

918,704.

3 SHEETS—SHEET 1



Jean Charles Séailles
Lucien Emile Legrand

INVENTOR:

Louis Gaston Sabathe'

L. G. SABATHÉ.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED AUG. 30, 1906.

Patented Apr. 20, 1909.
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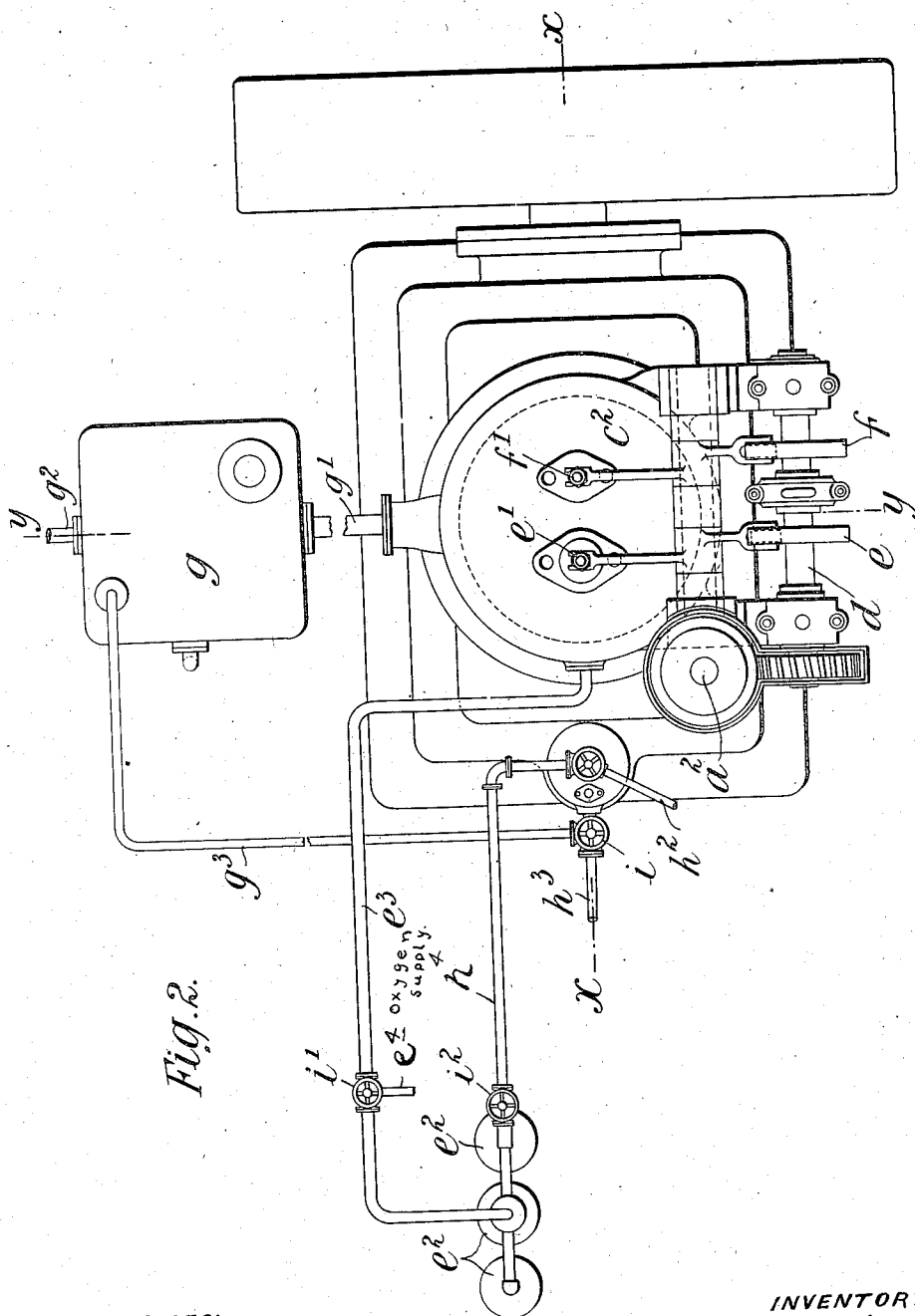


Fig. 2.

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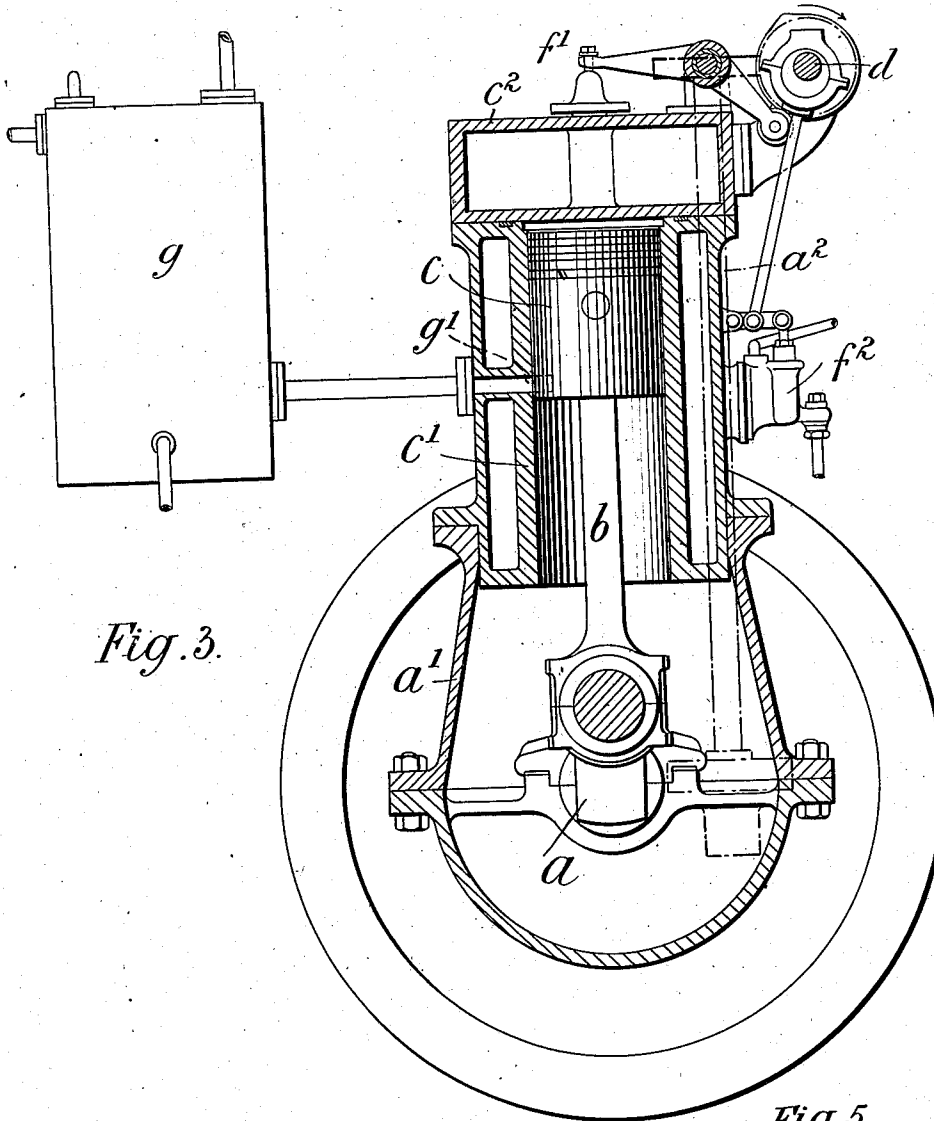
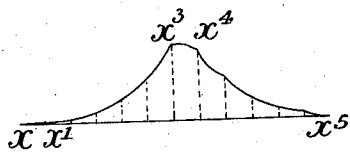


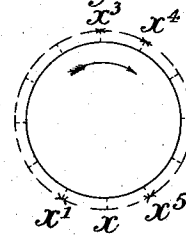
Fig. 3.

Fig. 4.



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Fig. 5.



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UNITED STATES PATENT OFFICE.

LOUIS GASTON SABATHÉ, OF PARIS, FRANCE.

INTERNAL-COMBUSTION ENGINE.

No. 918,704.

Specification of Letters Patent.

Patented April 20, 1909.

Application filed August 30, 1906. Serial No. 332,604.

To all whom it may concern:

Be it known that I, LOUIS GASTON SABATHÉ, of 38 Rue des Entrepreneurs, Paris, in the French Republic, a citizen of the French Republic, have invented a certain new and useful Improved Internal-Combustion Engine, of which the following is a specification.

This invention relates to combustion engines in which an inert gas is employed as the vehicle of heat, and in which a solid, liquid or gaseous, fuel is introduced into and burned in the inert gas by the concurrent introduction of a gas capable of supporting combustion; the object of the present invention being to enable the cycle of operations to be accomplished in two strokes of the piston; that is to say, one revolution of the motor-shaft.

According to my present invention, a portion only of the products of combustion are released from the cylinder toward the end of the forward or operative stroke of the engine and at the commencement of the reverse turn or compression stroke; the remaining portion of the residual products being compressed by the continued movement of the piston. Toward the end of the compression stroke and at the commencement of the following or operative stroke, gas capable of supporting combustion is introduced into the cylinder together with the combustible; combustion thereupon taking place. Or the combustible may be introduced first during either the whole or a portion of the period of compression, and the gas adapted for supporting combustion subsequently. The products of combustion expand and force the piston forward until the latter passes the exhaust port; whereupon a portion of the products of combustion escape, and the pressure in the cylinder falls to that of the ambient atmosphere or thereabouts. The cycle of operations is thereupon repeated.

It is assumed for the purpose of the present description that the engine is one in which the release of the gases from the cylinder is controlled by the movement of the piston therein, but this method of construction is not essential to the working of my system.

The recompressed products of combustion are at such a temperature that the ignition and combustion of the combustible may be effected without the necessity of high compression by the mere introduction of a gas

capable of supporting combustion. By regulating the quantity of combustible and of gas capable of supporting combustion introduced, the power of the engine comprising a cylinder of any given size, may be varied very rapidly and in a considerable degree.

The gas capable of supporting combustion may be stored in a suitable receptacle under pressure, and injected therefrom as required. The combustible, if in a gaseous state, may be stored and injected during $x'-x^3$ of the diagrams in a similar manner. If, however, the combustible be in a solid, liquid or gaseous state, it may be injected in a suitable quantity for each motive stroke in a pulverulent, pulverized or mixed condition, together with the gas capable of supporting combustion, during x^3-x^4 of the following diagrams. Where liquid fuel is employed and introduced at $x'-x^3$ of the diagrams, a pump, driven by suitable means from the engine, may be used for injecting the same into the motor cylinder or combustion chamber.

The accompanying drawings illustrate a combustion engine adapted to work on my improved method.

Figure 1 is a vertical section on the line $x-x$ in Fig. 2, Fig. 2 a plan, and Fig. 3 a section on the line $y-y$ in Fig. 2. Figs. 4 and 5 are indicator diagrams hereinafter more particularly referred to.

The engine comprises the usual crank-shaft a working in a casing a' , connecting rod b , and piston c working in the cylinder c' . From the crank-shaft a is driven, by means of suitable gearing mounted on the extremities of a vertical shaft a^2 , a countershaft d on which are mounted the cams $e f$ for operating the valves $e' f'$ mounted on the cylinder cover c^2 . The gas capable of supporting combustion is stored in the receptacles e^2 and is conveyed by the pipe e^3 ; the supply thereof being controlled by the valve i' . The valve f' controls the inlet of the combustible, which may be supplied by means of a pump f^2 , suitably driven from the countershaft d . The exhaust gases from the cylinder c' pass into a tank g by way of the outlet g' in the cylinder; this outlet being opened and closed by the piston c .

The engine is furnished with a pump or compressor h for a purpose hereinafter more particularly referred to.

Fig. 4 is an unfolded diagram of a combustion engine working on my improved

method, the vertical distance representing pressures and the horizontal distances representing the movement of the piston in one direction instead of in reverse directions.

5 The following cycle of operations is accomplished in one revolution of the crankshaft or two strokes of the piston as shown in the diagram in Fig. 5; it being assumed that the engine is one in which the release of
10 the gases from the motor cylinder is controlled by the motor piston:— $x-x'$ exhaust open; $x'-x^3$ compression and introduction of combustibles; x^3-x^4 introduction of gas capable of supporting combustion—and
15 combustion: x^4-x^5 expansion: x^5-x exhaust open. The different stages may to some extent overlap one another.

In applying my invention to the engines of submarine vessels, air may be employed
20 for supporting combustion when the vessel is on the surface of the water, and pure oxygen when it is submerged. When the vessel is being driven while submerged pure oxygen is supplied from receptacles (not
25 shown) by way of a pipe e^4 and the valve i' . The products of combustion, exhausted from the engine pass into the tank g where they are washed and condensed, and they may then, by means of the pump or compressor h ,

be ejected into the sea; the products of combustion being led from the tank to the pump
30 by way of the pipe g^3 and discharged by way of the pipe h^2 . When the vessel is on the surface of the water, air may be drawn
35 into the pump h by way of the pipe h^3 , and forced by way of the pipe h^4 into the receptacles e^2 , where it is stored under pressure for use while the vessel is on the surface; the products of combustion in the tank
40 g being released by way of the pipe g^2 . Suitable valves $i i' i''$ are provided for changing according to their different positions from air to oxygen working.

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

15 The method of operating an internal combustion engine consisting in retaining and compressing a portion of the products of combustion and simultaneously injecting
50 fuel, and subsequently introducing a gas capable of supporting combustion.

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

LOUIS GASTON SABATHÉ.

Witnesses:

JEAN CHARLES SÉAILLES,
LUCIEN EMILE LEGRAND.