(No Model.) 4 Sheets—Sheet 1.

R. M. LOWNE.

ENGINE.

No. 479,651. Patented July 26, 1892.

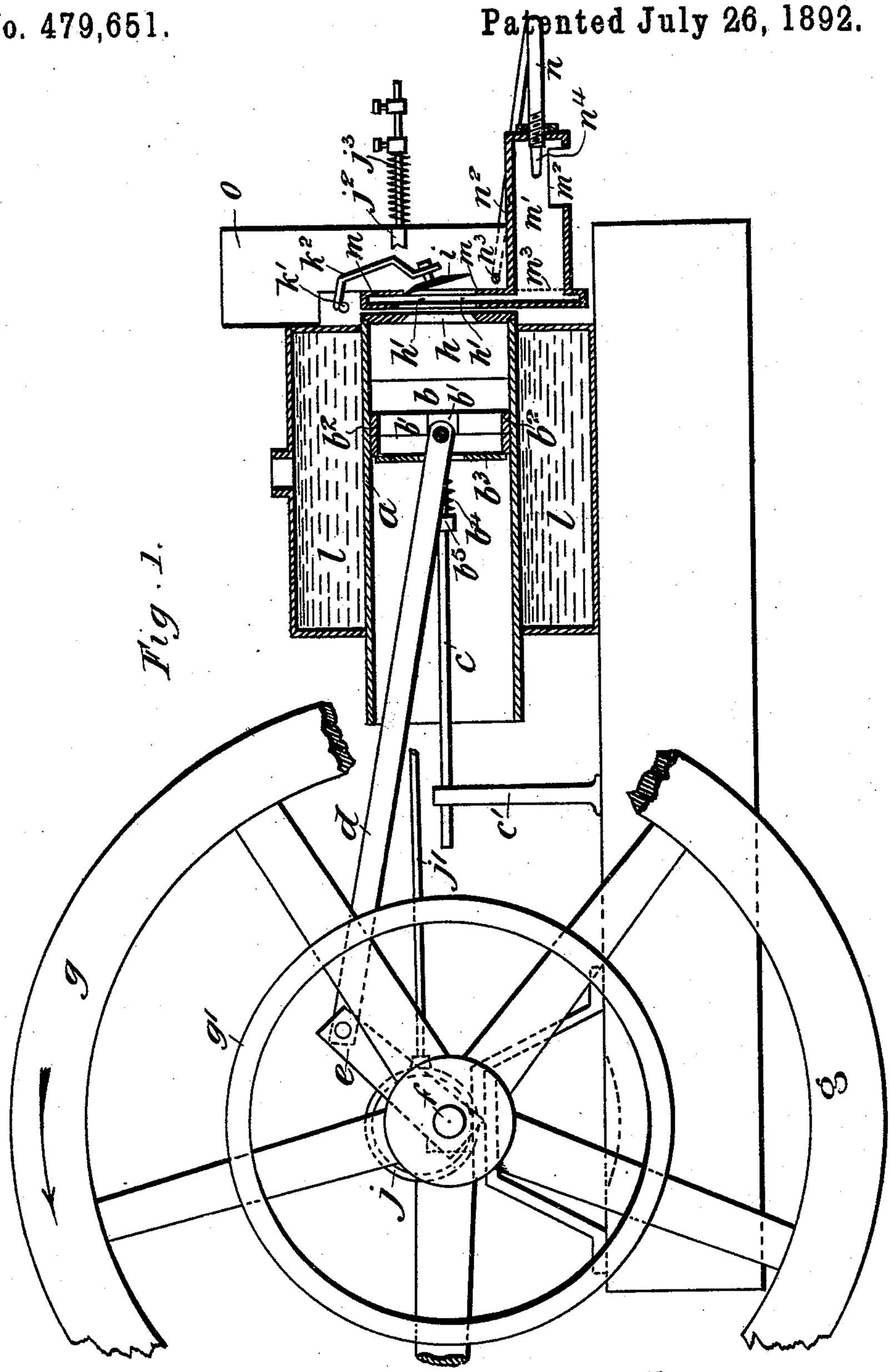


Fig. 1.

Attest
S. H. Knight.
E. Arthur.

Inventor
Robert Mann Lowne
By Knight Bros
Attys.

(No Model.) 4 Sheets—Sheet 2.

R. M. LOWNE.

ENGINE.

No. 479,651. Patented July 26, 1892.

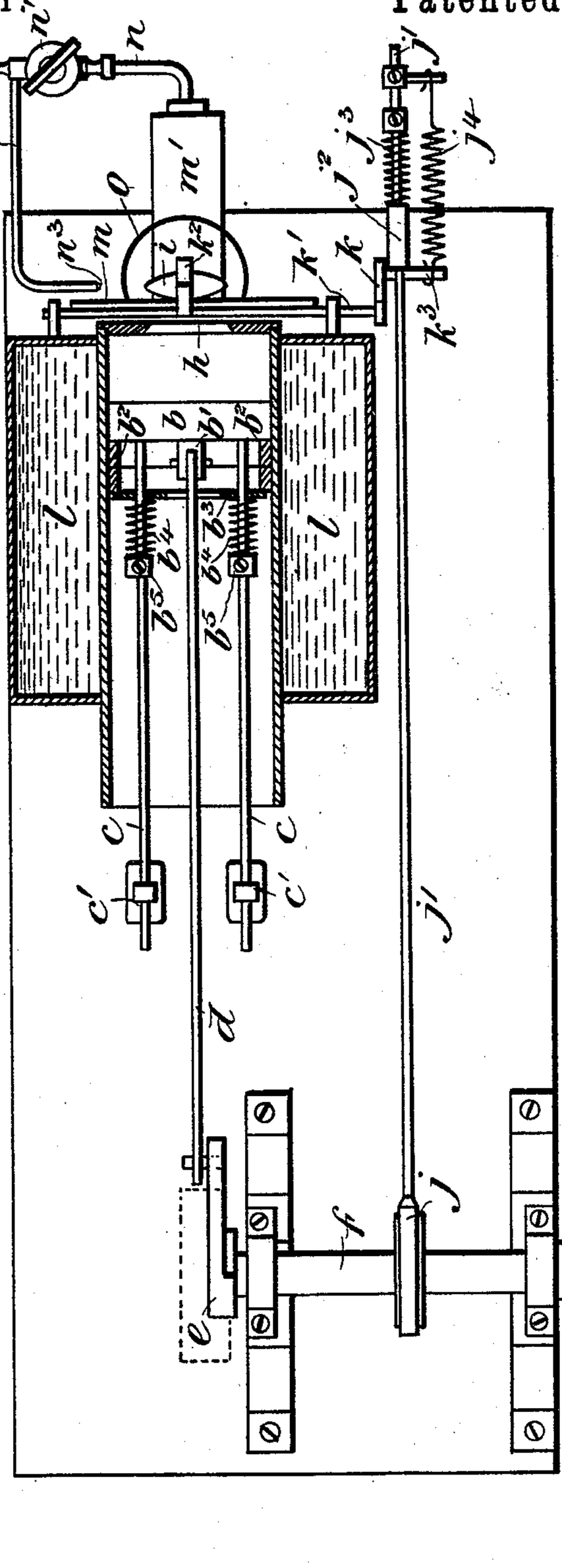


Fig. 2.

Attest:
S. H. Knight
E. Arthur.

Inventor
Robert Mannz Lowne
By Knight Bros.
Attys.

(No Model.)

4 Sheets—Sheet 3.

R. M. LOWNE.

ENGINE.

No. 479,651. Patented July 26, 1892.

Fig. 3.

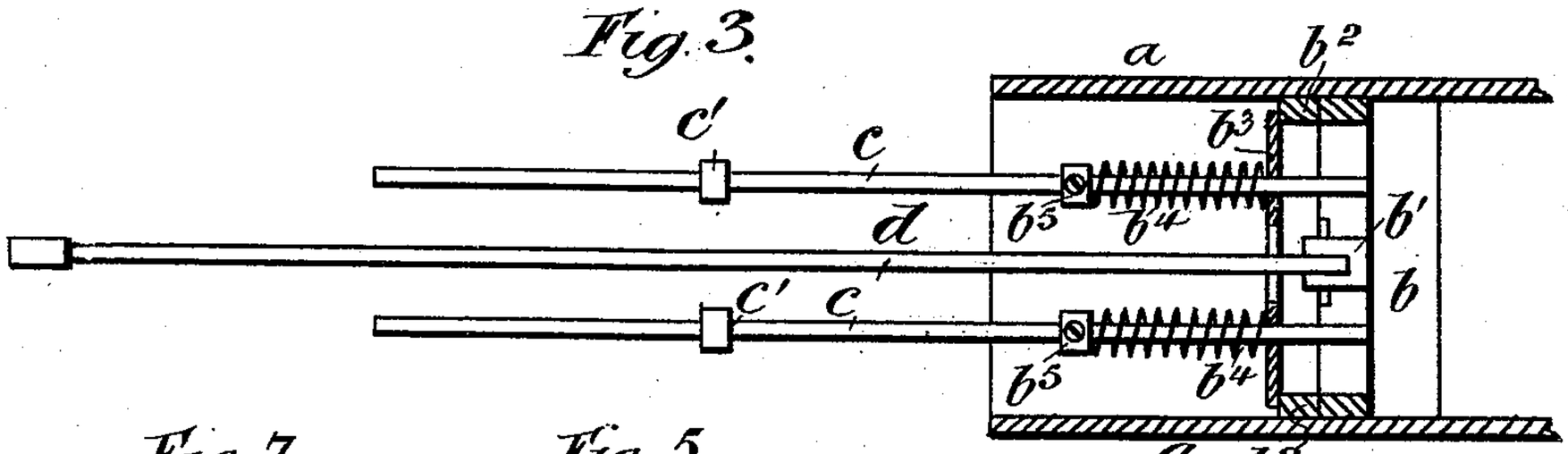


Fig. 7.

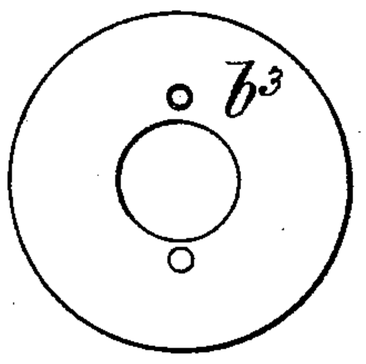
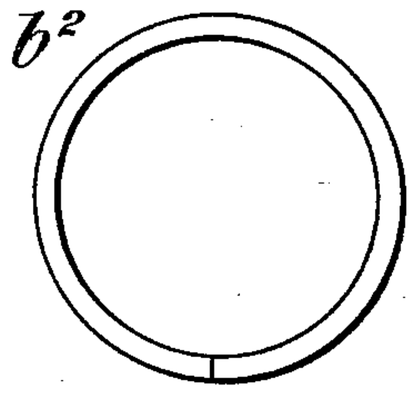


Fig. 5.



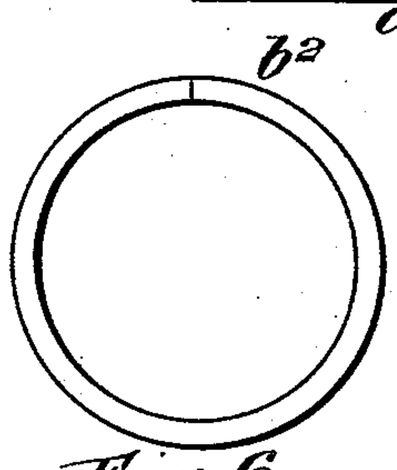


Fig 6

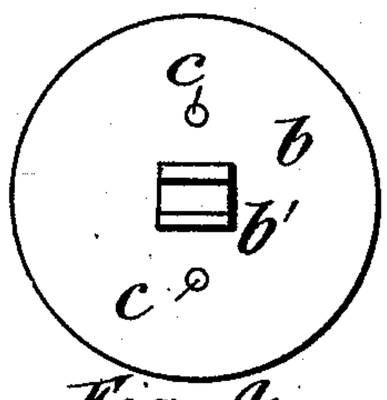


Fig. 4.

Fig. 8.

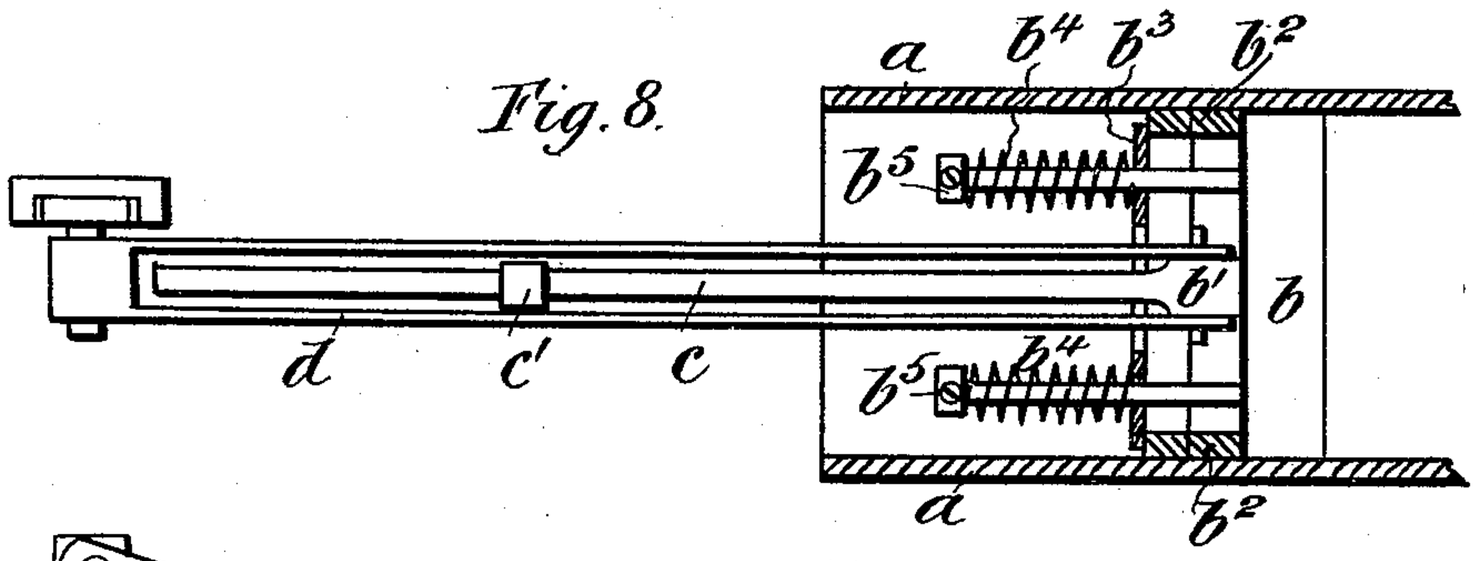
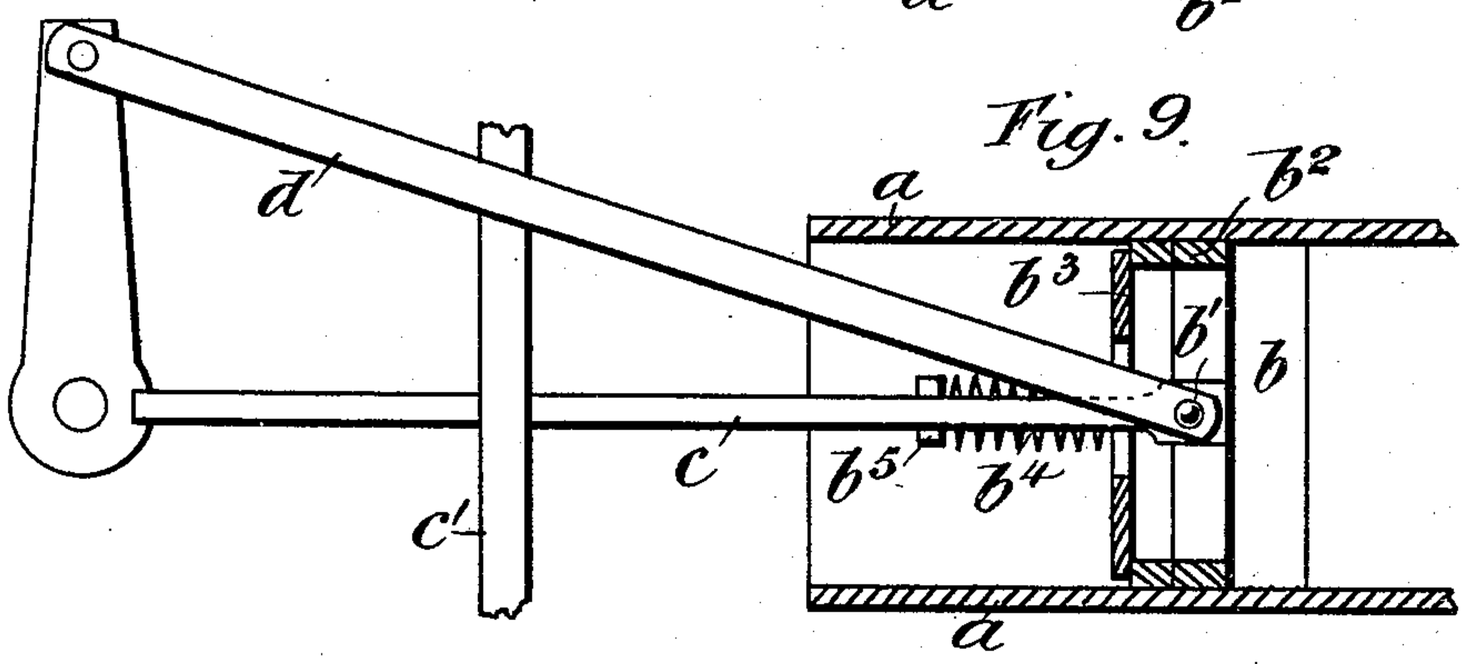


Fig. 9.



Attest;
S. H. Knight
E. Arthur

Inventor
Robert Mann Lowne
By Knight Bros.
Attys.

(No Model.) 4 Sheets—Sheet 4.

R. M. LOWNE.

ENGINE.

No. 479,651. Patented July 26, 1892.

Fig. 10.

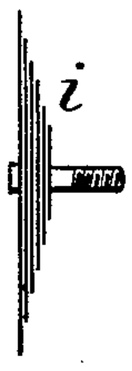


Fig. 11.

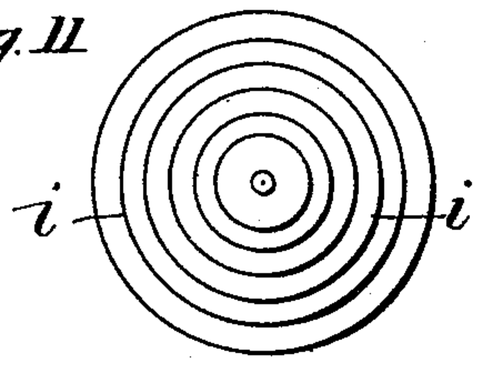


Fig. 12.

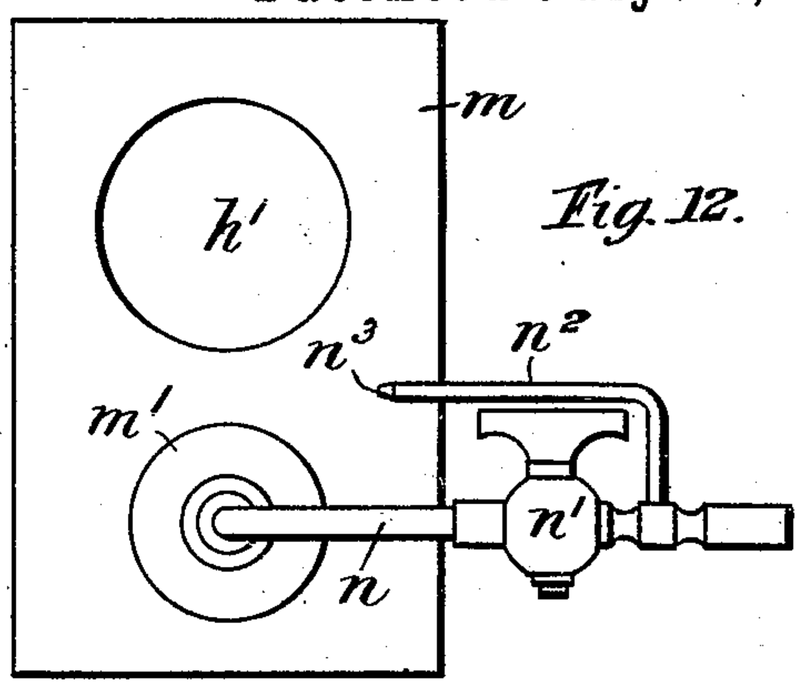


Fig. 13.

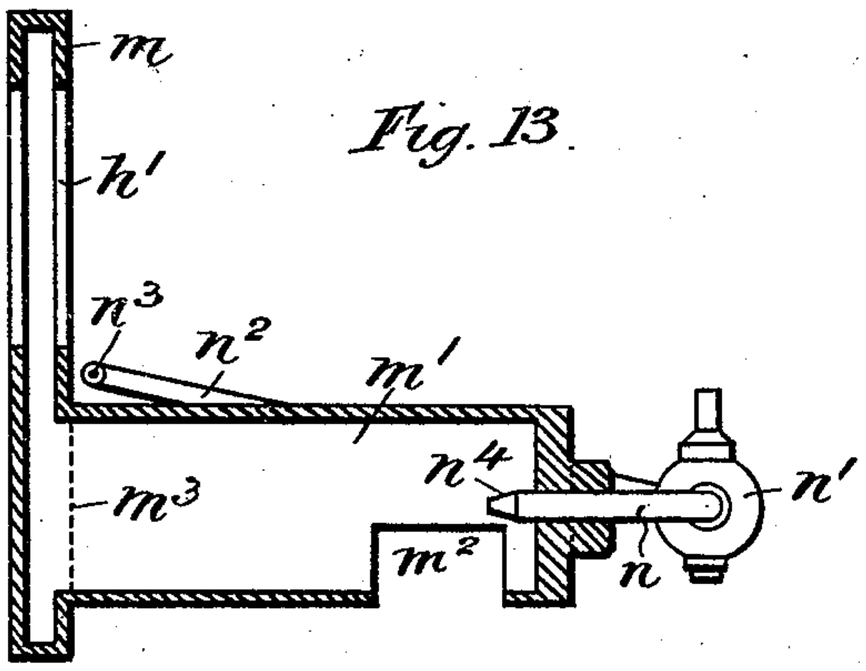
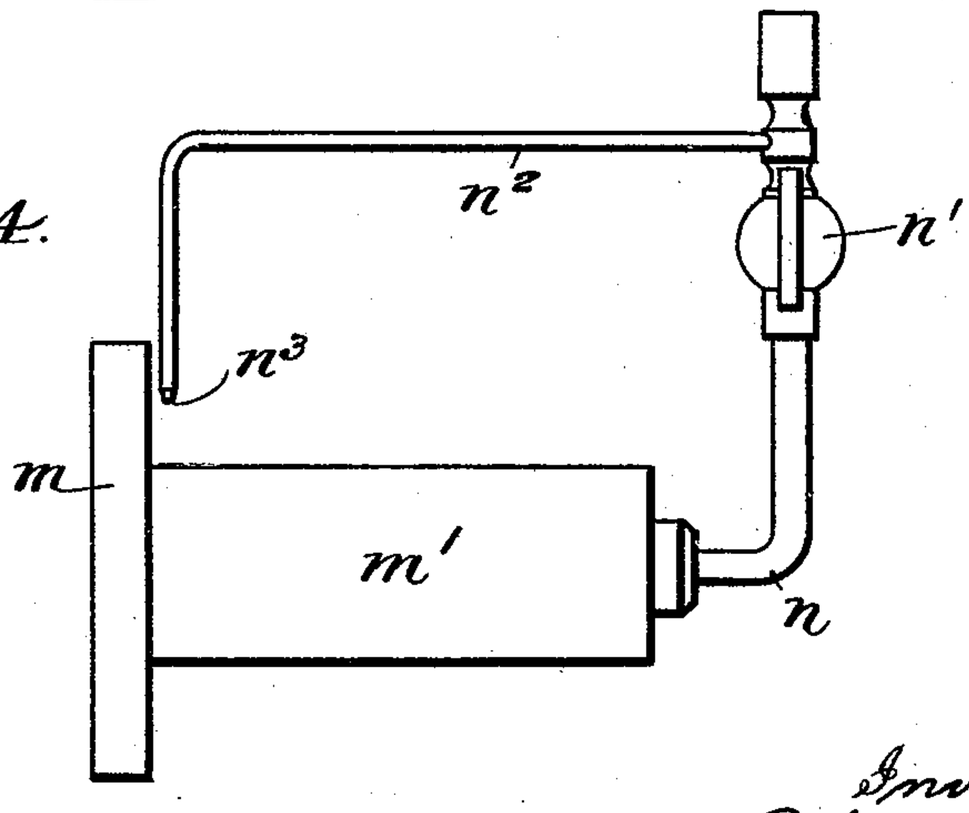


Fig. 14.



Attest:
S. H. Knight
E. Arthur.

Inventor
Robert Mann Lowne
By Knight Bros.
Attys.

UNITED STATES PATENT OFFICE.

ROBERT MANN LOWNE, OF LONDON, ENGLAND.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 479,651, dated July 26, 1892.

Application filed September 5, 1890. Serial No. 363,972. (No model.)

To all whom it may concern:

Be it known that I, ROBERT MANN LOWNE, a subject of the Queen of Great Britain, residing at Leicester House, East Finchley, London, in the county of Middlesex, England, have invented certain new and useful Improvements in Motive-Power Engines, of which the following is a specification.

My invention relates to a method of obtaining and transmitting power by means of a vacuum or partial vacuum caused within a cylinder or vessel, the vacuum or partial vacuum causing the external air to operate a piston and other appliances for obtaining motion.

In carrying my invention into effect I employ a cylinder with a piston of any convenient construction which shall fit as nearly as possible air-tight into the cylinder and at the same time be capable of moving freely, and I employ suitable guide-bars for keeping the piston parallel, such guide-bars being attached to the piston and moving with it. I connect the piston to a connecting-rod, which is attached to a crank and shaft carrying a fly-wheel. The cylinder, piston, guide-bars, crank, and shaft with fly-wheel may all be of ordinary construction.

According to my invention I form an opening of any convenient and suitable size at the end or thereabout of the cylinder and I cover this opening with a flap-valve or other convenient valve, which I cause to be operated by an eccentric, cam, or pin attached to the crank-shaft or the fly-wheel; or the flap or other convenient valve may be operated in any other suitable manner, the object being to open and close the opening into the cylinder or vessel. Close to the opening into the cylinder or vessel I arrange a flame or fire, caused by the combustion of gas or gases, gas and air, spirit, oil, or any other combustible substance or material. The object of the flame or fire is to fill or partially fill the interior of the cylinder or vessel with flame or gases or flame and gases at a very high temperature during the stroke or part of the stroke of the piston. When the cylinder is full or partially full of flame or gases or flame and gases at a very high temperature, then the flap or other convenient valve is caused to close by any suitable mechanical means and the flame or gases or flame and gases instantly become cooled to about the same temperature as the cylinder itself. The flame or highly-heated gases or the flame and highly-heated gases on becoming cool contract according to the difference between the temperature thereof when the valve is closed and that of the cylinder itself. The contraction of the flame or highly-heated gases or the flame and highly-heated gases when the valve is closed causes a vacuum or partial vacuum within the cylinder or vessel and the external air exerts a pressure on the piston which forces it in the direction of its stroke and operates the working parts of the motor.

According to my invention, instead of employing a cylinder and piston of ordinary construction I may employ a vessel of any convenient form, and instead of a piston I may employ a flexible diaphragm, and when the motor is only required to obtain a reciprocating motion I may dispense with the crank and fly-wheel and may operate the valve in any convenient manner by means of the motion of the piston; or I may dispense with the piston and employ the flexible diaphragm, operating the valve directly from it.

When convenient, I may employ two or more openings into the cylinder or vessel and cover them with a valve or valves for the purpose described, also for better supporting the combustion of the flame, in order for it better to enter and fill or partially fill the cylinder or vessel, I may admit air through the opening or openings mentioned, or I may admit air through another opening or openings, which I may arrange and cover, and stop the air entering from time to time in any convenient manner. The piston, as before stated, has two guide-bars attached to it. To the center of the piston I attach the connecting-rod. Over the guide-bars I arrange a split metallic ring, which fits closely against the body of the piston. Over this metallic ring I arrange another similar ring with its split at a different point of the circumference of the piston. Over this second ring I place a plate, which fits over the guide-bars and is kept in position so as to exert a pressure on the rings by spiral springs fitting around the guide-bars and the pressure of which can be

regulated by screws and nuts or by clips and set-screws, or by any other suitable means. This method of arranging the piston, guide-bars, and packing-rings is applicable as a substitute for the trunk-pistons of trunk-engines generally. When necessary to keep the cylinder or vessel from becoming too hot, I surround it with water or with circulating water in any convenient manner.

The advantages of the motor according to my invention are extreme simplicity of its working parts, combined with great power for its size, and ease and safety of its management, also its reliability and steadiness in working.

When working the engine by the consumption of gas, I employ, by preference, a ring-shaped Bunsen burner of such proportions as to bring the flame as close as possible to the opening in the end of the cylinder.

In order that my said invention shall be more fully understood and readily carried into effect, I will proceed, aided by the accompanying drawings, more fully to describe the same.

In said drawings, Figure 1 is a side elevation, and Fig. 2 is a plan, both partly in section, of an engine constructed according to my invention. Fig. 3 is a detail view of the piston and cylinder, partly in section. Figs. 4, 5, 6, and 7 are detail views of parts hereinafter described. Figs. 8 and 9 are respectively a plan and side elevation of the piston, cylinder, and connecting-rod, partly in section. Figs. 10 and 11 are respectively an edge and face view of the valve. Fig. 12 is a rear elevation of the burner. Fig. 13 is a vertical section of the same, and Fig. 14 is a plan of the same.

a is the cylinder or vessel.
b is the piston.
c c are the guide-bars.
d is the connecting-rod.
e is the crank.
f is the crank-shaft.
g is the fly-wheel.
g' is a pulley for transmitting power.
h is the opening into the cylinder.
h' is the position of the flame on entering the cylinder.
i is the flap-valve.
j is the eccentric for opening the valve.
j' is the eccentric-rod.
j^2 is a movable projection working on the eccentric-rod and attached to a spiral spring j^3.
j^4 is a spiral spring weaker than j^3 and which acts in an opposite direction.
k is a lever attached to the valve-spindle k' and carrying a pin k^3.
k^2 is a connecting-piece, which carries the valve i.
l is a water-jacket.
m is a ring-shaped Bunsen burner.
n is a supply-pipe, having a stop-cock n' for admitting gas to the burner m.
n^2 is a small pipe terminating with a small jet at n^3, which by being lighted will keep a small jet of gas burning for the purpose of lighting and keeping the Bunsen burner m alight.

o is a screen and short chimney placed partially around and extending above the burner m, the object being to protect the flame and at the same time create a draft for the burner. The chimney o may be extended in length and carried into a flue for taking off the products of combustion; but when the engine is worked by the consumption of gas, as shown in the drawings, the smell of the Bunsen flame is not greater than that of an ordinary gas-stove, and it is quite a matter of taste whether it is necessary to lead the chimney o into a flue or not.

Having mentioned the different parts with reference to the letters, I will now explain the working action of the engine.

For engines such as that shown in the drawings, when the gas is not permanently laid on, an india-rubber pipe is brought from any gas-supply pipe, the size being according to the size of the engine. For small engines suitable for driving sewing-machines, large automatic American organs, harmoniums, and a variety of purposes taking a similar amount of power, an ordinary fish-tail burner will admit sufficient gas for working the engine at full power and the india-rubber pipe may for convenience be attached to such burner for obtaining the supply of gas. The india-rubber pipe must now be attached to the pipe n and the gas lighted at the jet n^3. The stop-cock n' is turned on and the gas passes through the jet n^5 and lights as a Bunsen flame at h', passing up the chimney o.

In starting the engine its working may generally be described as follows: The fly-wheel g, on being pulled round by hand in the direction of the arrow, draws the piston through the cylinder and at the same time draws the Bunsen flame through the opening h in the end of the cylinder. The valve is caused to close by the eccentric before the piston finishes its forward stroke. Almost immediately upon the closing of the valve the flame which has entered the cylinder contracts and causes a vacuum within the cylinder behind the piston. The fly-wheel is still moved by hand until the crank passes its dead-point. Then the pressure of the external air forces the piston back, working the crank and fly-wheel with a force according to the amount of rarefaction behind the piston. The momentum of the fly-wheel again draws the piston forward, causing the flame again to enter the cylinder and again to cause a vacuum in it, and so on as long as the engine runs.

To more particularly describe the action of the engine I will explain that the valve is closed by means of the spring j^3 and projection j^2, butting on the pin k^3 at about three-quarters stroke of the piston and it is held shut by the compression of the spring j^3 by the action of the eccentric. Immediately on

the contraction of the flame the valve is further held shut by the atmospheric pressure acting on the outer side of the valve only and holding it against the opening h into the cylinder. This force is exerted upon the valve until the effective return stroke of the piston is completed. Then the valve opens. This is effected by means of the equilibrium being restored between the inside and outside of the cylinder. At the same time the eccentric liberates the valve by moving the projection j^2 and spring j^3 away from the pin k^3, while the light spring j^4 pulls upon the pin k^3 and opens the valve directly the equilibrium is restored, and the light spring j^4 holds the valve open until the projection j^2 and spring j^3 again close it. After the effective stroke of the piston has been completed, whatever products of combustion may be behind the piston are forced out of the cylinder through the opening h by the completion of the stroke of the piston.

The piston shown in Fig. 3, is constructed and guided according to my invention and which I employ as a substitute for a trunk-piston. b is the body of the piston, to which are fixed two guide-bars c c. b' is a joint and pin, which carries the connecting-rod d. b^2 b^2 are split metallic rings. b^3 is the plate for keeping the rings in position. b^4 b^4 are the spiral springs for holding the plate b^3 upon the rings b^2. The rings are kept by this means in close contact with the body of the piston b. The springs are kept in position by the clips b^5 b^5. The guide-bars c c run in bearings c' c'. The advantages of this piston are great lightness of running, steadiness of action, and at the same time it is practically perfectly air-tight. I arrange the split part of the rings opposite one another and at right angles to the plane of oscillation of the connecting-rod, so that, although the body of the piston may wear at the top and bottom from the angular and oscillating pull of the connecting-rod, yet the sides of the body of the piston are not subject to this wear and will therefore keep close to the cylinder. This is the reason why I place the split parts of the rings at the sides, for then the splits do not require any packing, as the body of the piston practically prevents air from passing. Figs. 4, 5, 6, and 7 are elevations showing, respectively, the body b of the piston, the rings b^2, and the plate b^3.

In the form shown in Fig. 8 I employ one guide-bar c instead of two, and I split the connecting-rod d, having half on each side of the guide-bar and its bearing, or I may still further modify it by having the connecting-rod on one side of the guide-bar only. The flap-valve I preferably employ is formed of a number of thin plates of steel graduating in size, as shown in Figs. 10 and 11.

The object of making the valve of a number of plates is that they act one upon another in a similar manner to the action of the plates of a carriage-spring and prevent the shock which would otherwise occur every time the valve was closed. A valve made of a number of plates is applicable to valves of engines generally where it is desirable to reduce the shock of the valve striking its seat.

I will now more particularly describe the burner with respect to Figs. 12, 13, and 14. m is a flat metal box with an opening h' right through it. Attached to or part of m is a tube m', with a plug in the end carrying the gas-pipe n and jet n^3. m^2 is an opening into the tube m' for admitting air. m^3 is a partition of wire-gauze for preventing the gas from lighting within the tube m'. The gas and air ordinarily burn outside the opening h', although without the wire-gauze there would be danger of the gas lighting in m'.

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

1. In an engine, the combination, with the cylinder having an opening therein, a burner arranged at said opening, a valve for closing said opening, and means for closing said valve, of a spring for opening the valve when the equilibrium between the interior and exterior of the cylinder is established, substantially as set forth.

2. In an engine, the combination, with the cylinder having an opening, the burner arranged at said opening, and a valve for closing said opening, of the eccentric-rod, a spring connected with said rod for closing the valve, and a spring for opening the valve, substantially as set forth.

3. In an engine, the combination, with the cylinder having an opening and a valve for closing said opening, of a spring for holding said valve normally open, and the burner having the opening h' arranged opposite the opening in the cylinder, substantially as set forth.

4. In an engine, the combination, with the cylinder having an opening and a valve for closing said opening, of a spring for holding said valve normally open, the burner having an opening arranged opposite the opening in the cylinder, and the auxiliary burner n^3, arranged near the latter opening, substantially as set forth.

5. In an engine, the combination, with the cylinder having an opening and a valve for closing said opening, of the burner having the vertical box m, provided with the opening h', arranged opposite the opening in the cylinder, and a semicircular chimney or screen arranged against the box m and surrounding the valve and said opening h', substantially as set forth.

6. In an engine, the combination, with the cylinder having an opening, the burner arranged at the said opening, and a valve for closing said opening, of a rod on which said valve is mounted, a crank having a pin on said rod, the eccentric-rod, a spring connecting the eccentric-rod with said pin, and a projection on said eccentric-rod adapted to strike said pin, substantially as set forth.

7. In an engine, the combination, with the cylinder having an opening and a valve for

closing said opening, of a burner having the flat box *m*, provided with an opening opposite the opening in the cylinder, substantially as set forth.

8. In motive-power engines, the combination of working cylinder *a*, having one of its ends open to the atmosphere, the single small opening *h* in its other end adapted for the double purpose of admitting flame to the cylinder and exhausting the gas therefrom, a burner-box communicating with said opening *h*, the valve *i*, guarding the opening *h*, means for operating said valve for opening and closing said opening, a burner in said burner-box for supplying flame and heated gas directly to the interior of said working cylinder *a* through the said opening *h*, and a piston located in said cylinder, substantially as set forth.

9. In an engine, the combination of the cylinder *a*, piston *b*, an opening *h* in one end of the cylinder proper and being of smaller diameter than the interior of said cylinder, a valve *i*, means for operating such valves to open and close said opening *h*, and a b urner *m* for supplying flame and heated gas to the interior of the cylinder *a* through said opening *h*, said burner being arranged transversely to as contradistinguished from coaxially with said opening, substantially as set forth.

10. In a low-pressure engine, the combination of a cylinder, the piston-body working in said cylinder and having a connecting-rod, the spring-pressed plate b^3, the split rings arranged between said plate and piston-body, and means for operating said piston in the cylinder, substantially as set forth.

ROBERT MANN LOWNE.

Witnesses:
B. J. B. MILLS,
CLAUDE K. MILLS,
Both of 23 *Southampton Buildings, London.*