No. 614,114. Patented Nov. 15, 1898.

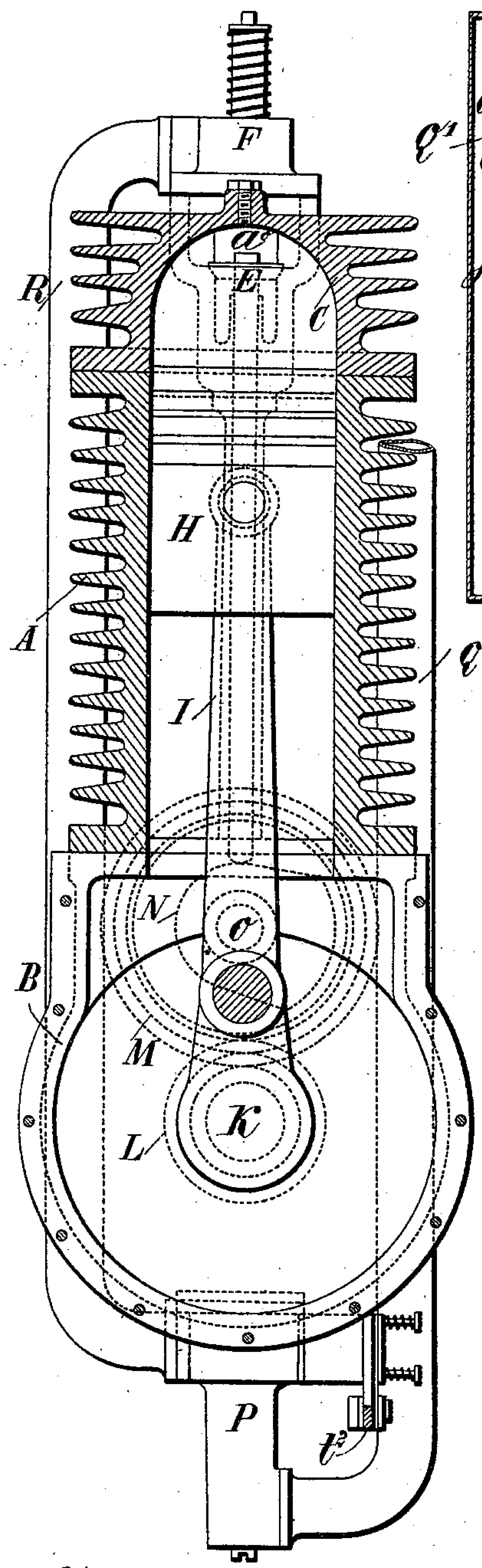
C. A. LEFEBVRE.

OIL OR SIMILAR MOTOR.

(Application filed May 27, 1897.)

(No Model.) 2 Sheets—Sheet I.

FIG. 2.



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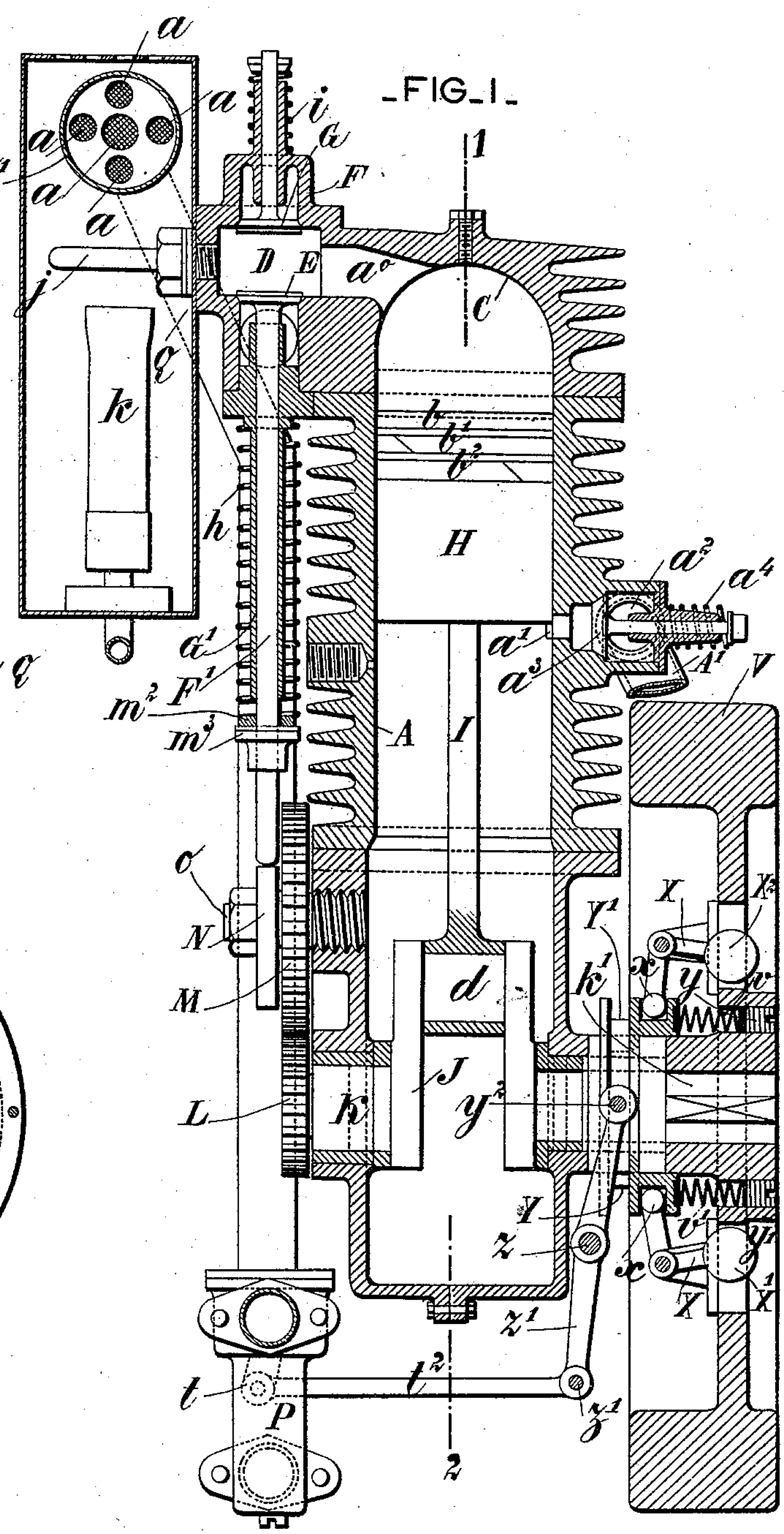

Witnesses:-
C. Holloway
W. C. Pinckney

Inventor:-
Claude Alfred Lefebvre,
By J. E. M. Bowen
Atty

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FIG. 4.

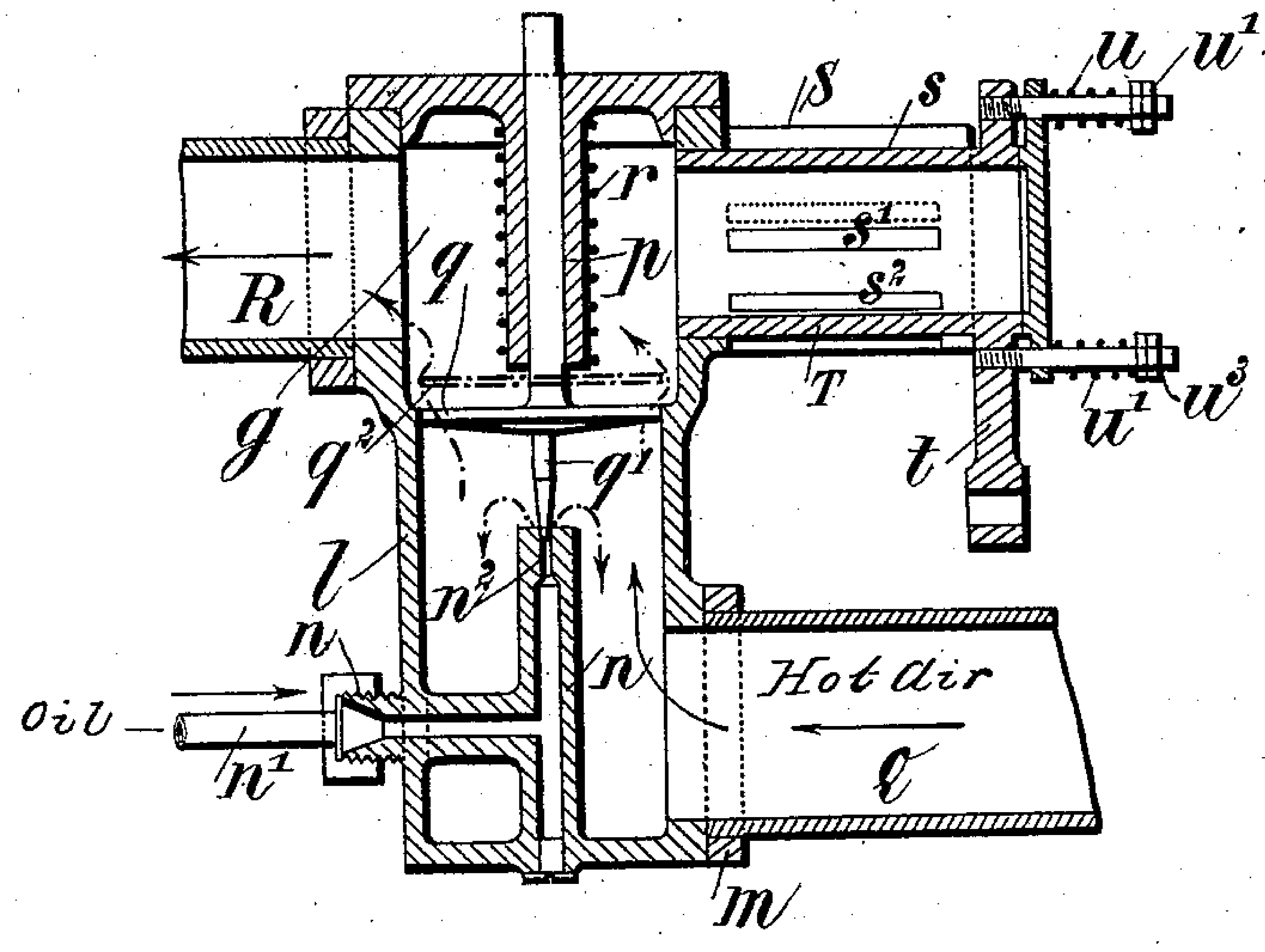
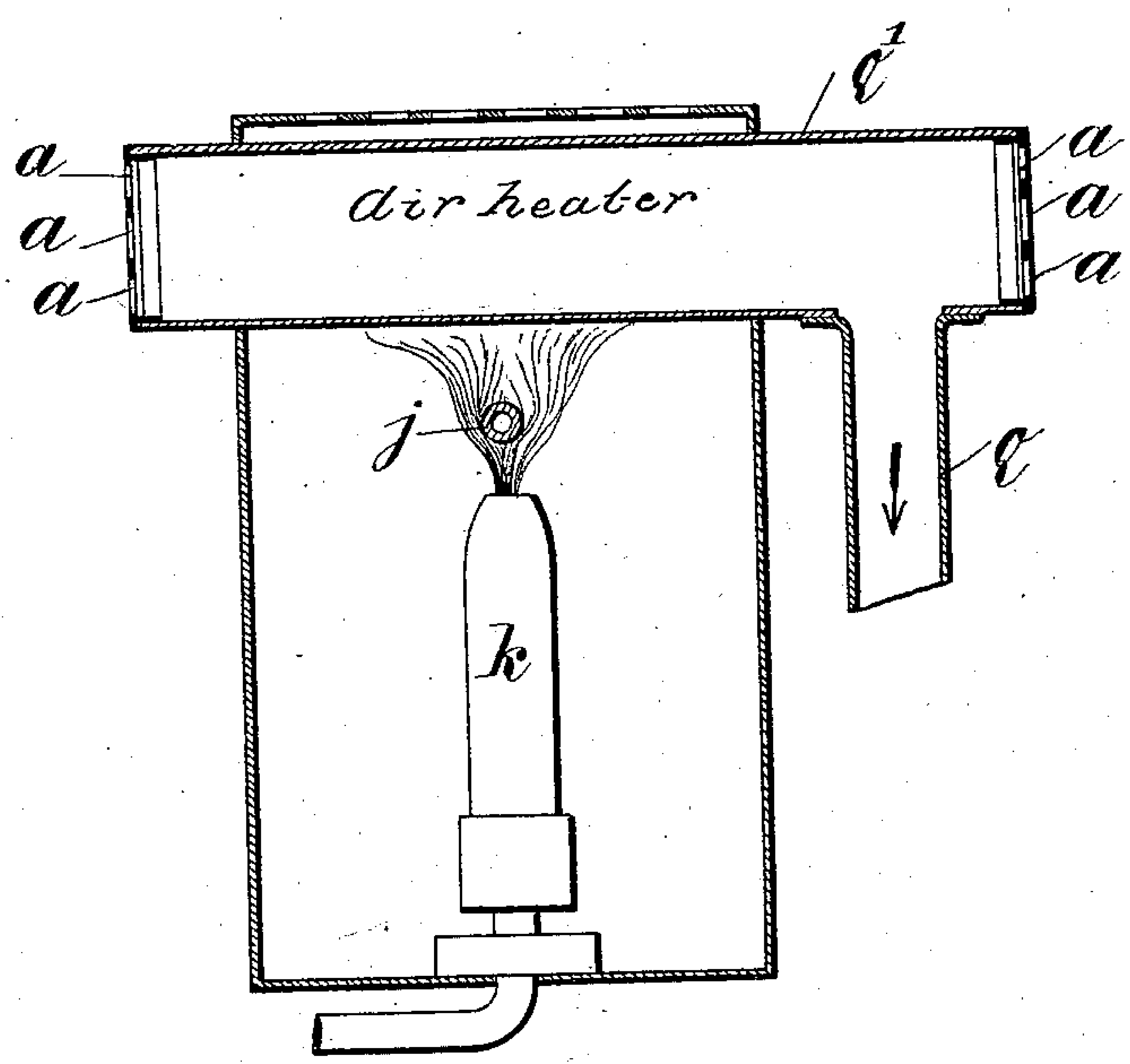


FIG. 3.



Witnesses:-
C. Holloway
M. C. Pinckney

Inventor:-
Claude Alfred Lefebvre,
By J. E. M. Bowen
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CLAUDE ALFRED LEFEBVRE, OF PARIS, FRANCE.

OIL OR SIMILAR MOTOR.

SPECIFICATION forming part of Letters Patent No. 614,114, dated November 15, 1898.

Application filed May 27, 1897. Serial No. 638,334. (No model.)

To all whom it may concern:

Be it known that I, CLAUDE ALFRED LEFEBVRE, a citizen of the Republic of France, residing at Paris, No. 32 Rue Caumartin, in the Seine Department, France, have invented certain new and useful Improvements in or Relating to Oil or Similar Motors, of which the following is a specification.

This invention relates to improvements in four-cycle or so-called "Otto" cycle oil or similar motors, but is also applicable to other hydrocarbon-motors, and relates particularly to the heating, carbureting, and regulating of the air-supply and to the cooling of the cylinder.

In the accompanying drawings, Figure 1 is a section of the motor through the axis of the main shaft; Fig. 2, a vertical section on the line 1 2 of Fig. 1. Fig. 3 is a section of the air-heater, and Fig. 4 a longitudinal section of the carbureter on an enlarged scale.

The cylinder A is secured at the bottom by means of flanges to the casing B and at the top to the explosion-chamber C. The latter is cast in one piece with a chamber D, in which is arranged the exhaust-valve E. At the top of the chamber D there is a small chamber F for the carbureted air-inlet valve G.

a^0 is a passage connecting the valve-box D with the explosion-chamber C.

j is an igniting-tube communicating with the chamber D, on which it is mounted. Under said tube is arranged the burner k for heating the igniter and tube Q', hereinafter referred to.

i is a spring retaining the inlet-valve G against its seat, the tension of said spring being always so regulated as to yield to the atmospheric pressure during the charge-injection period.

G' is a guide-sleeve for the spindle F' of the exhaust-valve E, which is held against its seat by a spring h, placed between a collar m^2, secured on the rod F' by means of a key m^3 and a shoulder on the guide G'.

The piston H of the cylinder A is provided at the back with packing-segments b b' b^2 to insure accurate fitting, and the piston-rod I connects it to the pin d of the crank J of the shaft K K', rotating in bearings in the casing B, which is made in two parts.

On the shaft K is keyed a pinion L, driving a toothed wheel M, the diameter of which is twice that of the pinion L and the hub of which is provided with a suitably-shaped cam N for operating the spindle F' of the exhaust-valve E once every two revolutions of the crank-shaft. The toothed wheel M rotates on a pin O on the casing B.

P is the carbureter, arranged at the lower part of the casing B. It consists of a chamber l, to which is secured by a flange m a pipe Q for introducing the air. This pipe Q communicates with the atmosphere through a tube Q', above the igniter. The air is drawn in through openings a a, preferably covered with wire-netting, and is heated in its passage through the tube Q' by the burner k before entering the carbureter P.

By placing said tube directly in front of the discharge-orifice of the burner there can be imparted to the air passing through the same toward the carbureter a more intense heat than if a secondary heating agent was employed instead, and thus a more thorough and rapid union of the hydrocarbon and air can be secured in the carbureter than would be the case if gradual heating of the combined hydrocarbon and air within the carbureter was resorted to instead.

n is an inlet branch for petroleum or other hydrocarbon supplied through the pipe n' from a tank placed a little higher than the carbureter.

At the upper part of the chamber l is secured a cover provided with a guide p for a valve q, closing with its point q' the orifice n^2 of the passage n, through which the oil is supplied. A spring r is slightly compressed between the shoulder of the guide p and the valve q, which it holds pressed with its point q' against the opening n^2 of the oil-inlet valve. The valve q has no seat and can slide with a small amount of friction in the chamber l.

R is the pipe through which the carbureted air passes to the inlet-valve G.

S is a branch pipe opposite the pipe R, in which can turn with a small amount of friction a tube T, provided, like the pipe S, with apertures, as S' and S^2. The apertures of the inner tube can be brought opposite the apertures of the outer tube by a partial rotary movement of the former, which is connected by an arm t with the regulating mechanism to be described.

U is a plate or cover normally closing the tube T and held in place by two rods surrounded by helical springs u and u', suitably compressed by nuts u^2 and u^3.

V is a fly-wheel keyed on the end k' of the crank-shaft and provided with two right-angled governor-levers X X, one of the arms x of each of them engaging with a recess or groove in a laterally-movable sleeve Y, provided with an another groove Y'. The sleeve is thus caused to participate in the rotation of the fly-wheel, on the hub of which it can slide, or it may slide on a boss or sleeve of the casing B, or on both. Two springs v v', the tension of which is regulated by screws y y', hold the sleeve Y in its normal position.

In the groove Y' is placed a slide y^2 on the end of a lever Z', pivoted at Z on the casing of the motor. The end z' of this lever is connected to the end of the arm t, already referred to, by means of a rod t^2.

The cylinder A of the motor is provided laterally with a passage a', through which it communicates with a small chamber a^2, connected to an outlet-pipe A'. This chamber is closed by a valve a^3, pressed against its seat by a spring a^4. The opening a' is preferably rectangular and its size depends on the volume of the cylinder, its width or height being arranged in the direction of the axis of the cylinder in such manner that the lower edge nearly coincides with the upper face of the piston H when the latter is at the bottom of its stroke. The motor is started by turning the fly-wheel. As soon as the piston H commences to move away from the bottom of the cylinder A the drawing in of the charge begins, the valve G being lowered by the inward suction and the outside pressure, while the valve q is raised, taking up a position indicated in dotted lines, and the orifice n^2 of the tube n being opened a certain quantity of oil enters the chamber l. This oil is immediately atomized by the air drawn in, and entering in a heated state through the tube Q the carbureted mixture thus formed is thereupon admitted through the tube R and valve G into the explosion-chamber of the cylinder A. The fly-wheel continuing to turn, the piston returns and compression begins. The valve G is thus immediately applied against its seat by the pressure so produced, and the valve q, by the action of its spring r, closes the oil-inlet opening. At the end of the compression-stroke the explosive mixture ignites upon contact with the heated tube j and the explosion takes place, the piston is driven forward, and on its return forces out the combustion-gases through the exhaust-valve E, the latter being raised by the cam N. When the exhaust is completed, the valve E closes, and the inertia of the fly-wheel causes the piston to move forward, whereby a further charge is drawn in and the same cycle of operation is repeated. If the speed of the motor becomes too great, the balls X' X^2 of the governor tend to move apart and cause the springs v v' to be compressed, and the sleeve Y is drawn nearer to the fly-wheel. The lever Z' thus turns about its pivot Z, the arm t is operated, and the apertures S' of the tube S are caused to register with the apertures S^2 of the tube T. Air is then drawn in through these passages, and the motor only drawing in air explosions cease and the speed of the engines becomes less. The springs v v' then return the sleeve Y to its original position and the cycle of operations of the motor again take place in their usual order. Should the closing of the conduit R supplying carbureted air become imperfect, owing to defective working of the valve G, and the gases in this conduit become ignited, the pressure on the cover U would cause the spring u u' to yield, and the gases produced by the explosion would escape through the tube T thus opened. Supposing the piston is at the end of its upstroke, the ignited and exploded gas drives it forward and it makes its first downstroke. At the end of this first stroke it uncovers the passage a', and the gas, which still has a certain pressure, opens the valve a^3 and part of it escapes through the tube A'. The piston H then makes its first upstroke and again closes the orifice a'. The exhaust-valve E is then raised by the cam mechanism described, while the valve a^3 is closed by the spring a^4. The gases remaining in the cylinder A are forced out by this piston and escape through the exhaust-valve E. It must be pointed out that the gases thus escape in a comparatively cool state, their previous expansion caused by the opening of the passage a' being a very quick one. At the rising of the exhaust-valve E there remain, therefore, in the cylinder A only comparatively cool gases, which considerably cool said valve in their passage around and through it. These gases have besides the great advantage of taking with them a certain part of the heat taken up by the cylinder-walls at the moment of the explosion, and consequently cool the inner walls of the cylinder, the radial fins being amply sufficient to cool it on the outside. The exhaust-valve E thus works under the same favorable conditions as the inlet-valve G. On the other hand the effort necessary to lift the exhaust-valve in the motors used hitherto has been a considerable one, while in the motor according to the present invention it is very slight, the internal pressure on said valve at the moment of its rising being very small. When the piston is at the end of its first upstroke, the cam N releases the spindle of the valve E, which returns to its seat. The piston then commences its second downstroke, and the drawing in of the next charge takes place through the inlet-valve G. When the piston uncovers the orifice a', the valve a^3 being closed, no drawing in through the tube A' can take place. The piston then begins its second stroke of the cycle or its second upstroke and compresses the mixture drawn in, the valve a^3 remaining closed even when the passage a' is uncovered, for the pressure on it at the beginning of the inward stroke of the piston is insufficient to overcome the resistance of the spring. The first cycle is then completed and the same operations are repeated, as described.

It will be understood that the opening of the valves a^3 enables the lubricating-oil that might have entered the explosion-chamber to be forced out, whereby the valves are prevented from being covered with oil or from sticking to their seats, which frequently happens in motors used hitherto. It must be also pointed out that the valve a^3 could be dispensed with in such case at the end of the drawing-in period, with a small reëntering of the combustion gases, and at the beginning of compression stroke a hardly perceptible loss of the explosive mixture would take place. For these reasons it is preferable to use this valve in connection with the passage a', for it works automatically and does not require to be as tight-closing as the distributing-valves.

It will be understood that the form, arrangement, and position of the various parts of the motor may be varied and altered according to circumstances.

I claim—

1. In an oil or similar motor, the combination with the cylinder and its piston, of the mixing-chamber, the vapor-inlet and the igniting-tube, and a proper exhaust-port, an air-passage leading into the mixing-chamber, an independent air-passage leading into the cylinder, a valve controlling said independent passage, a governor, means for imparting opening motion from said governor to said valve and an elastic tension device closing said valve, and adapted to act as a relief-valve, substantially as set forth.

2. In an oil or similar motor, the combination with a cylinder and a mixing-chamber, having proper air and oil inlets and the ignition-tube, of an air-admission valve communicating directly with the cylinder and comprising tubes S, T having apertures S′ S^2, a governor, and connecting means between said governor and said valve for operating the latter, substantially as set forth.

3. In an oil or similar motor, the combination with a cylinder and mixing-chamber having proper air and oil inlets, and the ignition-tube, of an air-admission valve communicating directly with the cylinder and comprising tubes S, T, having apertures S′, S^2, a governor, connecting means between said governor and said valve for operating the latter, and an automatic relief-valve attached to the end of one of said tubes, substantially as set forth.

Signed at Paris, France, this 10th day of May, 1897.

CLAUDE ALFRED LEFEBVRE.

Witnesses:

ABEL JULIEN,

PAUL BARAUD.