(No Model.) 4 Sheets—Sheet 1.

J. J. E. LENOIR.

GAS ENGINE.

No. 335,462. Patented Feb. 2, 1886.

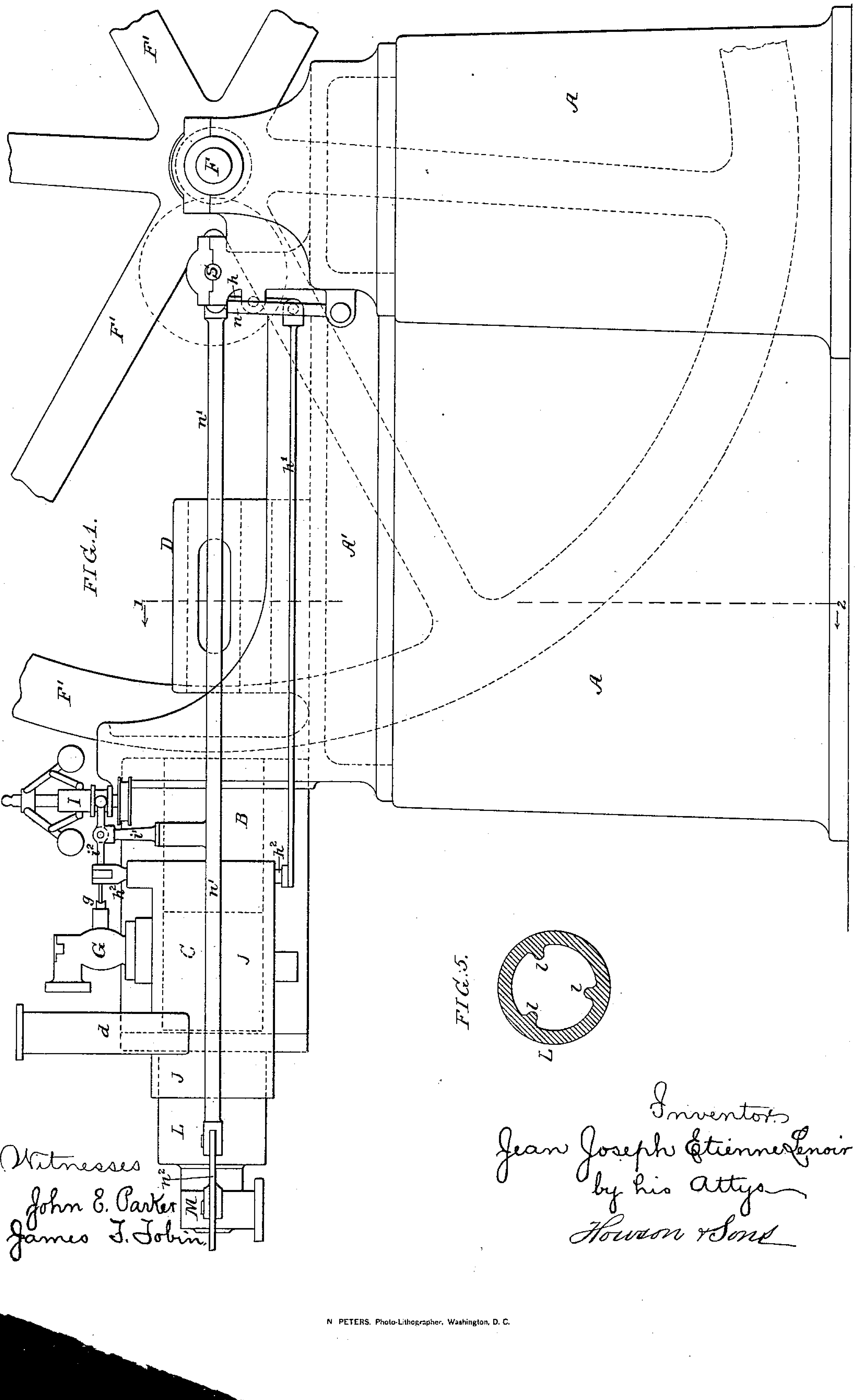

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FIG. 4.

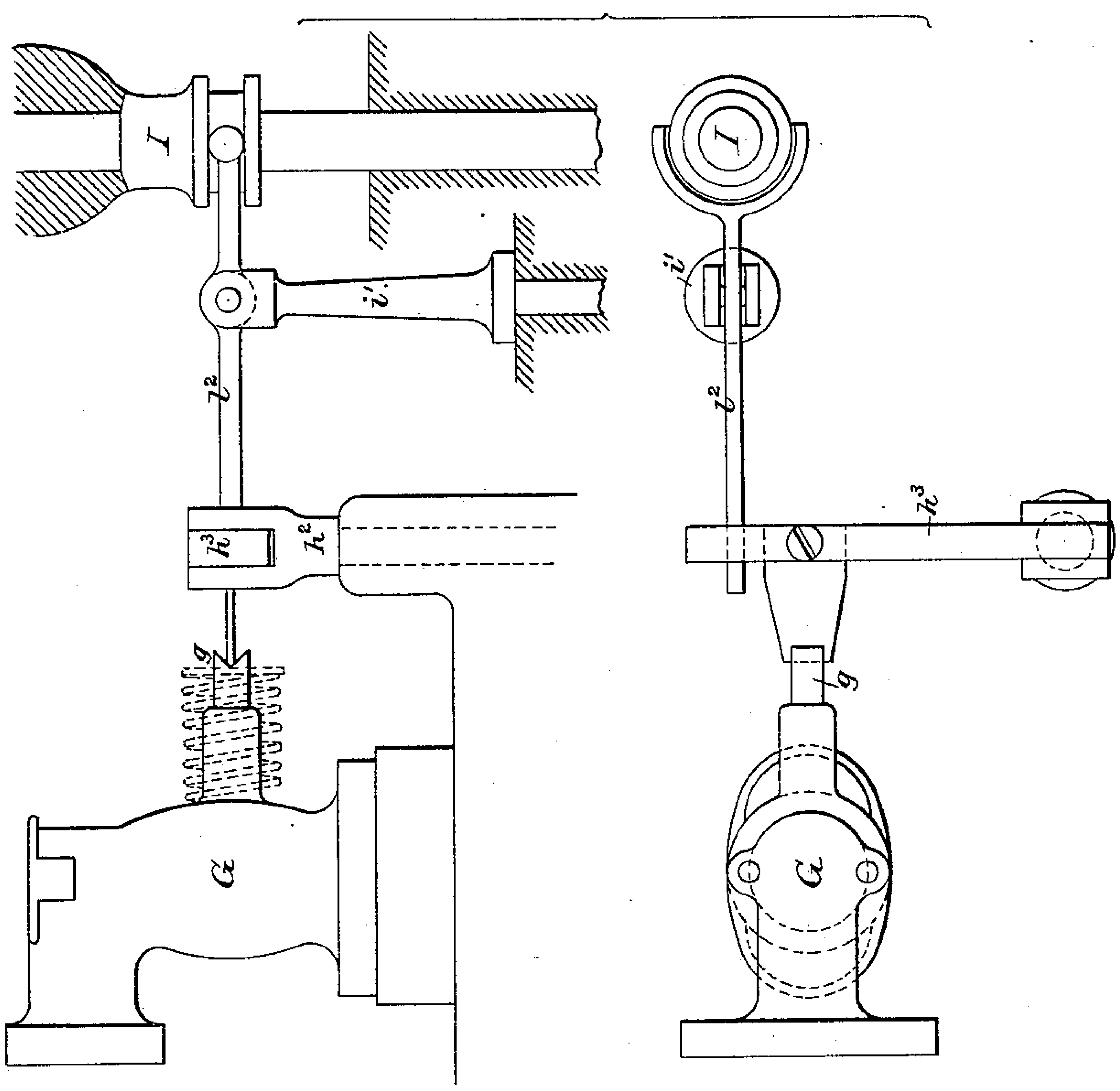
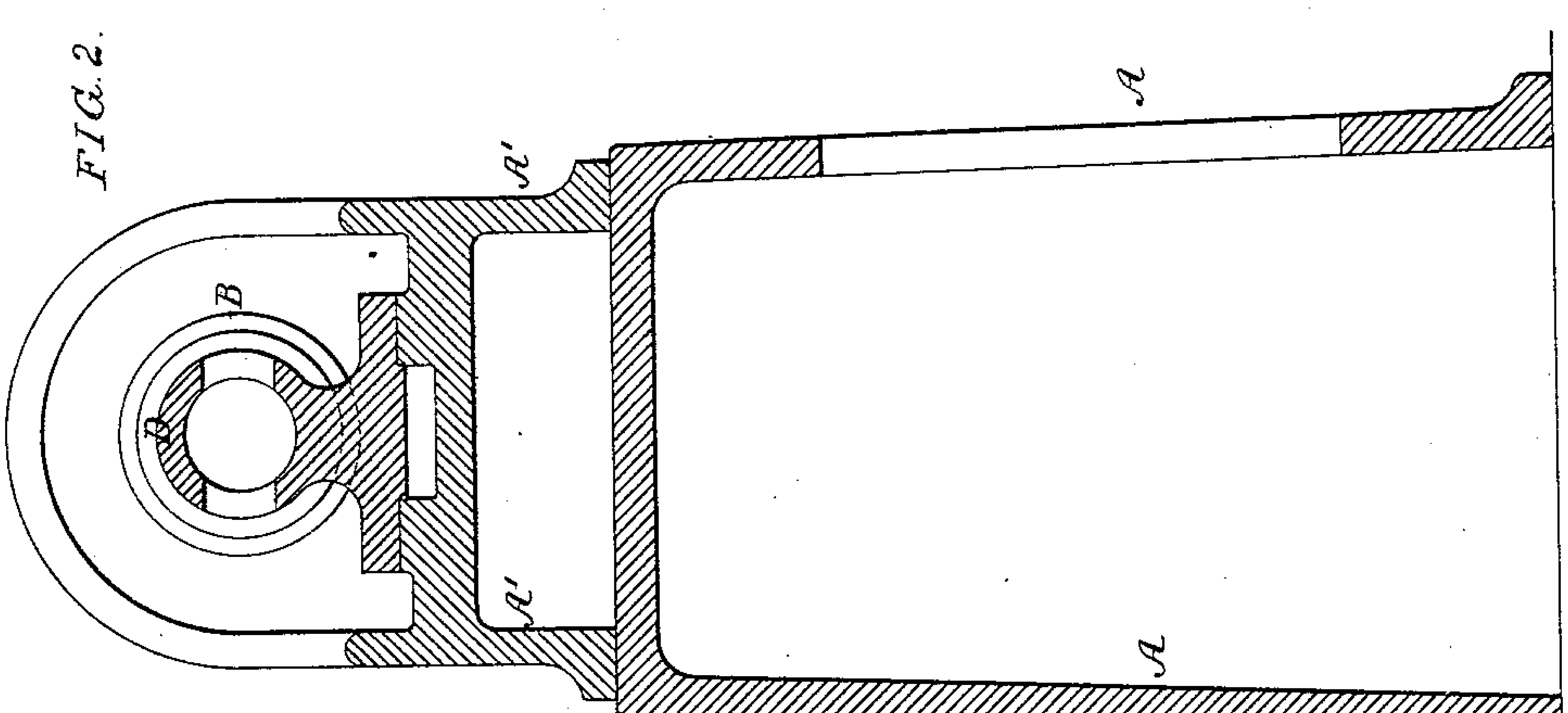


FIG. 2.



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J. J. E. LENOIR.

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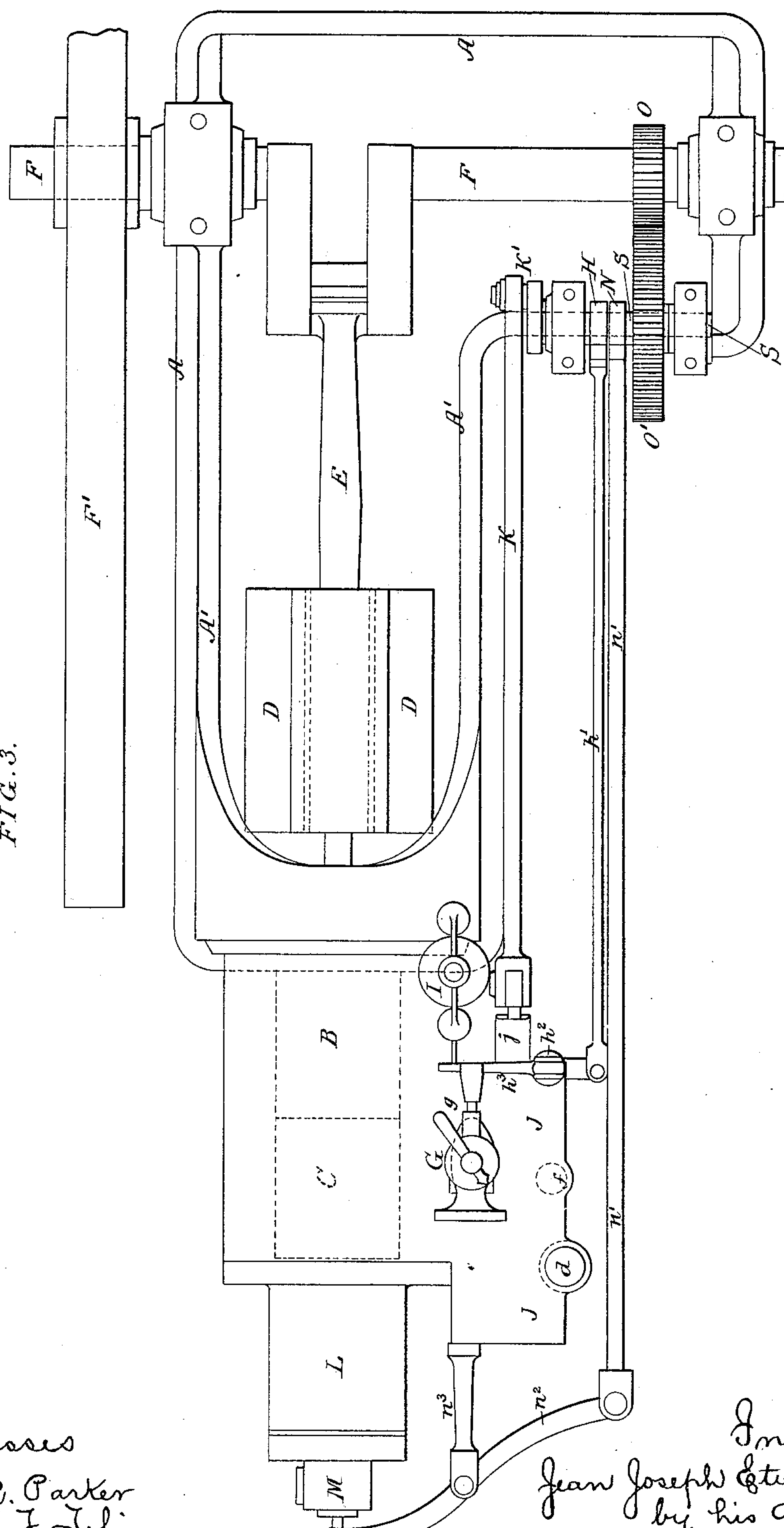

FIG. 3.

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J. J. E. LENOIR.

GAS ENGINE.

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FIG. 7.

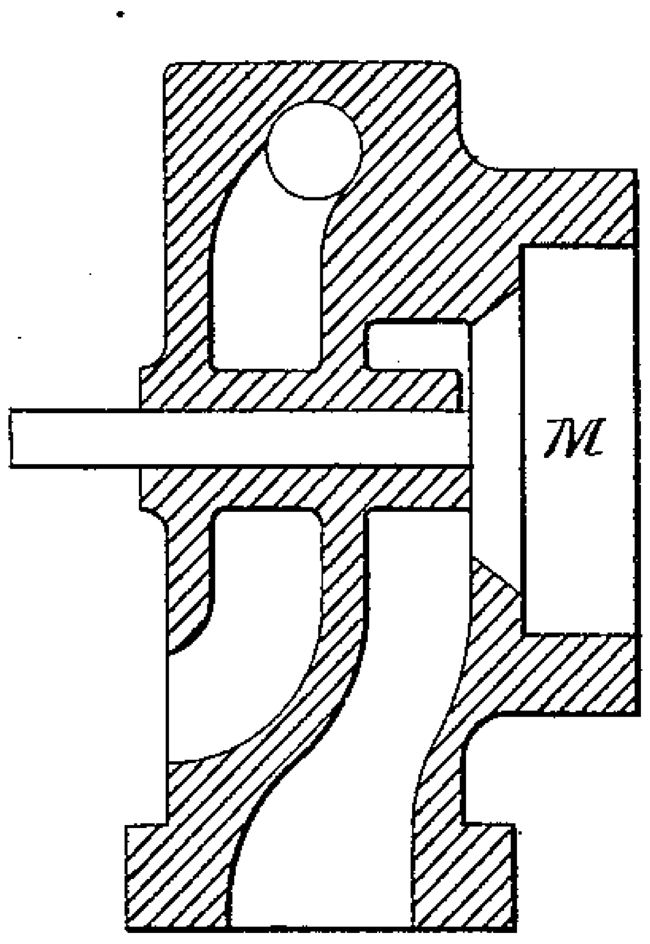


FIG. 6.

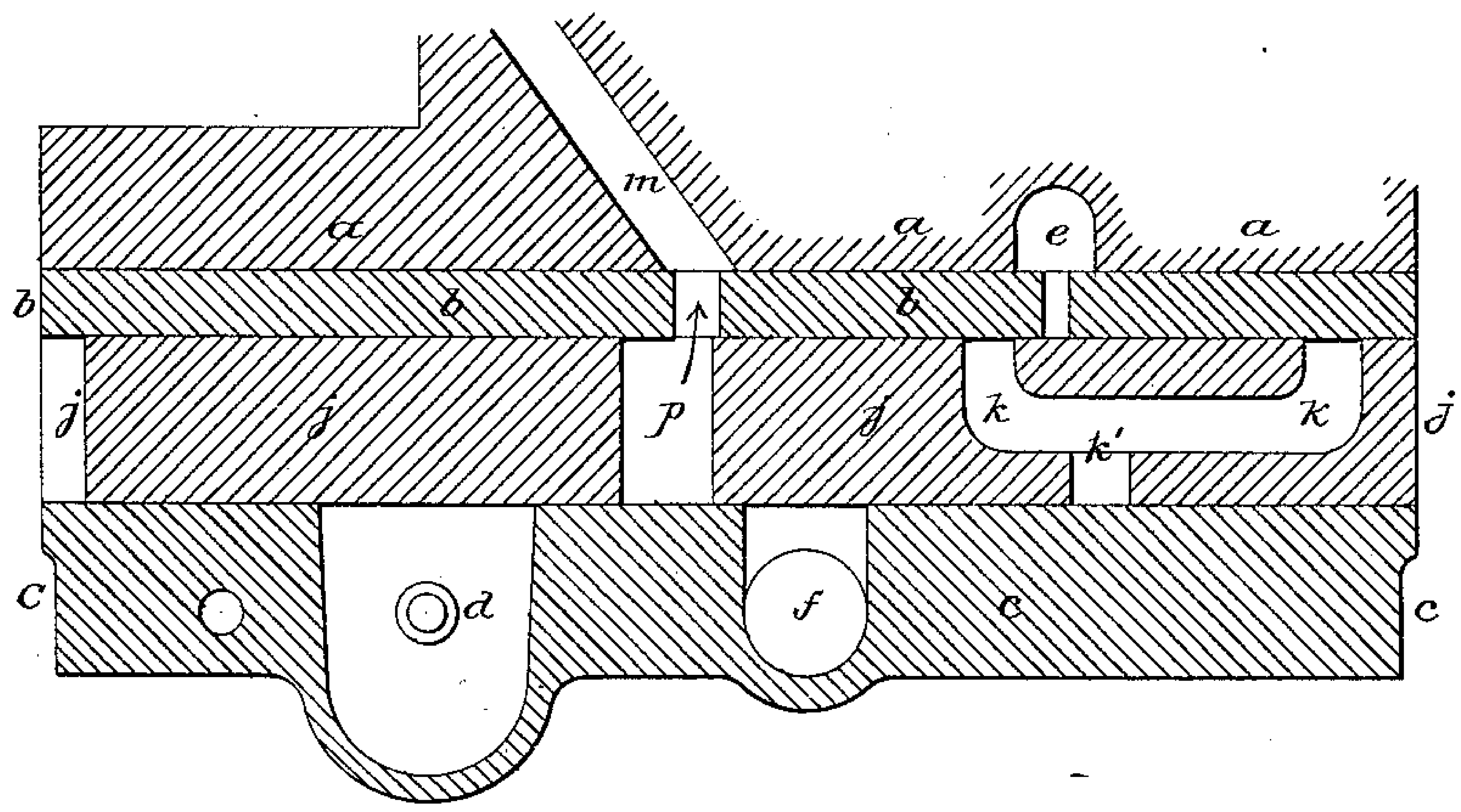
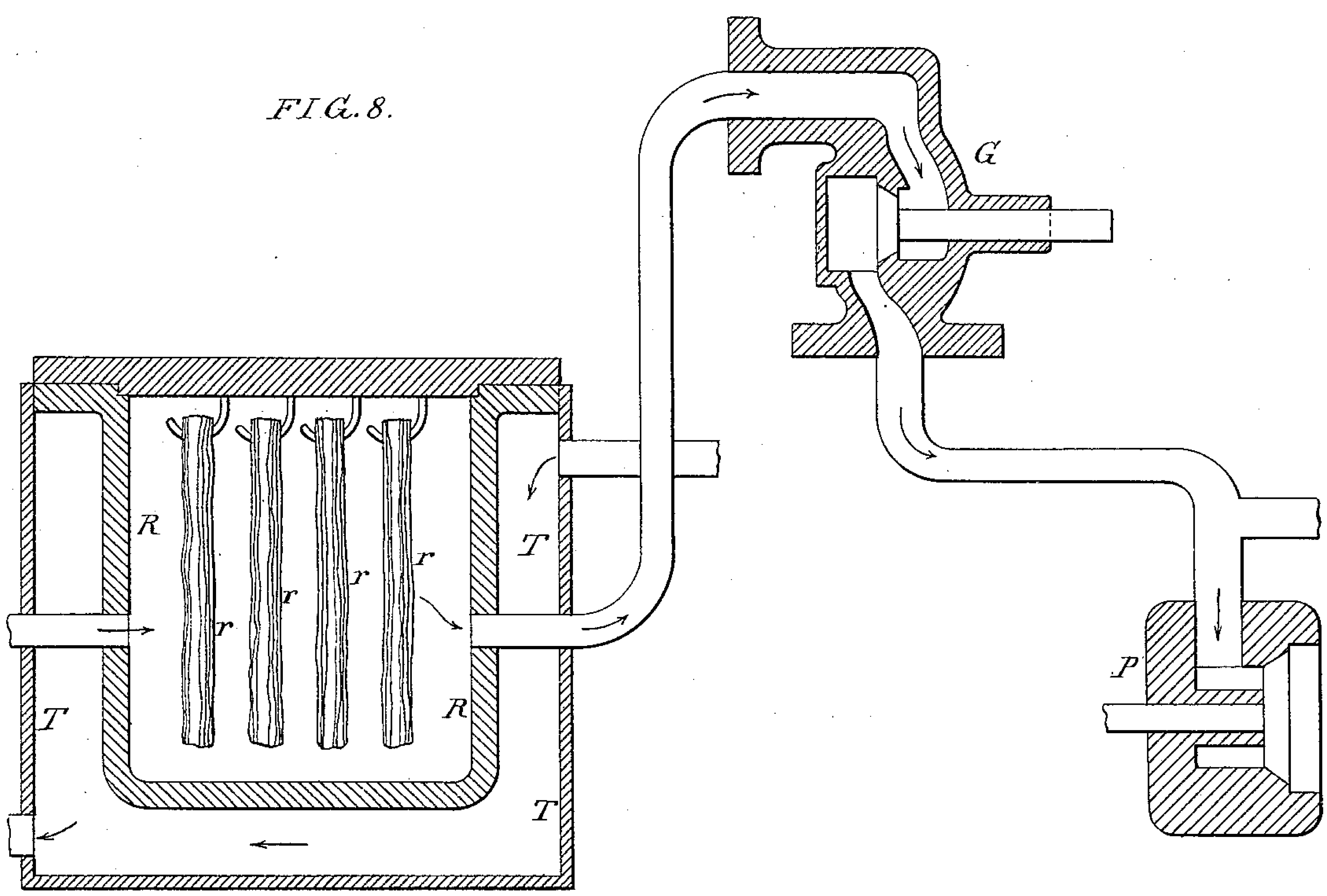


FIG. 8.



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UNITED STATES PATENT OFFICE.

JEAN JOSEPH ETIENNE LENOIR, OF PARIS, FRANCE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 335,462, dated February 2, 1886.

Application filed December 10, 1883. Serial No. 114,081. (No model.) Patented in France October 27, 1883, No. 158,259; in Belgium November 7, 1883, No. 63,141; in England November 10, 1883, No. 5,315, and in Austria September 6, 1884, No. 42,213.

To all whom it may concern:

Be it known that I, JEAN JOSEPH ETIENNE LENOIR, a citizen of the Republic of France, and residing in Paris, France, have invented Improvements in Gas-Engines, of which the following is a specification.

My invention consists of certain improvements in the construction of that class of gas-engines in which an ignition of the gaseous mixture takes place at every other back-and-forth movement of the piston, some of my improvements being also applicable to other forms of gas-engines.

In the accompanying drawings, Figure 1 is a side view or elevation of a gas-engine embodying my improvements, the fly-wheel being cut away for want of space. Fig. 2 is a transverse section through the frame and cross-head guides on the line 1 2, Fig. 1. Fig. 3 is a plan view of the engine. Fig. 4 illustrates in side view (partly in section) and in plan view the governing devices drawn to a larger scale. Fig. 5 is a sectional view through the heating-chamber. Fig. 6 is an enlarged sectional view of the slide-valve, valve-chest, and posts. Fig. 7 is an enlarged sectional view of the exhaust-valve, and Fig. 8 is a sectional view of the gas-supply valve and attachment.

Referring to Figs. 1 and 2, A is the base or pedestal, on which is mounted the bed A′ of the engine, B being the cylinder, and D the cross-head guides. The piston C (shown by dotted lines) is controlled, through the usual connecting-rod, E, by the crank-shaft F, mounted in suitable bearings and carrying a fly-wheel, F′, the crank-shaft being geared, through the spur and pinion O O′, to a shaft, S, controlling the valve-gear, the relative sizes of the spur and pinion being such that the shaft S makes one revolution for every two revolutions of the crank-shaft. On the inner end of the shaft S is a crank, K′, Fig. 3, controlling, through a connecting-rod, K, the slide-valve *j*, which is arranged longitudinally of the cylinder B. On the same shaft S are mounted two cams, H and N, Fig. 3, of which the former operates a tappet, *h*, Fig. 1, connected by the rod *h′* to an arm on the lower end of a vertical rock-shaft, h^2, carrying at its upper end an arm, h^3, controlling the stem *g* of the gas-supply valve G, as hereinafter described. The other cam, N, operates a tappet, *n*, connected by a rod, *n′*, to a lever, n^2, pivoted to a post, n^3, Fig. 3, on the valve-chest J, and controlling the exhaust-valve M, which is arranged in the end of the cylinder, or, rather, at the end of the heating or ignition chamber L immediately in the rear of the cylinder B. As shown in the sectional view, Fig. 5, I provide the interior of this chamber L with ribs *l*, to increase the heating-surface.

The valve M, for the escape of the burned gases is illustrated in section in Fig. 7, and will not need further description. The gas admission valve G, Figs. 4 and 8, which is closed by the usual spring, (indicated by dotted lines in Fig. 4,) is opened periodically by the movement of the arm h^3. This arm is pivoted or hinged to the shaft h^2, and its outer end is supported by an arm of the lever i^2, which is mounted on the post *i′*, and is controlled by the governor I, so that when the engine runs at too high a speed the governor will allow the end of the arm h^3 to drop out of line with the valve-stem *g*, so that the engine will run without the gas-supply until the normal speed is restored.

The construction of the slide-valve and ports in the valve-chest is illustrated in Fig. 6, *a* being the seat of the valve, *j* the slide-valve, *b* the intermediate plate, and *c* the back plate. There is in the valve-chest the usual gas-supply opening, *e*, leading from the above-described valve G, and in the back plate the air-supply *f*, while *d* is the igniting-jet. The slide *j* is provided with the ports *k k′*, for the simultaneous admission of the air and gas to the port *m*, which opens into the working-cylinder for the piston, while the port *p* in the slide is the ignition-port.

The operation of the slide *j* is similar to that of gas-engines now in use, the slide being first moved to admit the air and gas to the cylinder on the outward stroke of the piston. This mixture is thence forced into and compressed in the ignition-chamber L on the return-stroke of the piston. When the piston has reached the end of its inward stroke, the slide *j* has been moved to cause the ignition of the compressed mixture in the chamber L, and the full effect of the explosion on the piston is thus given at the beginning of its outward stroke. On the next inward return movement of the piston the exhaust-valve M is opened to allow the burned gases to escape, and then the above-described operations are repeated. As the port *m* opens into the bottom of the working-cylinder B, or, in other words, between the said cylinder and ignition-chamber L, the mixture of air and gas is first drawn into the cylinder on the outward stroke of the piston, and does not enter the ignition-chamber until it is forced therein on the inward return-stroke of the piston, and, owing to the heat of this chamber from the explosions, this mixture is heated therein prior to ignition, but without heating the cylinder B to any great extent, so that the piston being but little expanded by heat it is not liable to stick. Owing to the heating of the gaseous mixture in the chamber L, however, a comparatively poor gaseous mixture may be used, as the elevated temperature attained by the heater produces a maximum expansion of the gases, thus enabling a relatively large amount of power to be produced by the consumption of a relatively small quantity of gas.

The motor constructed as above described may be worked with carbureted hydrogen in place of illuminating-gas, in which case a valve, P, Fig. 8, is preferably substituted for the slide-valve *j*, and the explosive mixture is ignited by electricity. For this purpose I may use in place of batteries a small magneto or dynamo electric machine supplying an accumulator or secondary battery.

In order to carburet the air for working the engine, the air is passed through a chamber, R, Fig. 8, in which are suspended screens *r*, dipping into the carbureting-liquid and presenting a large carburetting-surface. The air from the carburetor passes through the valve G to the cylinder B.

To heat the air in the carburetor, the burnt gases from the engine may be caused to circulate in the jacket T, or otherwise.

I claim as my invention—

1. The combination of the working-cylinder and piston of a gas-engine with an ignition or heating chamber at the end of said cylinder, and having internal ribs, as and for the purpose set forth.

2. The combination of the cylinder and piston of a gas-engine and gas-controlling valve G, with an arm, h^3, pivoted to a rock-shaft, h^2, and a governor, I, controlling said arm with reference to the stem of the valve G, substantially as set forth.

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

JEAN JOSEPH ETIENNE LENOIR.

Witnesses:
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