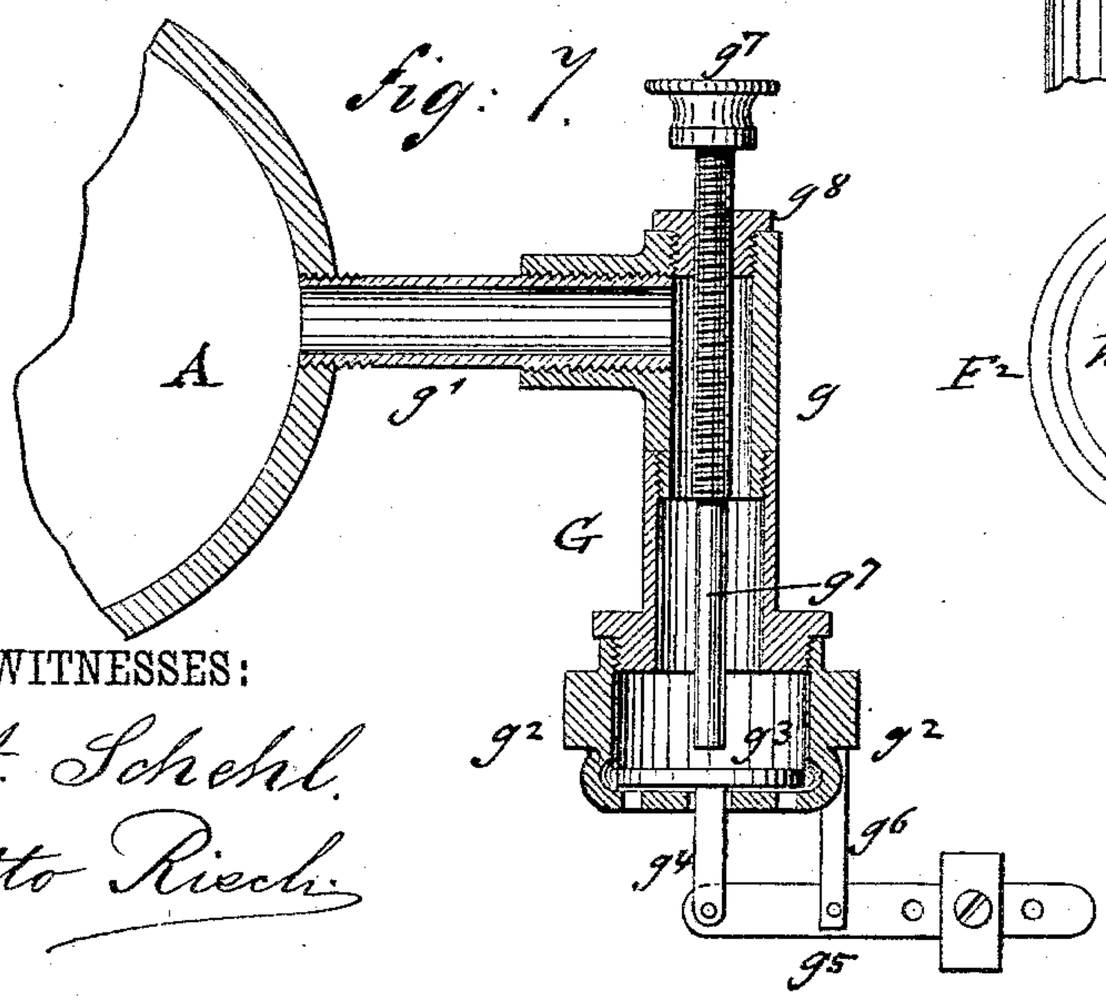
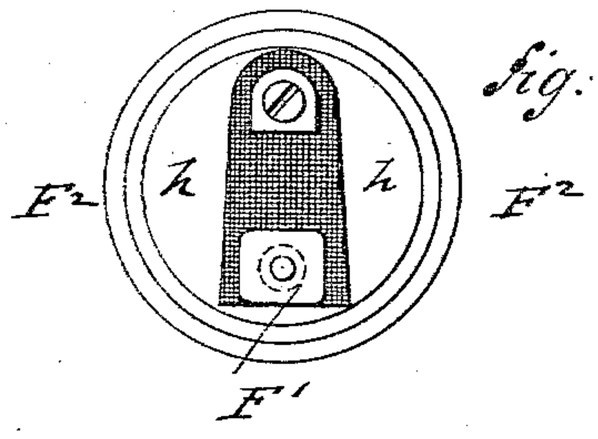


Fig. 4a.



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UNITED STATES PATENT OFFICE.

JOSEPH S. WOOD, OF BROOKLYN, NEW YORK.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 300,294, dated June 10, 1884.

Application filed February 28, 1884. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH S. WOOD, of Brooklyn, Kings county, State of New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention has reference to improvements in gas-engines of that class in which a mixture of gas and air is drawn in and exploded during the forward motion of the piston, while the products of combustion are exhausted from the cylinder by the return motion of the piston.

In the accompanying drawings, Figure 1 represents a side elevation of my improved gas-engine. Fig. 2 is a plan, Fig. 3 an end elevation, and Figs. 4, 4ª, 5, 6, and 7 are details, respectively, of the valve for supplying the gas-and-air mixture to the cylinder, of the check-valve, of the igniter, and of the auxiliary air-supply valve.

Similar letters of reference indicate corresponding parts.

A in the drawings represents a cylinder, B a piston, B′ a connecting rod or pitman, and C a crank-shaft upon which is mounted a fly-wheel, C′; *a*, an eccentric by which oscillating motion is imparted to the valve that admits the explosive gas-and-air mixture to the cylinder, and *a′* a second eccentric by which reciprocating motion is imparted to the igniter. The cylinder A is closed at one end by a head, A′, having a central port, *b*, with which communicates the gas-and-air valve D.

At one side of the cylinder A, near the head A′, is arranged the igniter E, and at the other side the auxiliary air-supply valve G, which latter serves as a regulator for supplying an additional quantity of air to the gas-and-air mixture in the cylinder, so as to produce the more effective explosion of said mixture.

The cylinder A and its accessories and the crank-shaft C are mounted upon a frame, A^2, of suitable shape. The cylinder A is arranged in the usual manner, with a water-jacket and means for supplying and conducting off the cooling-water, which features are not shown in the drawings, as they are well known and form no part of my invention. The cylinder, crank-shaft bearings, and the gas-and-air valve are provided with suitable lubricating devices for securing the smooth and easy motion of the engine.

The explosive gas-and-air mixture is supplied to the cylinder by the oscillating valve D, which is of cylindrical shape, and inclosed by a cylindrical casing, D′, that is secured to the head A′ of the cylinder A. The valve-casing D′ communicates by ports *e e′* e^2, respectively, with a gas-supply pipe, F, which latter is connected to a gas-reservoir, as usually employed in gas-engines. The gas-supply pipe F is provided with a check-valve, F′, arranged in a cylindrical casing, F^2, as shown in detail in Figs. 4 and 4ª. The check-valve F′ is weighted and applied to a fixed interior partition, *h*, of the valve-casing F^2. The partition *h* has a port, *h′*, that is opened or closed by the weighted check-valve F′, which latter is made of suitable flexible material that is not affected by heat. The check-valve F′ is arranged at that side of the partition *h* next to the cylinder A. The check-valve F′ is normally open, owing to the pressure of the gas in the gas-reservoir, but is tightly closed at each explosion by the gases of combustion, so that they cannot pass into the gas-reservoir and deteriorate the gas in the same, so as to render it less effective for combustion. When the gas-and-air valve is open, the required quantity of gas is supplied by the pipe F from the gas-reservoir.

The oscillating valve D is provided with three radial channels, *d d′* d^2, that register with the ports *e e′* e^2 of the valve-casing D′. The radial gas-channel *d* is of smaller cross-section than the channels *d′* d^2, which communicate, respectively, with the air-port *e′* and the cylinder-port *a*, so that the proper proportions between the gas and air are established. When the channels *d d′* d^2 register with the ports *e e′* e^2, the valve D is in a position either for supplying the explosive gas-and-air mixture or for exhausting the products of combustion from the cylinder. When they are out of register with the ports of the valve-casing D′, the explosion of the gas-and-air mixture in the cylinder A takes place. The gas-and-air valve D is oscillated by its valve-gear connected to the

eccentric *a* in such a manner that when the piston B commences its forward stroke the different passages of the valve are placed in communication with the ports of the valve-casing, as shown in Fig. 4, so as to admit the entrance of gas and air. The air-and-gas mixture is sucked by the forward motion of the piston through the port *a* into the cylinder A, the valve D being then turned on its axis by its valve-gear into the position shown in dotted lines in Fig. 4, whereby the ports of the valve-casing D′ are closed. The explosion of the air-and-gas mixture in the cylinder then takes places, which is caused by the igniter E. When the piston returns, the valve D is also returned, so that its channels register with the ports of the valve-casing and admit the exhaustion of the products of combustion.

The igniter E is shown in detail in Figs. 5 and 6, and consists of a reciprocating valve, *f*, that is guided in a casing, *f′*. A chimney, f^2, is mounted above the open portion of the casing *f′*, and serves to exert an upward draft upon the flame of the igniter-burner E′, that is arranged vertically below the chimney f^2. The igniter-valve *f* is operated by a valve-gear connected to the eccentric *a′*, which at the proper moment establishes communication between the interior of the cylinder A and the igniter E. For this purpose the igniter-valve *f* has a concave recess, f^3, at its middle part, which recess communicates by a conically-tapering hole, f^4, with the ignition-opening f^5 of the cylinder A. At the moment when the air-and-gas mixture has been sucked into the cylinder A, the openings f^4 and f^5 of the igniter-valve *f* and cylinder A register with each other, so that the burner-flame is sucked into the cylinder and causes the explosion of the gas-and-air mixture, whereby the piston is forced forward, so as to complete its stroke. At the moment when the explosion takes place, the igniter-valve closes the ignition-opening of the cylinder A, so that no gases of combustion can escape through the igniter-valve. The fly-wheel carries the crank-shaft over its dead-point and causes the return of the piston. Simultaneously the channels of the gas-and-air valve are placed in register with the ports of its casing and the admission-port of the cylinder, so that the products of combustion from the cylinder can be exhausted through the air-pipe to the atmosphere. The check-valve F′ is closed during the period of exhaust by the pressure exerted thereon by the products of combustion. As soon as the piston resumes its forward stroke, the air-and-gas mixture is sucked in again and exploded at the proper moment, and so on.

For the purpose of establishing the exact proportions between the gas and air of the explosive gas-and-air mixture and producing the perfect combustion of the same, the auxiliary air-supply valve G is employed, which consists of a vertical tube, *g*, that communicates by a horizontal tube, *g′*, with the cylinder A. At the lower part of the tube *g* is arranged a valve-casing, g^2, the bottom of which is perforated and closed by a vertically-guided valve, g^3, the downwardly-extending stem g^4 of which is connected to a weighted lever, g^5, that is fulcrumed to a downwardly-extending arm, g^6, of the valve-casing g^2. The weight of the lever g^5 is adjustable, so that the valve can be weighted more or less. A vertical spindle, g^7, extends through a stuffing-box, g^8, at the top of the tube *g* in downward direction through the tube *g* to a point at some distance from the valve g^2, the spindle being screw-threaded at the upper part, so as to be capable of vertical adjustment in the stuffing-box g^8, according to the vertical play of the valve. The higher the valve is raised the greater the supply of air that is sucked in through the auxiliary regulating-valve G into the cylinder.

By the auxiliary air-supply valve a means is furnished by which that small additional quantity of air which is required to produce the complete combustion of the gas-and-air mixture is sucked in automatically and independently of the operation of the gas-and-air-supply chamber. The engine is thereby adapted to be run not only with illuminating-gas of varying chemical composition, but also with gasoline-gas, which latter requires a larger proportion of air, and which heretofore could not be used for running gas-engines of the well-known types. The additional quantity of air required by the explosive air-and-gas mixture is regulated by means of the spindle g^7 and weighted valve-lever g^5. My engine is thereby adapted to be run with any kind of gas with equally satisfactory results, as the proper quantity of air required for the complete and effective combustion is supplied by the auxiliary air-valve, which forms the essential feature of my invention. By arranging a gas-and-air valve at each end of the cylinder, at the top of the same, and arranging a second igniter and auxiliary air-valve at the opposite end of the cylinder, a double-acting gas-engine of simple, cheap, and effective construction is obtained.

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

1. In a gas-engine, the combination of a cylinder, a reciprocating piston, a crank-shaft, an igniter arranged at one side of the cylinder, means for reciprocating the igniter-valve, a gas-and-air-supply valve communicating with the cylinder, a valve-gear for oscillating the piston-valve, said valve communicating with the gas-supply pipe, air-pipe, and the cylinder, substantially as set forth.

2. In a gas-engine, the combination of a cylinder, A, having an inlet-port, *a*, a gas-and-air-supply valve, D, having gas and air channels *d d′* d^2, a valve-gear for oscillating said valve, a valve-casing, D′, having ports *e e′* e^2, and a

gas-supply pipe, F, having a check-valve, F', the oscillating gas-and-air valve serving also to exhaust the products of combustion, substantially as set forth.

3. In a gas-engine, the combination, with the cylinder, of an auxiliary supply-valve composed of a supply-tube having a perforated bottom, a vertically-adjustable spindle, and a weighted valve, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JOSEPH S. WOOD.

Witnesses:
PAUL GOEPEL,
SIDNEY MANN.