No. 622,469. Patented Apr. 4, 1899.

F. C. HIRSCH.

OIL ENGINE.

(Application filed Sept. 8, 1898.)

(No Model.)

7 Sheets—Sheet 1.

Fig. 1.

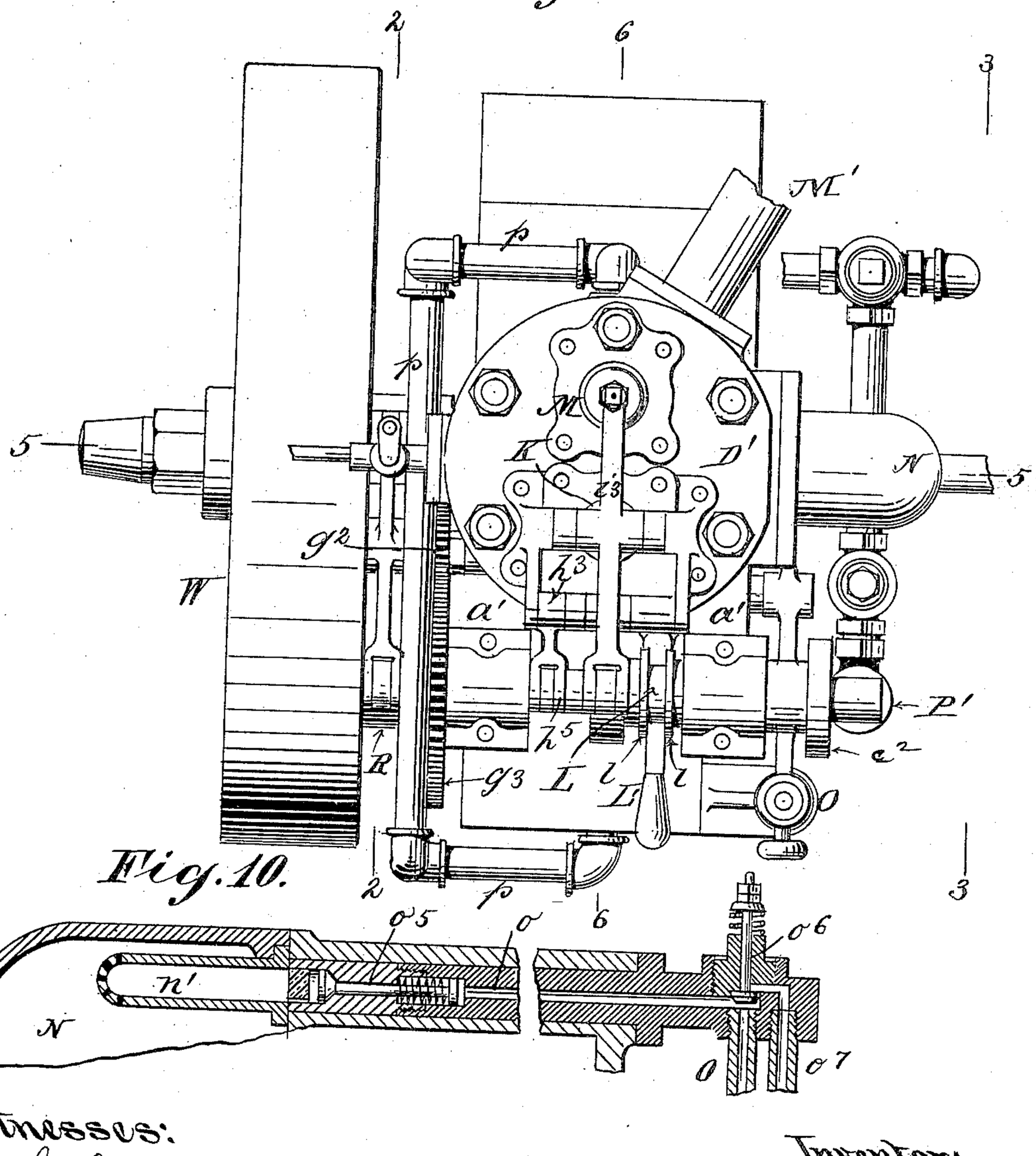
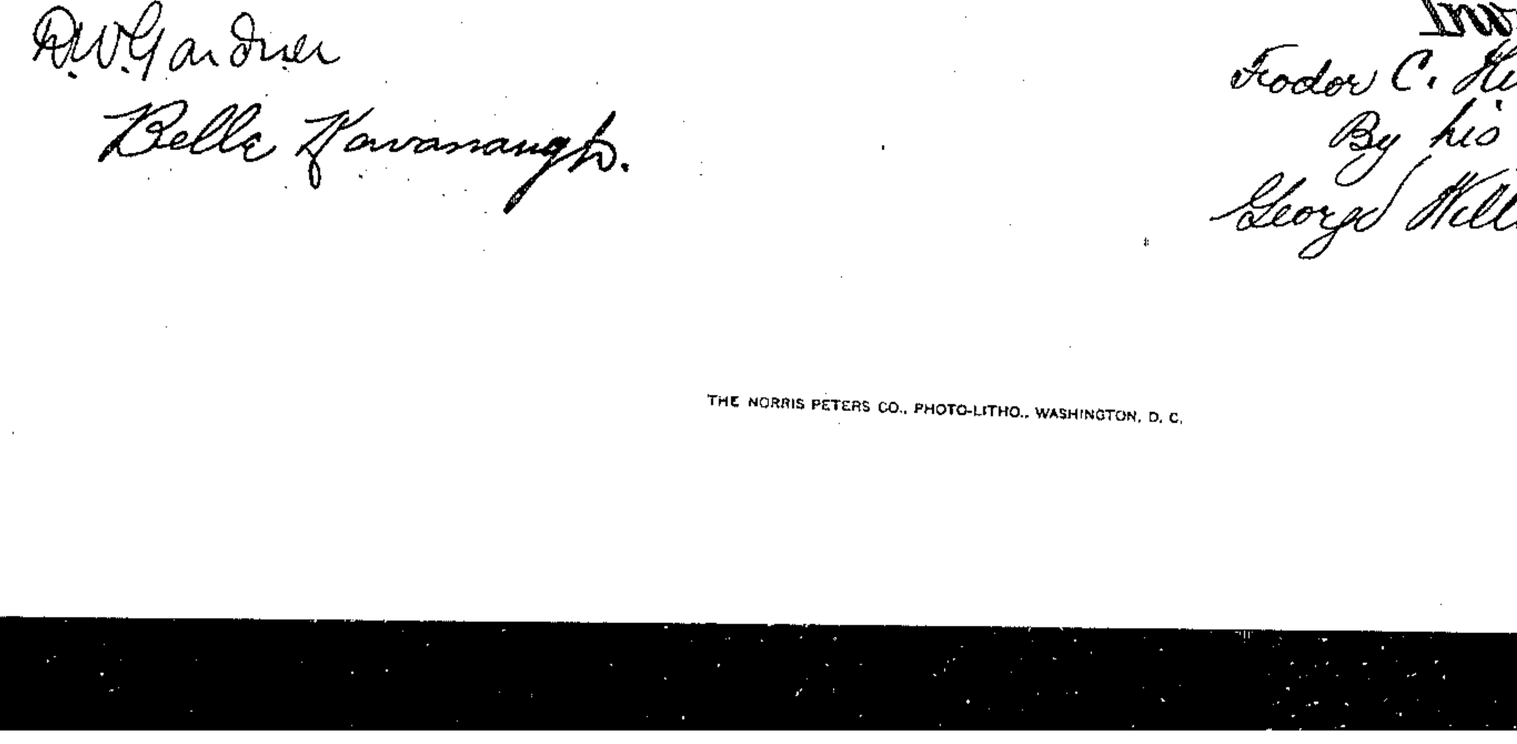


Fig. 10.



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No. 622,469.

Patented Apr. 4, 1899.

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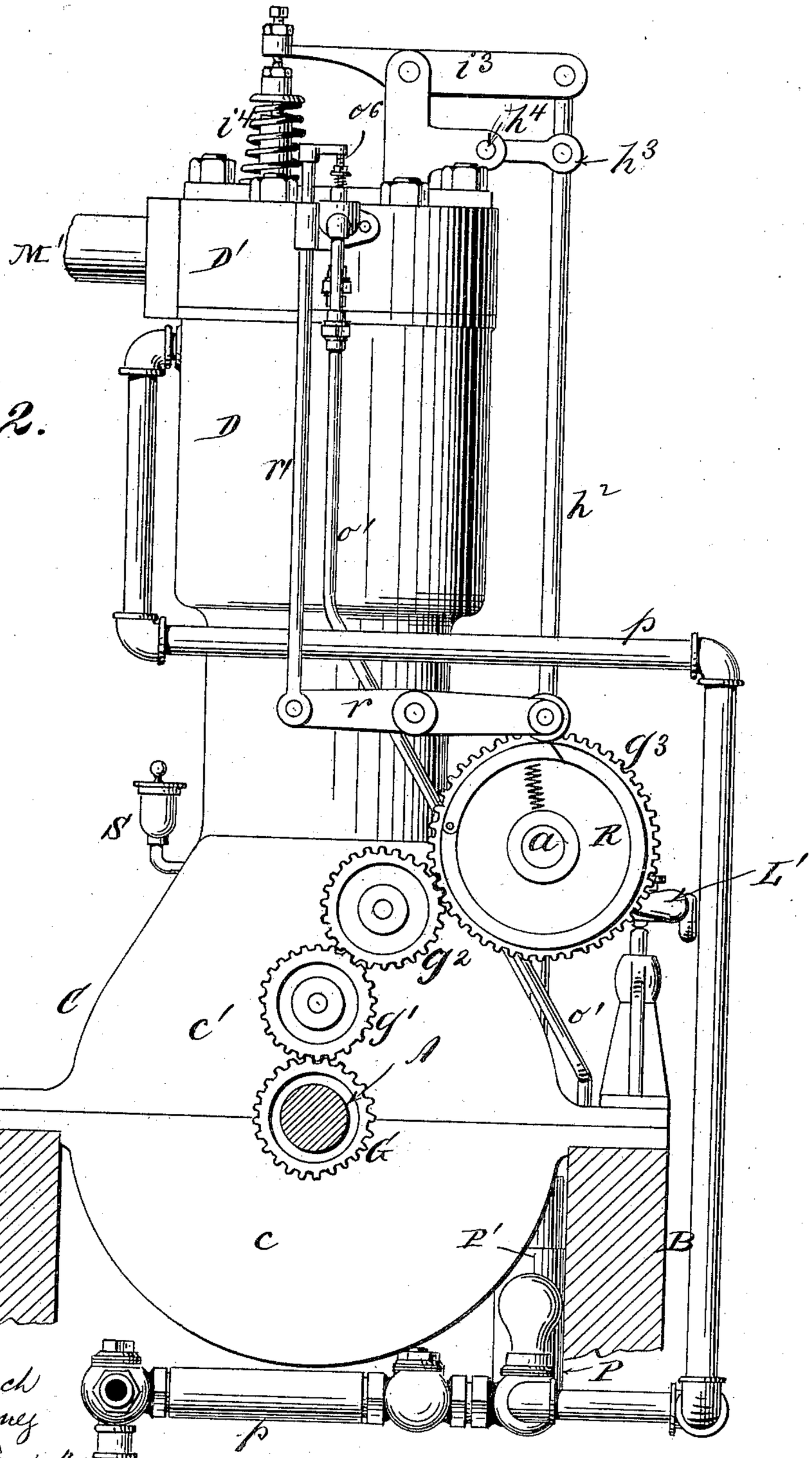
7 Sheets—Sheet 2.

Fig. 2.



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Patented Apr. 4, 1899.

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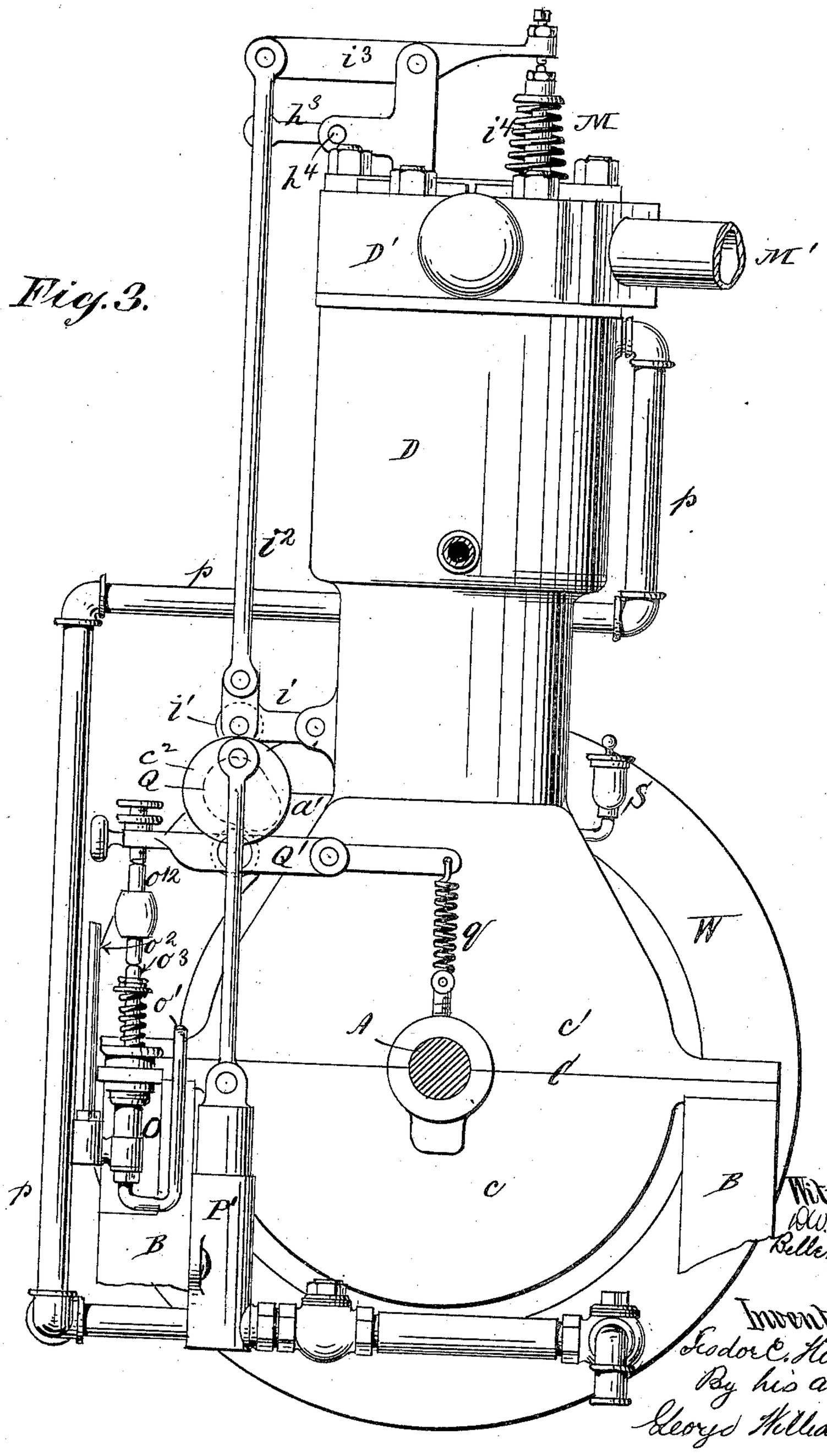
(No Model.)

7 Sheets—Sheet 3.

Fig. 3.



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No. 622,469. Patented Apr. 4, 1899.

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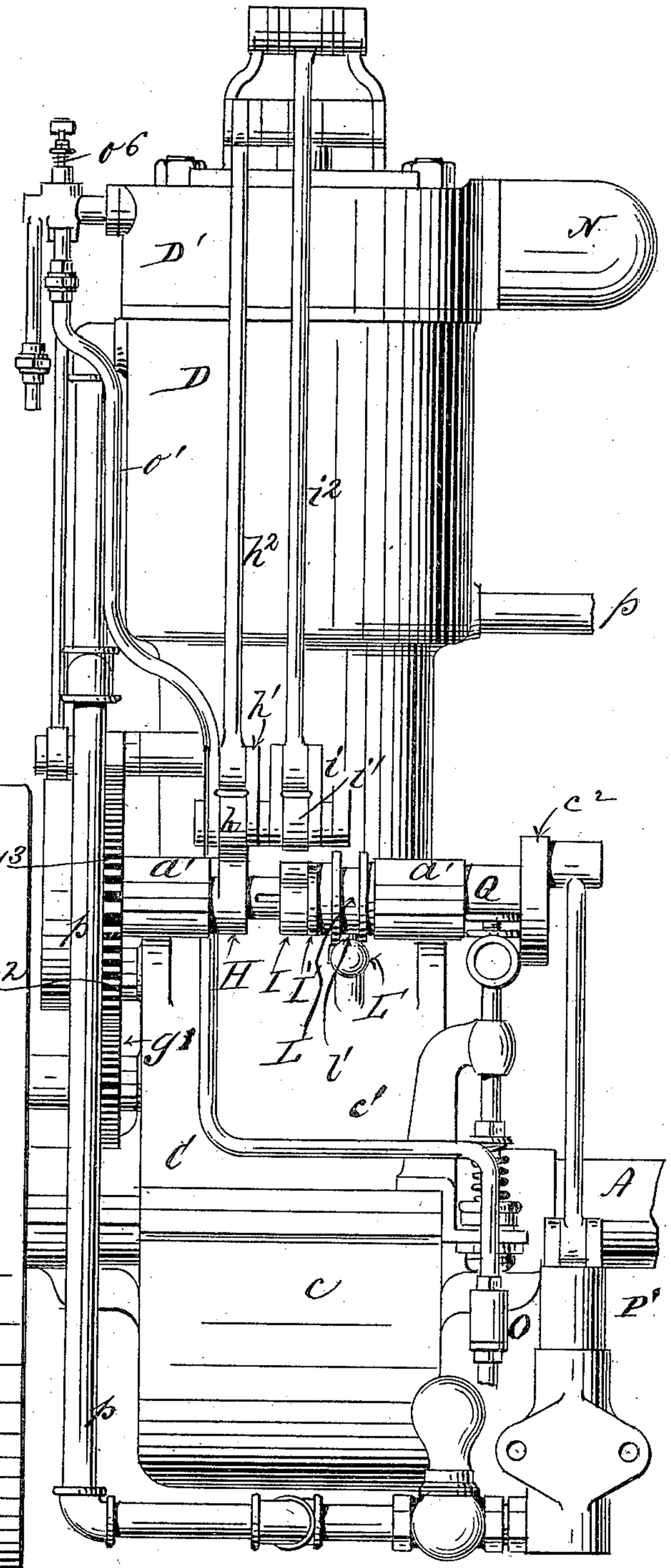
(Application filed Sept. 8, 1898.)

(No Model.) 7 Sheets—Sheet 4.

Fig. 1.



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(Application filed Sept. 8, 1898.)

(No Model.)

7 Sheets—Sheet 5.

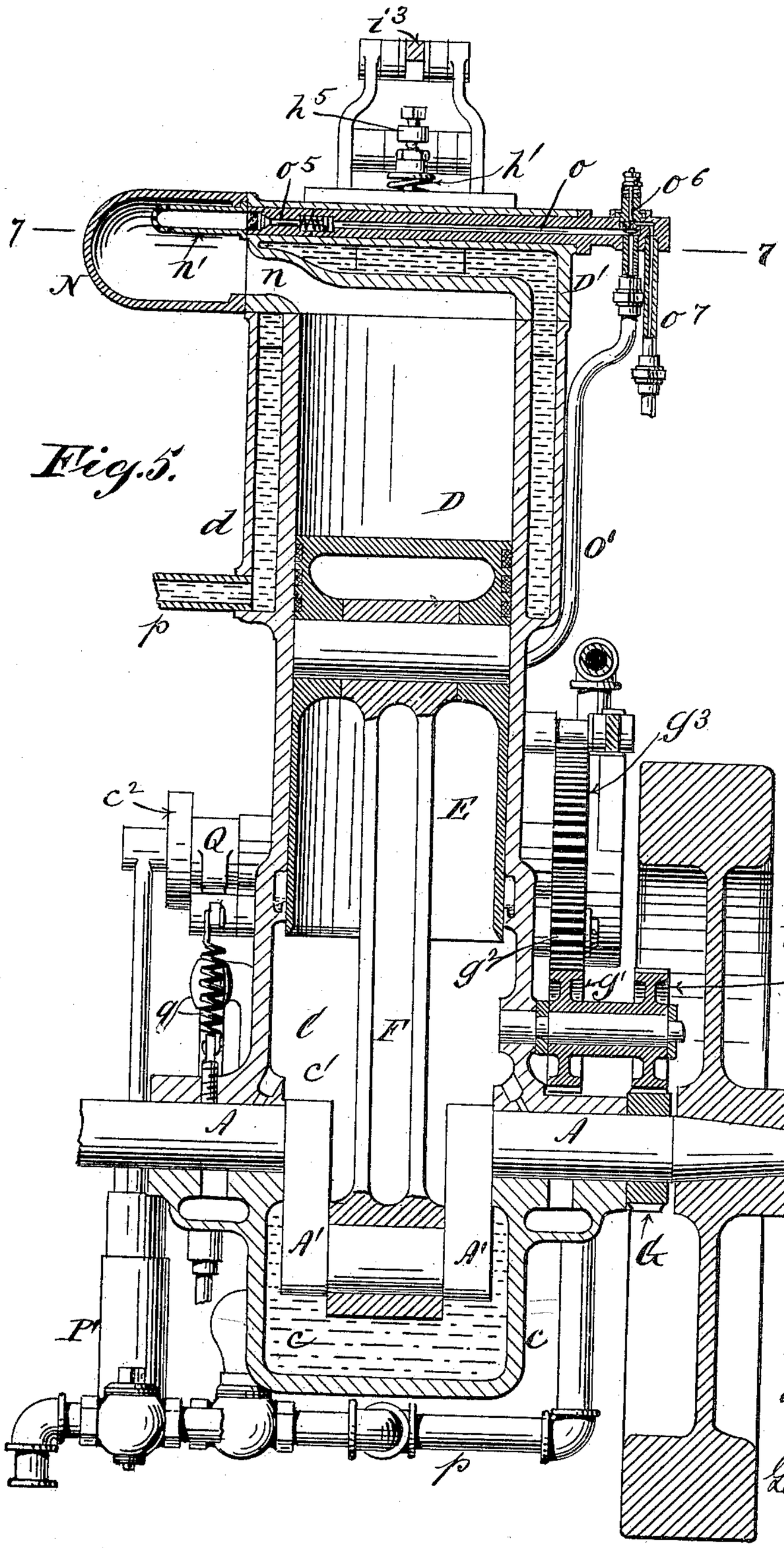

Fig. 5.

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Patented Apr. 4, 1899.

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OIL ENGINE.

(Application filed Sept. 8, 1898.)

(No Model.)

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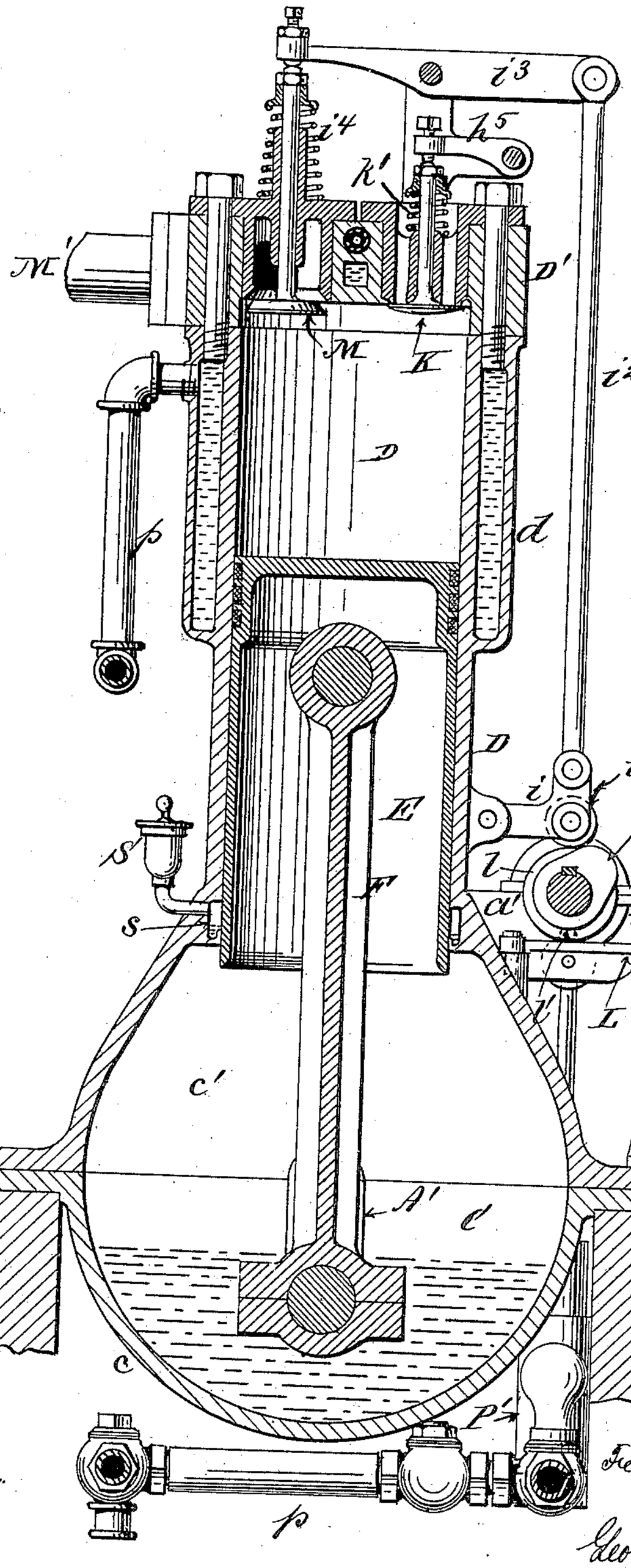
Fig. 6.



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F. C. HIRSCH.

OIL ENGINE.

(Application filed Sept. 8, 1898.)

(No Model.) 7 Sheets—Sheet 7.

Fig. 7.

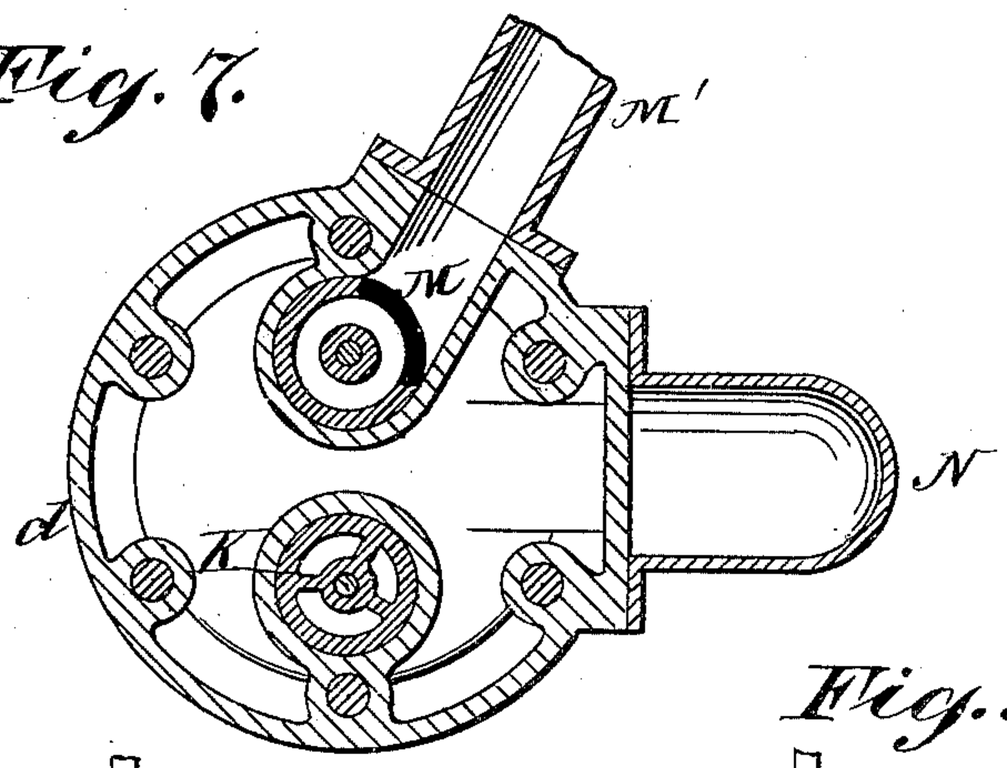


Fig. 8.

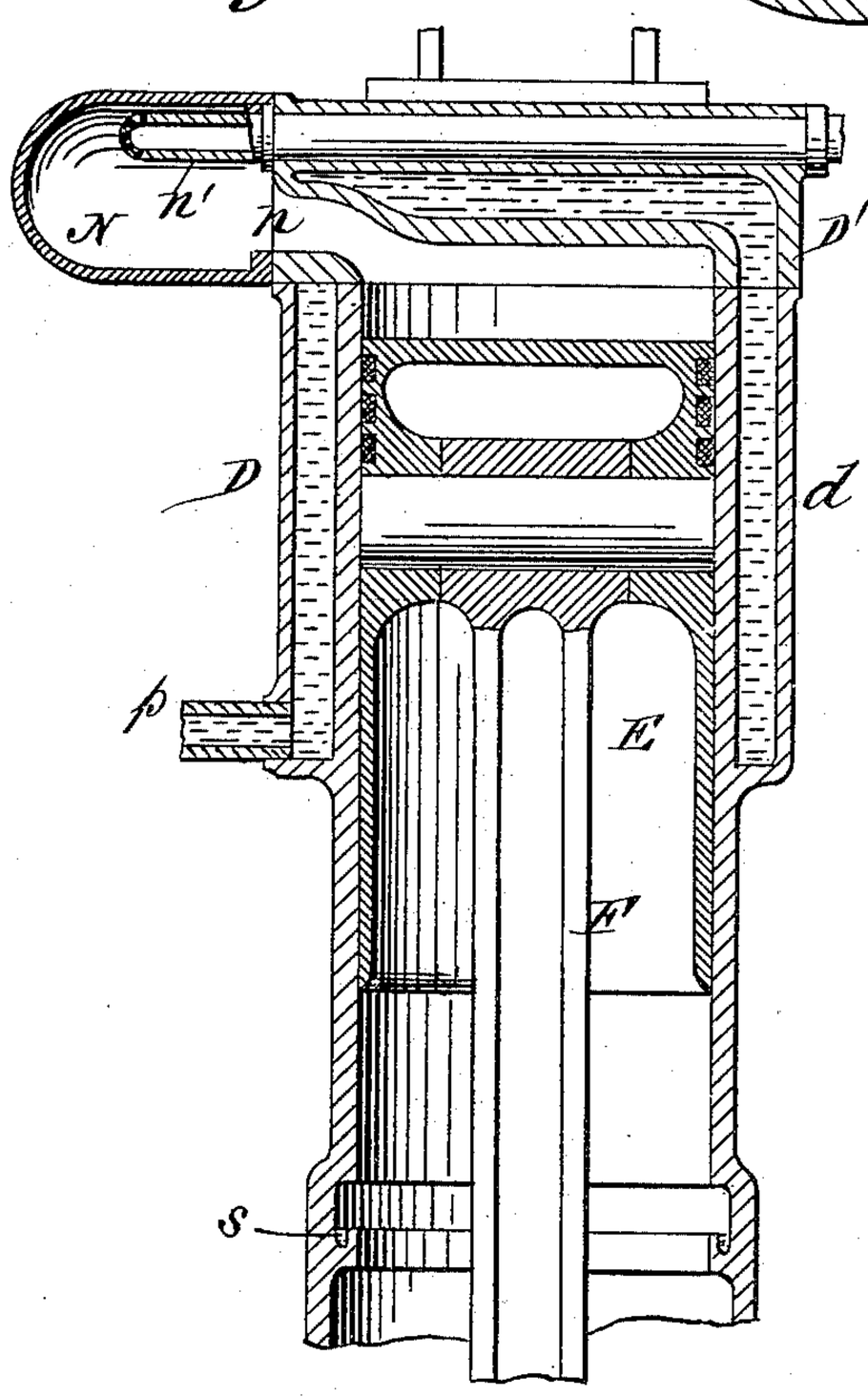
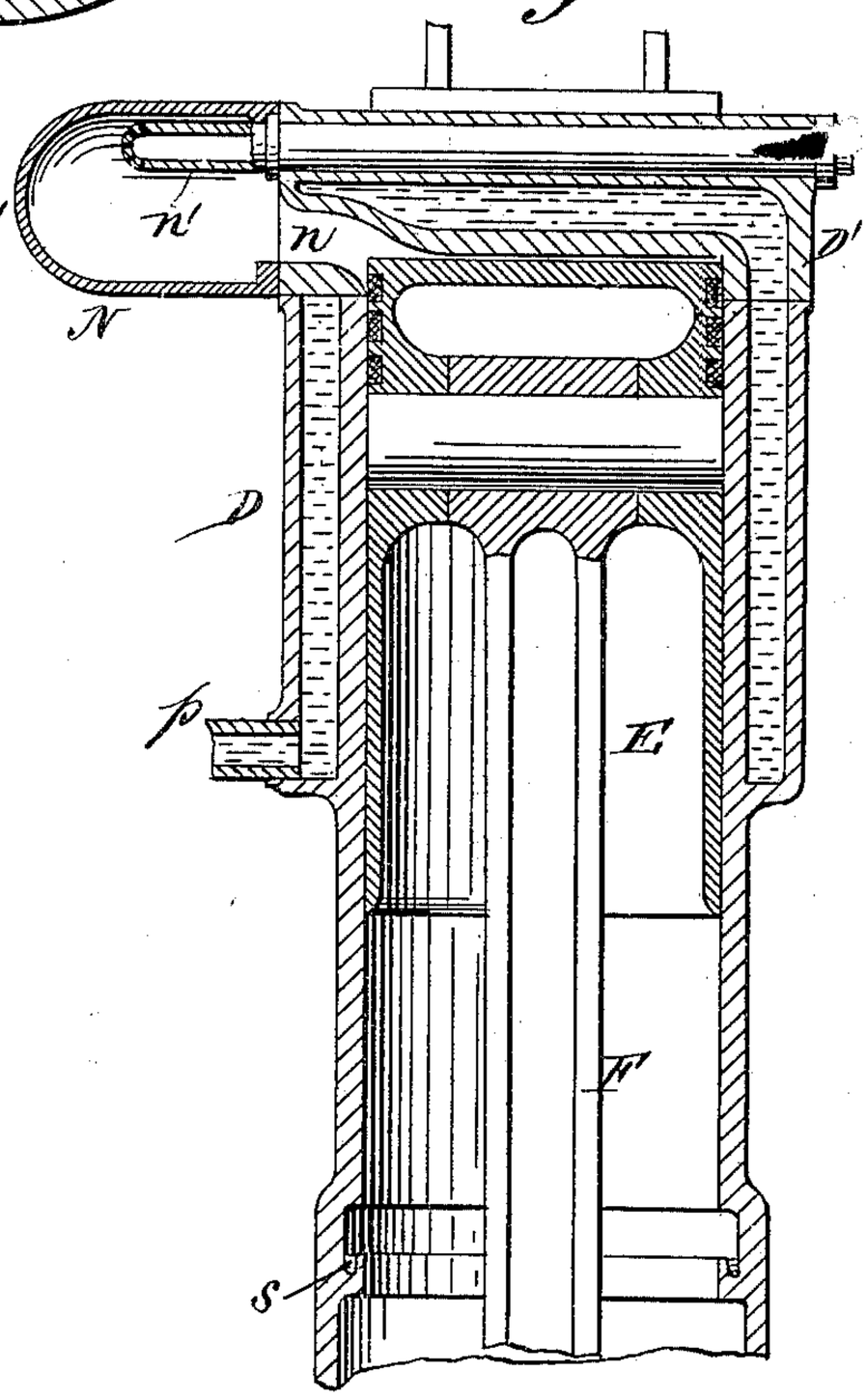


Fig. 9.



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UNITED STATES PATENT OFFICE.

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OIL-ENGINE.

SPECIFICATION forming part of Letters Patent No. 622,469, dated April 4, 1899.

Application filed September 8, 1898. Serial No. 690,458. (No model.)

To all whom it may concern:

Be it known that I, FEODOR C. HIRSCH, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Oil-Engines, of which the following is a specification sufficient to enable others skilled in the art to which the invention appertains to make and use the same.

My invention relates to engines designed to be operated by the combustion of vaporized fuel, such as kerosene-oil, in an ignition-chamber containing an expansion medium, such as air, the ignition-chamber communicating directly with the power-cylinder.

The object of the invention is to provide an engine of this character in which the highest and most efficient pressure of the expansion medium is attained and the full value of the charge is utilized at the beginning of the outward or working stroke of the piston; and to these ends my invention consists in an oil-engine constructed and arranged substantially as described, whereby these objects are attained.

The distinguishing feature of my invention consists in the fact that the engine is so constructed and arranged that the necessary quantity of expansion medium, such as air, is taken into the ignition-chamber and practically compressed therein before the fuel or oil is introduced, and this is introduced at once, so that the compression takes place immediately after the expansion medium is impregnated with the fuel and is practically completed just before the completion of the inward stroke of the piston, so that the highest and most effective pressure of the expansion medium can be utilized at the beginning of the outward or working stroke of the piston. I thus produce a practically complete combustion of the fuel prior to or at the beginning of the outward or working stroke of the piston, and thus not only attain the highest and most effective pressure at the instant the piston commences its outward or working stroke, thus utilizing the full value of the charge in driving the piston at the beginning of the outward stroke, but also avoid the objections resulting from a prolongation of the feed of the fuel after the piston has commenced its outward or working stroke, resulting in incomplete combustion and fouling of the engine.

In the accompanying drawings, Figure 1 is a plan of my improved engine. Fig. 2 is a sectional elevation taken upon plane of line 2 2, Fig. 1. Fig. 3 is a similar view taken upon plane of line 3 3, Fig. 1. Fig. 4 is a front elevation of the engine. Fig. 5 is a vertical section upon plane of line 5 5, Fig. 1; Fig. 6, a similar view upon plane of line 6 6, Fig. 1. Fig. 7 is a horizontal section upon plane of line 7 7, Fig. 5. Fig. 8 is a sectional view showing the position of the piston at the time when the oil is injected into the igniter. Fig. 9 is a sectional view showing the position of the piston at the completion of its stroke. Fig. 10 is an enlarged view of the igniter-chamber and adjoining parts.

The lower part of the crank-chamber C consists of a semicircular casting c, mounted upon suitable pillow-blocks B. The upper part c' of the crank-chamber C is preferably cast in one piece with the cylinder D, to the upper end of which is bolted the cylinder-head D', in which are set the inlet and exhaust valves. The cylinder is formed with the water-jacket d, through which a circulation of water is maintained during the operation of the engine through the medium of the connections p and pump P', operated by disk c^2 on the counter-shaft a.

A is the main or power shaft, formed with the crank A', connected with the piston E by means of the pitmen F. Upon the power-shaft A is mounted the usual fly-wheel W. A gear-wheel G upon the power-shaft A transmits motion through the intermediate gears g g' g^2 to the larger gear g^3 upon the counter-shaft a, the relative diameters of the wheels being such that the counter-shaft a is timed to make one revolution while the power-shaft is making two revolutions.

The counter-shaft a is mounted in bearings on the brackets a', projecting from the casing c'. Between the brackets a' are mounted upon the shaft a cams H I I'. The first of these, H, is rigidly attached to the shaft a and acts upon a roller h upon the pivoted carrier h', which is connected by the rod h^2 with the arm h^3 upon the rock-shaft h^4, to which is

secured the arm h^5, by which the air-valve K is depressed against the resistance of the spring k'.

Feathered to the counter-shaft a is the sleeve L, carrying the cams I I′ and formed with the annular flanges l l, which engage with the pin l' upon the hand-lever L′, by which the sleeve L may be moved longitudinally upon the shaft a. Above the path of the cams I I′ is pivoted the carrier i, provided with the roller i' for engagement with the said cams and connected by the rod i^2 with the rock-lever i^3, by which the exhaust-valve M is opened against the resistance of the spring i^4.

M′ is the exhaust-passage.

N is the ignition-chamber, communicating with the upper end of the cylinder D through the port n. The ignition-chamber is supplied with suitable charges of oil through the spray n', which receives the oil from the duct o, with which the supply-pipe o' communicates. The pipe o' connects with the oil-pump O, communicating by a pipe o^2 with a suitable oil-reservoir and operated by a cam Q upon the counter-shaft a, said cam Q depressing a rock-lever Q′ against the resistance of a spring q, and thereby depressing the piston-rods o^{12} o^3 and forcing a quantity of oil into the duct o. Interposed between the duct o and spray n' is a spring-valve o^5, which yields under the pressure of the pump and closes automatically when the pump is released. A check-valve o^6 relieves of undue pressure and allows the excess to return through the pipe o^7 to the reservoir.

As before said, the counter-shaft a makes one revolution to every two revolutions of the power-shaft A. The cams upon the said counter-shaft a are so timed with relation to each other and to the other operative parts that when in use the engine operates as follows: The ignition-chamber N being heated externally to the proper temperature, the cam I′ is slid under the roller i', so as to limit the opening of the exhaust-valve M until the engine has attained the required speed, when it is again returned to its normal position by means of a lever L′, thus bringing the main exhaust-cam I′ into position under the roller i'. Supposing the last inward stroke of the piston E to have been completed as it starts upward, the cam H and its connections open the air-valve K and hold it open during the completion of the inward stroke of the piston. During the outward stroke of the piston the air is compressed. When the piston has nearly completed its inward stroke (nine-tenths of the stroke, or thereabout, more or less) and is in the position approximately shown in Fig. 8, the cam Q′ operates the oil-pump O, so that a small quantity of oil is injected through the valve o^5 and into and through the spray n', which delivers it to the compressed air in the igniter N, the heat of which causes its combustion just prior to the completion of the inward stroke of the piston and the passage of the crank over the dead-center. The expansion thus caused forces the piston outward. As the piston again starts inward the cam I′ acts through its connections to open the exhaust-valve M′ for the discharge of the products of combustion. It will be seen that these operations involve two reciprocations of the piston, and consequently two revolutions of the power-shaft, and these operations are repeated consecutively and continuously throughout the operation of the engine.

Should the speed of the engine exceed that required for any reason, the centrifugal governor R acts on the rocker-arm r and through the connecting-rod r' upon the stem of the valve o^6, so as to depress the latter and close the oil-supply pipe o' until such time as the speed is sufficiently slackened to require the admission of more fuel to the ignition-chamber N.

In order to insure smooth running of the crank and cylinder, lubricating-oil is introduced into the lower part of the crank-chamber C, so that the crank dips therein and distributes the oil freely. In order to still further insure the ample lubrication of the piston E, the casing c' is formed with an annular recess s, (closed by the outer end of the piston during the latter part of its stroke), which is fed with oil from the lubricating-cup S or other suitable source of supply.

The valve o^5 acts as a check-valve to prevent back pressure when the explosion takes place in the igniter N.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an oil-engine, the combination with the cylinder, piston and ignition-chamber, of means for automatically admitting an expansion medium into the cylinder and compressing it in the ignition-chamber, and means for at once and completely injecting the fuel into the compressed expansion medium and igniting the same just prior to the completion of the compression stroke of the piston, whereby the full value of the charge is utilized at the beginning of the outward or working stroke of the piston and the disadvantages of a prolonged injection of the fuel avoided, substantially as described.

2. In an oil-engine, the combination, with the ignition-chamber N, cylinder D, piston E, pitmen F, crank-shaft A, and crank A′, of the counter-shaft a, geared to make one revolution to two of the power-shaft and provided with the cams H, I, I′, and Q, for operating the exhaust and air valves, and the oil-pump, together with said exhaust and air valves and with the oil-pump and connections, the whole arranged and operating substantially in the manner and for the purpose described.

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