(No Model.) 3 Sheets—Sheet 1.

J. S. WOOD.

GAS ENGINE.

No. 328,170. Patented Oct. 13, 1885.

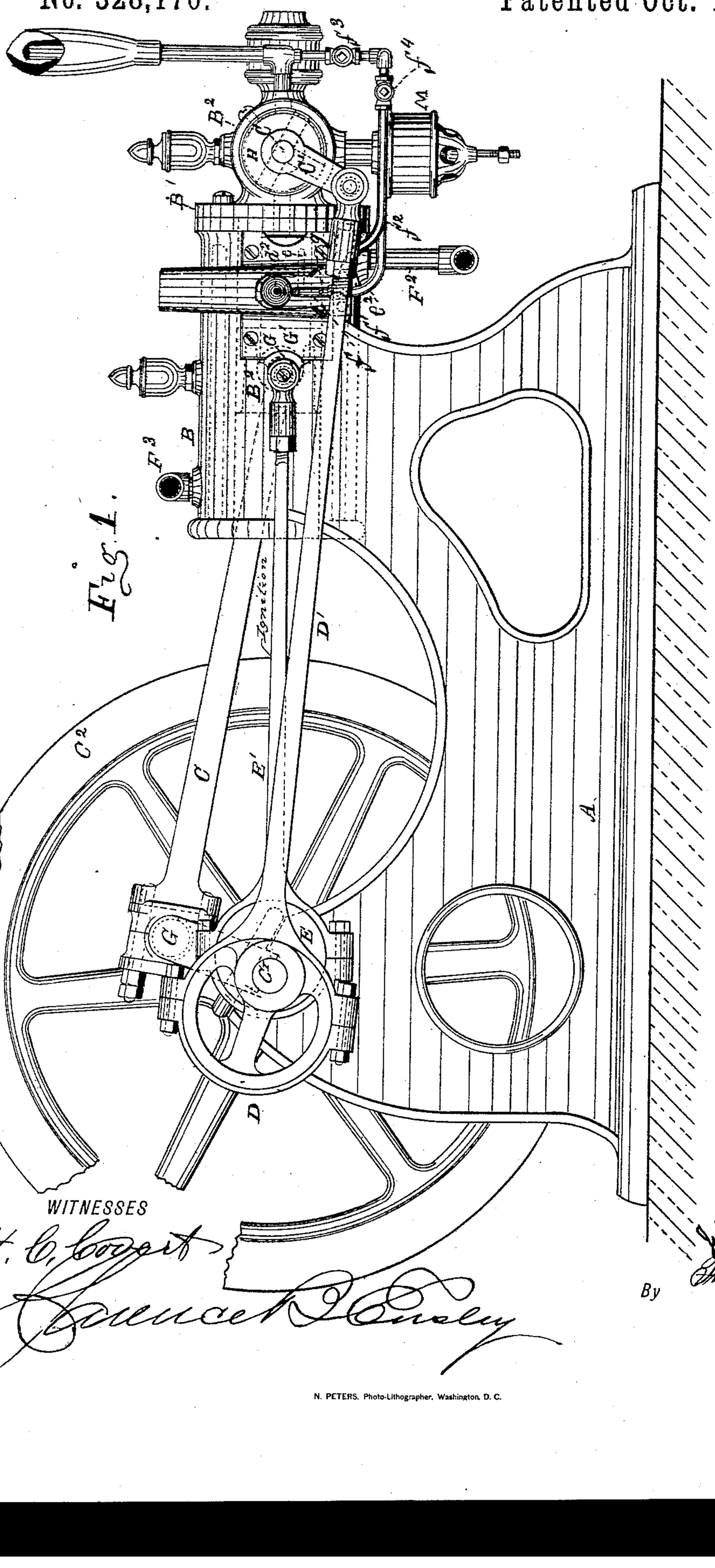

Fig. 1.

(No Model.) 3 Sheets—Sheet 2.

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GAS ENGINE.

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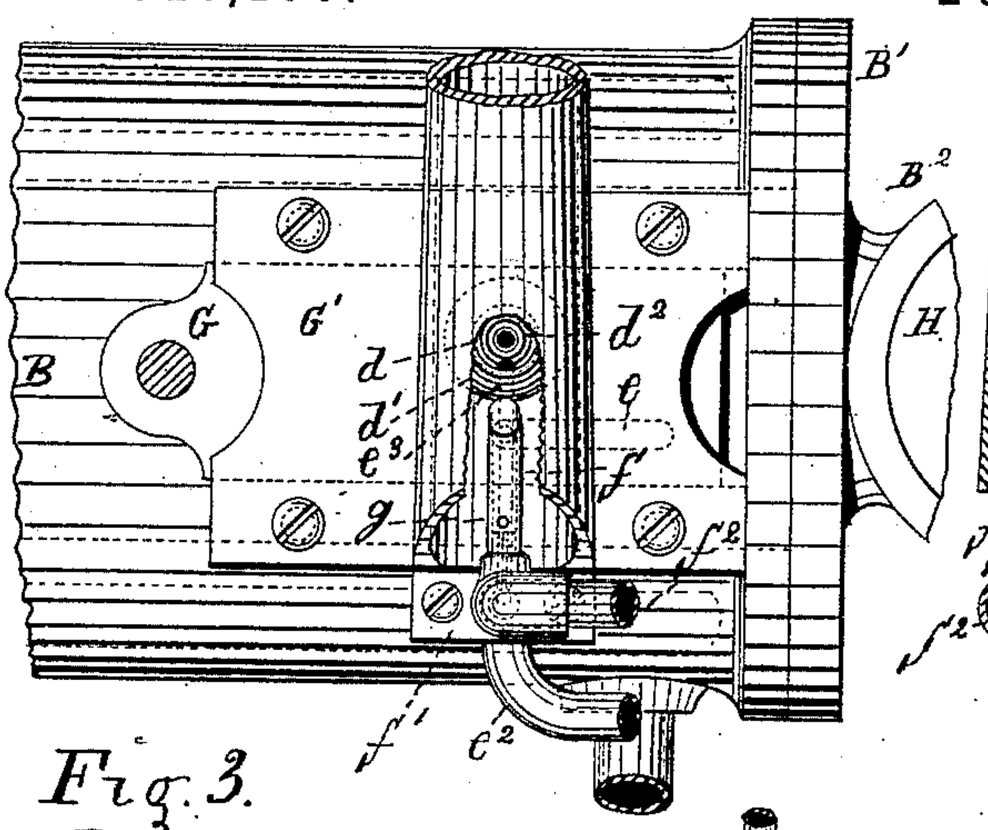


Fig. 3.

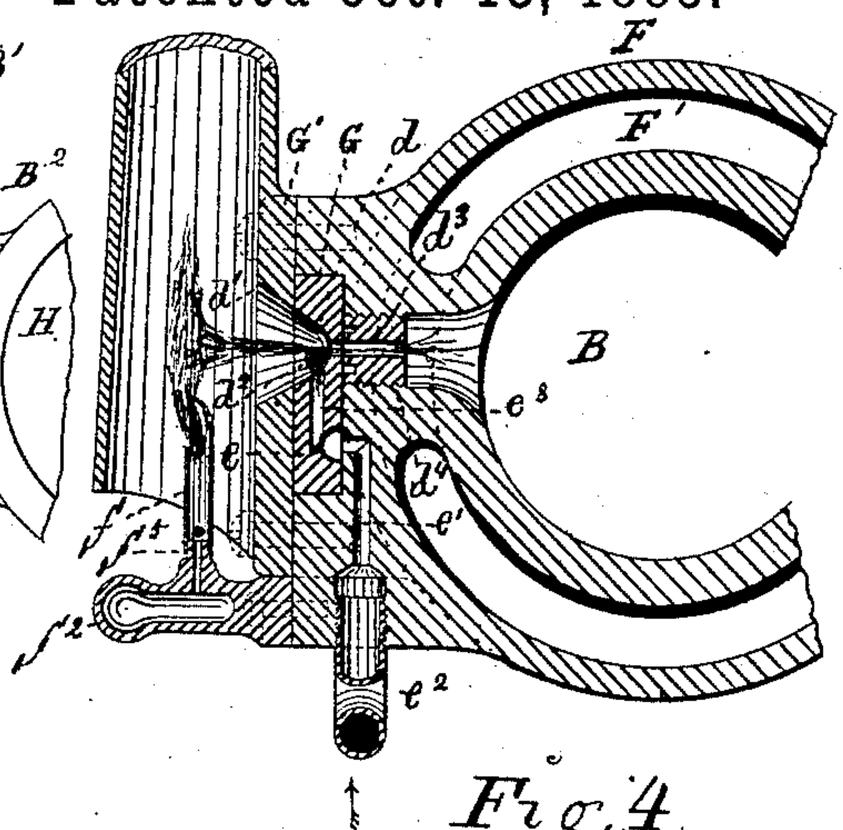
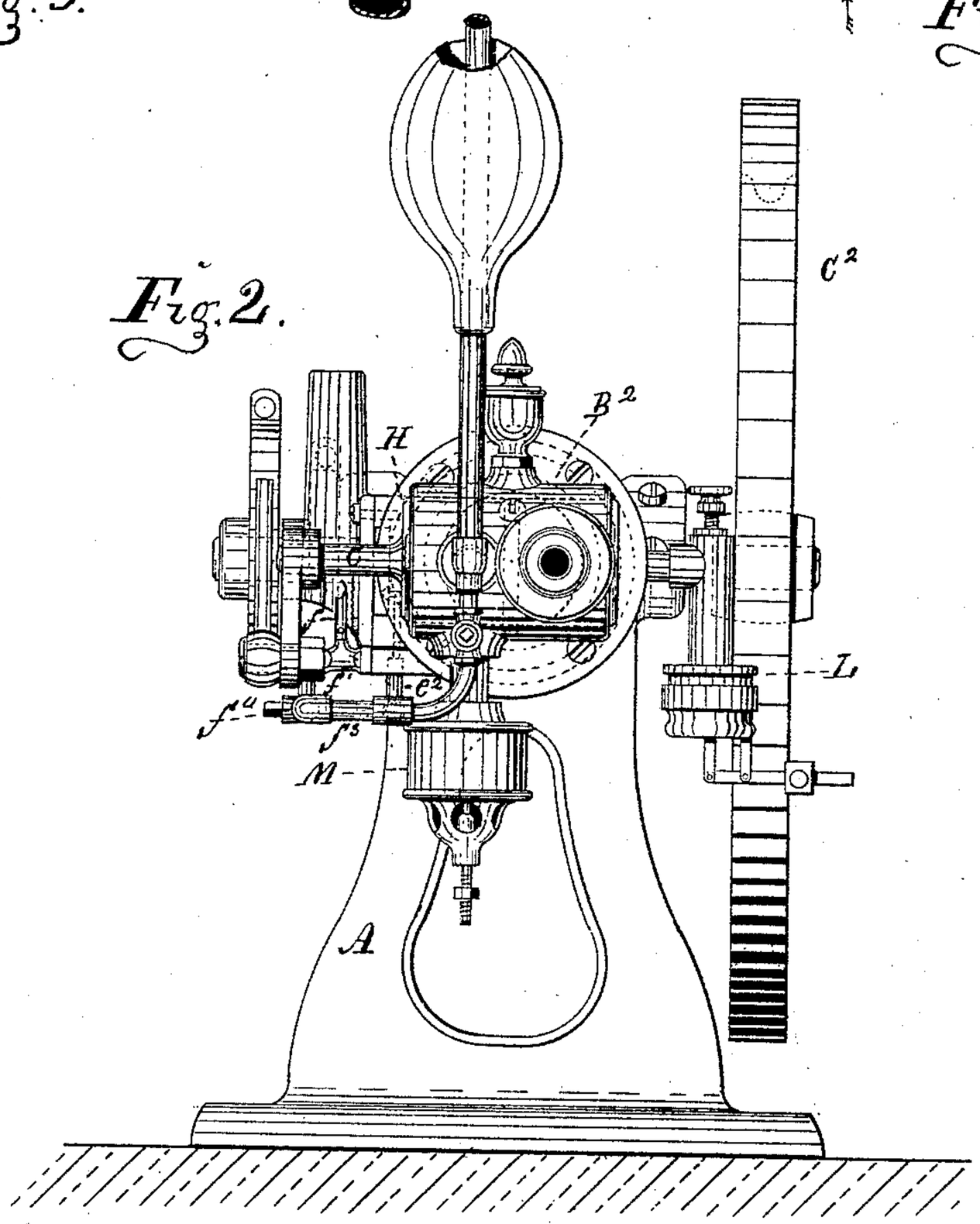


Fig. 4.

Fig. 2.



WITNESSES

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(No Model.) 3 Sheets—Sheet 3.

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GAS ENGINE.

No. 328,170. Patented Oct. 13, 1885.

Fig. 6.

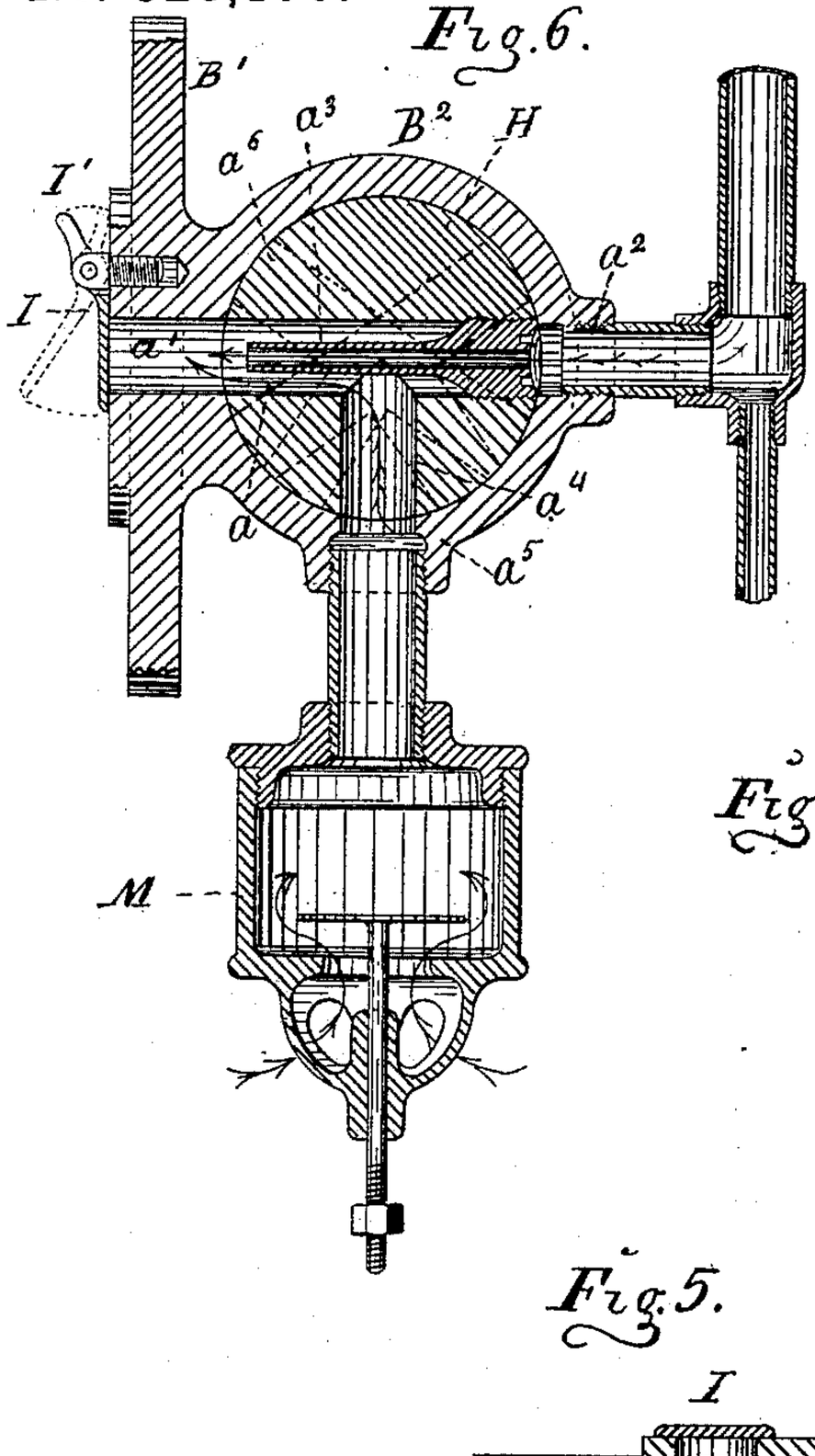


Fig. 7.

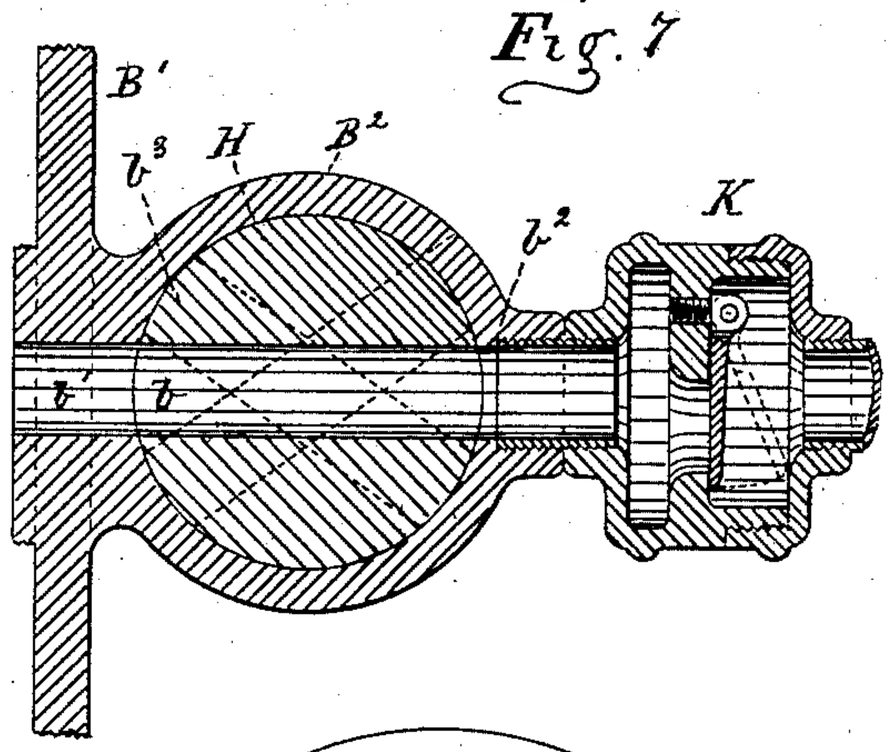


Fig. 8.

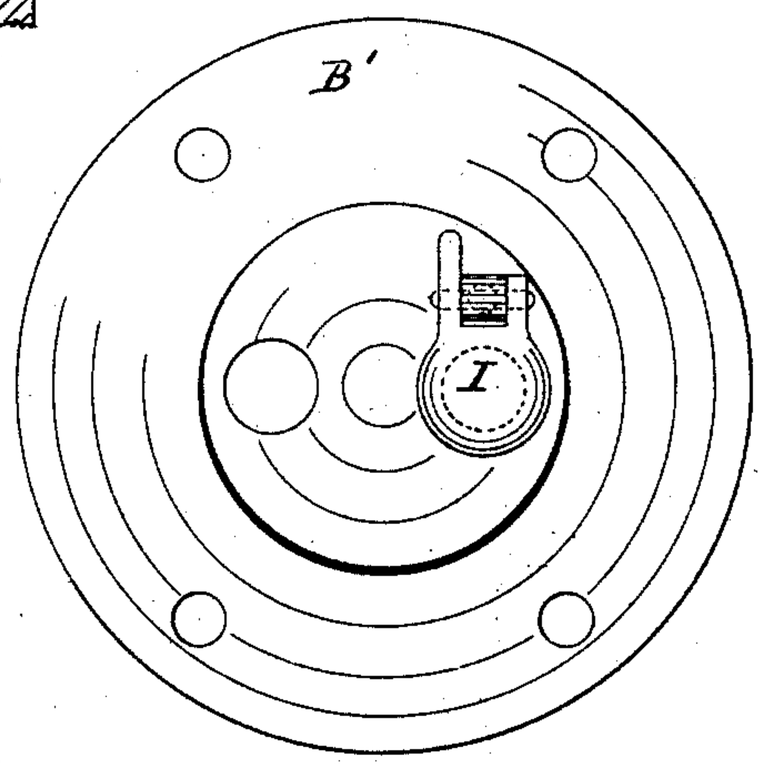
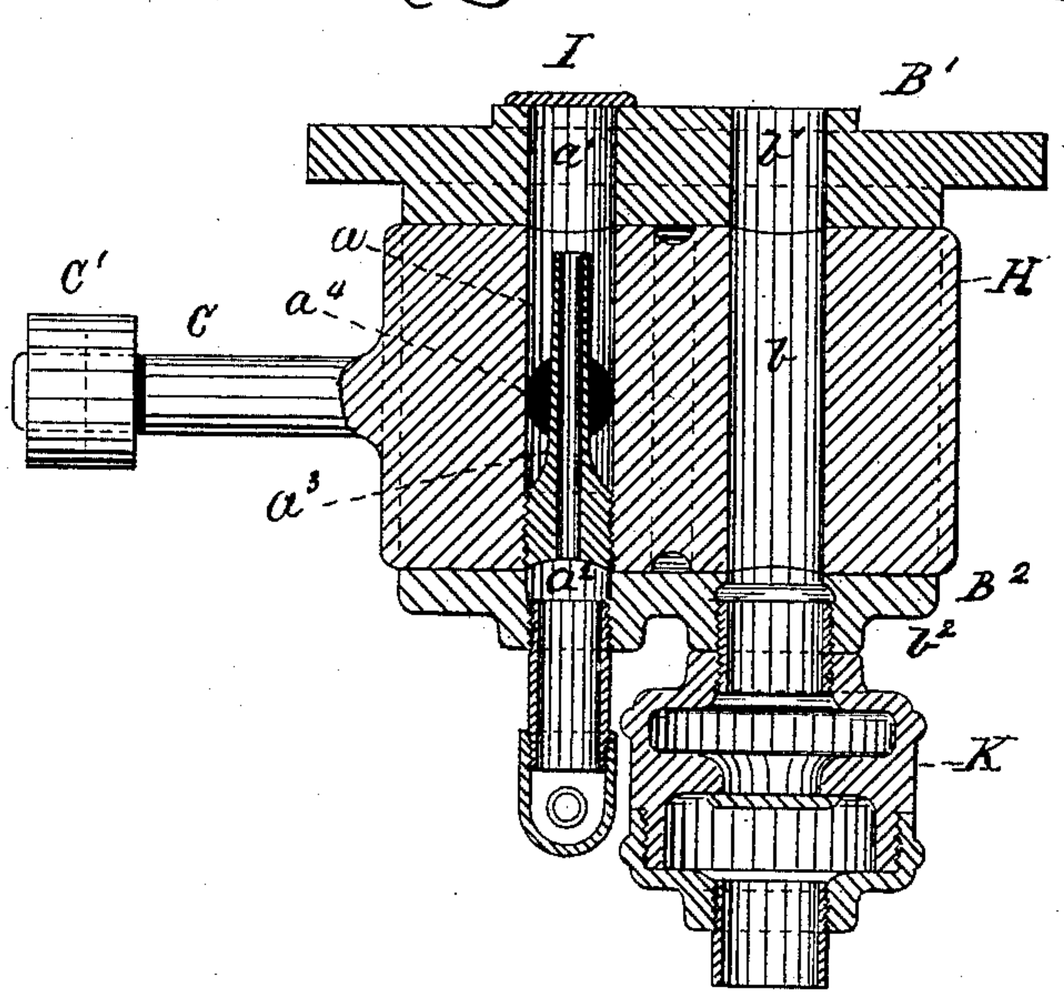


Fig. 5.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 328,170, dated October 13, 1885.

Application filed July 6, 1885. Serial No. 170,822. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH S. WOOD, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

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. These improvements have particular reference to and are made upon my invention patented June 10, 1884, No. 300,294.

In the accompanying drawings, Figure 1 represents a side elevation of my improved gas-engine. Fig. 2 is an end elevation; and Figs. 3, 4, 5, 6, 7, and 8 are enlarged sectional views showing in detail the nature and construction of my improvements.

Similar letters indicate corresponding parts in the drawings.

A is the bed-plate, with which is cast in one piece the cylinder B. B′ is the cylinder-head. B^2 is the piston; C, the connecting-rod; C′, the crank-shaft; C^2, the fly-wheel; and D is an eccentric giving an oscillating motion through eccentric-rod D′ to the cylindrical valve, which admits the explosive mixture of the air and gas to the cylinder. E is an additional eccentric, and E′ is an eccentric-rod which imparts motion to the ignition-slide for igniting the explosive mixture when the piston has reached the desired position in the cylinder, which point can be varied either sooner or later by changing the position of the eccentric on the crank-shaft. The cylinder B is made in the usual form, open at one end, having a jacket, F, and water-space F′, with the connecting inlet and outlet pipes F^2 and F^3 for the circulation of water to take up and carry away any excess of heat generated by the combustion of gases, all of which are well known and not claimed in my invention.

The cylinder is closed at the back end by the head B′, upon which is cast the valve-casing B^2, which is bored parallel for the reception of the valve and open at both ends.

Near the back end of the cylinder B, and upon one side, is arranged the igniter-slide G, and at the other side the auxiliary air-supply valve L, marked G in my original Patent No. 300,294. The purpose for which it is applied is therein fully described, and is not included among my improvements. The explosive mixture of air and gas is admitted into and exhausted from the cylinder B by the cylindrical valve H, inclosed by the cylindrical valve-casing B^2. The passage *a* in the valve H communicates, respectively, with the port *a′* in the cylinder-head B′ and the supply-passage a^2 in the cylinder-casing connecting with a gas-bag, as in common practice. In the passage *a* is arranged a tube or nipple, a^3, for proportioning the amount of gas admitted necessary for forming a proper explosive mixture, and can be removed and replaced by another tube of different capacity, if at any time found necessary with different gases. The supply of air is admitted through the passage a^4, communicating at right angles with the passage *a* in the valve, and mixes with the gas in its passage through the port *a′* into the cylinder when the passages *a* and a^4 register with the port, as shown in Fig. 6. The explosive mixture is admitted into the cylinder, and the explosion takes place when the passage and ports are out of register or when the passage is in the position of the dotted lines, as shown at a^6, Fig. 6.

I, Figs. 5, 6, and 8, is a hinged check-valve closing the admission-port in the cylinder-head B′, free to open inward during the admission of the explosive mixture, but is instantly closed by the explosion in the cylinder and remains closed until the products of combustion have been exhausted. When the admission-port is again opened and the piston has returned to that end of the cylinder to draw in another charge of air and gas, it is again opened as before. Attached to this valve is a short bent lever, I′, turning inward into the cylinder to serve as an auxiliary for starting the valve from its seat in case of sticking, against which the piston strikes and gives it a slight motion

when at this end of its stroke, thus insuring freedom of action to the valve.

The exhaust-passage *b* is arranged in the valve H on the same plane of the inlet-passage and parallel with it, having a corresponding port, *b'*, in the head B' and b^2 in the valve-casing. This passage is closed at the time of explosion, as shown by the dotted lines b^3 in Fig. 7; but opens when the piston has reached the opposite end of its stroke to exhaust the spent gases contained in the cylinder. At the port b^2 of the valve-casing B^2 is attached a check-valve, K, which opens outward to give free exit to the exhaust, but closes to the external atmosphere when the piston is drawing in a supply of air and gas through the supply-passages and the auxiliary air-supply valve L.

M, Figs. 1, 2, and 6, is a puppet-valve arranged in connection with the inlet air-passage *a*, Fig. 6, opening inward toward the admission-valve H, allowing free passage of air until the inflow is shut off by the admission-valve H, when by the force of gravity it closes, preventing the escape of air that has passed through it and also any gas that may accumulate during the time of explosion into and the exhaust of gas from the cylinder. Motion or oscillation is given to the valve H by means of the valve-spindle C and rock-arm C' in connection with the eccentric D and eccentric rod D'.

The ignition-slide G, Figs. 1, 3, and 4, is arranged in a recess (conforming to the shape of the slide) on the side of the cylinder B, and is held in position by a cover, G', and upon this cover is formed the chimney in ordinary use for the protection of the igniting gas-jet from extinguishment. To the slide G is given a reciprocating motion by means of the eccentric E and rod E'. This slide is formed with a conical recess, *d*, on the front or face side, with a correspondingly-formed opening, *d'*, in the slide-cover. At the apex of this conical recess is formed the ignition hole or vent d^2, which registers in its motion with a corresponding hole or vent, d^3 in the side of the cylinder shown in Fig. 4. This hole is made in a bushing, d^4, secured in the cylinder by a screw-thread to enable its replacement by another if desired. On the back of the slide G and facing the cylinder is formed a chamber, *e*, into which gas is introduced through the orifice *e'*, communicating with the gas-main by means of pipe e^2. This chamber *e* has also another passage, e^3, extending upward and into the conical recess *d* in the front side of the slide G, and opening near the ignition-hole d^2. The object of this arrangement of chamber *e* together with its communications is to supply a small quantity of pure gas as an auxiliary to the ignition-flame at the time of explosion, and also to insure its regular action.

The gas-burner *f* is supported by a bracket, *f'*, which is secured to the cylinder B, and is supplied with gas by the pipe f^2 from the gas-main f^3, and the flow is regulated by the valve f^4. This burner *f* is constructed in the form of a tube with the upper or flame end full open, with a flap or spreader extending upward a distance about equal to the diameter of the tube, and on the side toward the ignition-vent of the slide, this flap spreads the flame, and also prevents its extinguishment by the short blast produced by the explosion during the registering of the vent-holes in the slide and the cylinder. The gas-passage f^5 between the supply-pipe and burner is very much contracted, which allows of an expansion of the gas as it enters the burner, and at which point it is mixed with air admitted through holes *g* at the base of the burner-tube. This arrangement of burner produces a perfect combustion, and also a flame with intense heat with a minimum amount of gas.

The operation of the gas-engine is extremely simple. The ignition gas-jet is first turned on and ignited; then the valve opened, which admits the gas to the engine; then by giving the fly-wheel a partial turn the admission-port of the cylindrical valve H is opened, when gas and air is drawn in by the forward motion of the piston. When a sufficient charge has been admitted or when the piston has arrived at the proper position in its stroke, the admission-valve shuts off the supply by means of the eccentric. At this point the ignition-ports are brought into register for an instant, the gas-flame drawn in, and the charge exploded, the force of which drives the piston to the end of its stroke. At this point of the revolution the exhaust-port is opened by the return motion of the valve, when, by the momentum already acquired by the fly-wheel, the crank is carried over the dead-center and the piston driven back on the return-stroke, expelling the products of combustion from the cylinder, when the supply of gas mixture is again admitted and the operation continues until the engine is stopped by shutting off the supply of gas.

Having thus described the nature, construction, and application of improvements on my gas-engine patented June 10, 1884, No. 300,294, I disclaim in this invention all that is included in that patent; but

What I do claim as new and useful, and wish to secure by Letters Patent, is—

1. In a gas-engine, the combination of a cylinder, B, with a cylindrical valve, H, having an inlet-passage, *a*, and an exhaust-passage, *b*, separate and apart and arranged on the same plane with each other, with corresponding ports, *a'* and *b'*, in the head B', and ports a^2 and b^2 in the valve-casing B^2, together with the gas-regulating nipple or tube a^3, substantially as set forth.

2. In a gas-engine, in combination, a cylinder, B, a cylindrical valve-casing, B^2, and cylindrical valve H, together with a check-valve, K, opening outward and connected to

the exhaust-passage *b*, and the check-valve M, opening inward, arranged and connected with the air-passage a^5, for the purposes set forth.

3. In a gas-engine, in combination, a cylinder, B, cylinder-head B′ with a check-valve, I, and bent lever I′, for the purposes described.

4. In a gas-engine, in combination, a cylinder, B, with an igniter-slide, G, arranged on one side and near the back end, this slide having a cover, G′, a conical recess, *d*, an ignition-orifice, *d′*, an auxiliary gas-chamber, *e*, a supply-orifice, *e′*, and a discharge-orifice, e^3, substantially as described.

5. In a gas-engine, in combination, a cylinder, B, cylindrical valve H, ignition-slide G, and gas-jet burner *f*, bracket *f′* in connection with the supply-pipe f^2, reducing-orifice f^5, and air-supply holes *g*, all as substantially described and herein set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH S. WOOD.

Witnesses:
H. C. COVERT,
C. B. ENSLEY.