(No Model.) 2 Sheets—Sheet 1.

F. S. MEAD.

GAS, OIL, OR VAPOR ENGINE.

No. 563,670. Patented July 7, 1896.

Fig: 1.

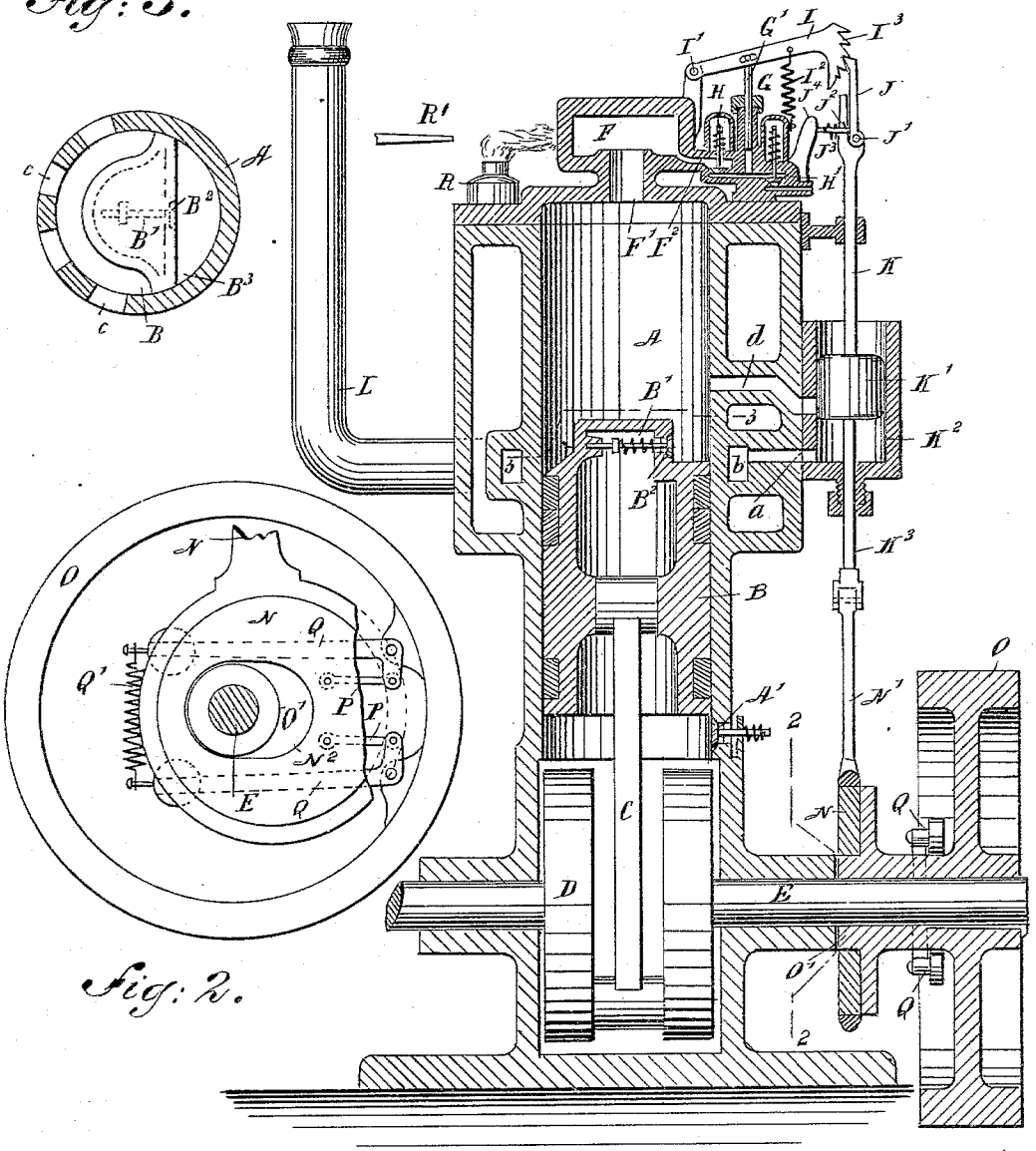

Fig: 3.

Fig: 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig: 5.

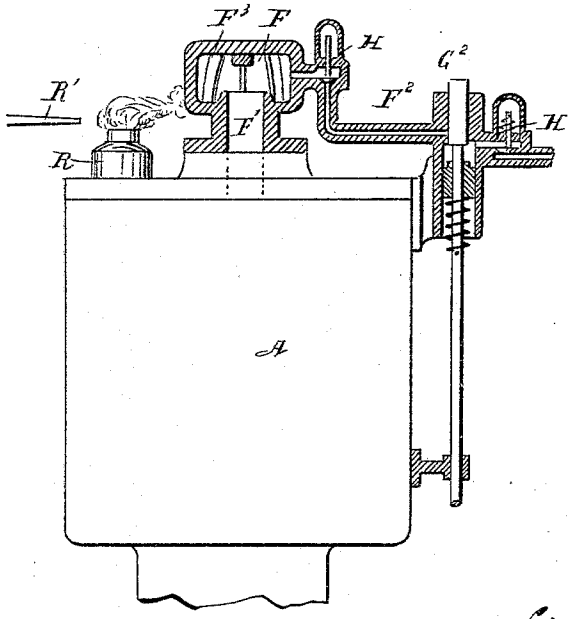


Fig: 4.

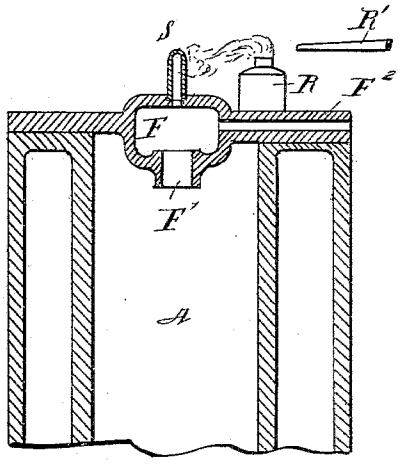
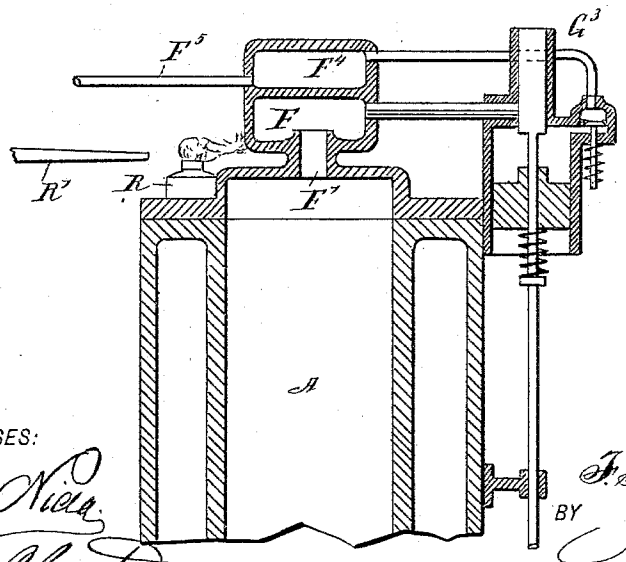


Fig: 6.



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UNITED STATES PATENT OFFICE.

FRANK S. MEAD, OF MONTREAL, CANADA.

GAS, OIL, OR VAPOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 563,670, dated July 7, 1896.

Application filed August 20, 1894. Serial No. 520,796. (No model.)

To all whom it may concern:

Be it known that I, FRANK S. MEAD, a citizen of the United States, at present residing at Montreal, in the Province of Quebec and Dominion of Canada, have invented a new and Improved Gas, Oil, or Vapor Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved gas, oil, or vapor engine, which is comparatively simple and durable in construction and arranged to give an impulse to the piston at every revolution of the crank-shaft.

The invention consists in certain parts and details, and combinations of the same, as will be hereinafter fully described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is an enlarged transverse section of the eccentric-governor, the section being taken on the line 2 2 of Fig. 1. Fig. 3 is a sectional plan view of the cylinder on the line 3 3 of Fig. 1. Fig. 4 is a sectional side elevation of the cylinder with a modified form of igniting-tube for the explosion-chamber. Fig. 5 is a sectional side elevation of a modified form of explosion-chamber and pump, and Fig. 6 is a similar view of another form of explosion-chamber.

The improved engine is provided with a cylinder A, in which operates a piston B, connected by a pitman C with the crank-arm D, secured on the main driving-shaft E. The upper end of the cylinder A forms the working chamber, and the lower end of the cylinder is provided with a spring-pressed air-inlet valve A′ for admitting to the lower end of the cylinder the air to be compressed on the outer stroke of the piston B, and which passes through the hollow piston and the check-valve B^2, the stem of which is provided with a spring B′ into the working end of the cylinder A. The upper end of the cylinder A is connected by a neck F′ with a separate and distinct explosion and vaporizing chamber F, connecting by an inlet F^2 with a pump G for supplying the said mixing and explosion chamber F with the necessary fuel either in the form of oil, gas, or vapor.

On opposite sides of the pump G in the inlet F^2 are arranged the check-valves H and H′, of which the valve H prevents backflow of the gases when ignited in the chamber F, and the valve H′ prevents the return flow of the fuel on the downward movement of the plunger G′ of the pump G. The plunger G′ is pivotally connected at its outer end with a lever I, fulcrumed at I′ on a bracket attached to the chamber F, and the said lever is pressed by a spring I^2, so as to insure a quick return or downward movement of the lever I to cause the plunger G′ to force the drawn-in fuel past the valve H into the chamber F. The free end of the lever I is formed with a segmental rack I^3, adapted to be engaged by a pawl J, fulcrumed at J′ on a piston-rod K, carrying a piston K′, working in the cylinder K^2. The pawl J is provided with a spring-pressed pin J^2, adapted to normally hold the pawl against a shoulder on the piston-rod K, and the said pin J^2 is adapted to be engaged by an inclined projection J^4, fixed on the cylinder-head and serving to throw the pawl J out of engagement with the segmental rack I^3 at the time the piston K′ moves into an uppermost position, so as to permit the spring I^2 to force the lever I downward to actuate the plunger G′ and force the previously-drawn-in fuel of the plunger G′ into the mixing and explosion chamber F.

The cylinder K^2 is connected near its lower closed end by a port *a* with an annular chamber *b*, connected with the exhaust-pipe L. The annular chamber *b* is connected by a series of exhaust-ports *c* with the interior of the cylinder A, the said ports *c* being arranged on the side opposite to the straight side B^3, containing the spring-pressed valve B^2, previously mentioned. (See Fig. 3.) A second port *d* connects the cylinder K^2 with the interior of the cylinder A above the ports *c*, as illustrated in Fig. 1.

The lower end K^3 of the piston-rod K connects with the eccentric-rod N′ of an eccentric-disk N, having an elongated aperture N^2, through which passes the hub O′ of a fly-wheel O, secured on the main driving-shaft E. The eccentric-disk N is connected by links P with weighted bell-crank levers Q, ful-

crumed on the fly-wheel O, and having their outer free ends connected with each other by a spring Q'. (See Fig. 2.) By this arrangement the throw of the eccentric N is regulated according to the speed of the engine, so that more or less fuel is pumped into the explosion or mixing chamber F, and the auxiliary exhaust *d* is left open during a longer or shorter period, according to the speed at which the engine is running.

In order to start the engine, I prefer to heat the explosion and mixing chamber exteriorly by a lamp R and a suitable blowpipe R', as indicated in Fig. 1, it being understood that the service of this lamp and blowpipe is dispensed with after the engine is once running.

It will be seen that the vaporizing and exploding chamber F receives the fuel from the pump G unmixed with air, and as the said chamber is heated it heats and holds the oil, vapor, or gas during the time the piston B rises, and presses fresh hot air into the said chamber F, the fresh air being obtained from the lower end of the cylinder A by way of the hollow piston B and valve B^2. When fresh hot air is forced into the chamber F, at the time the piston B is on the up center, then the said mixture is ignited, either by an electric spark or by a heated pipe, (see Fig. 4,) or in any other suitable manner, so that the force of the explosive charge passes through the neck F' into the working end of the cylinder A to drive the piston B downward. The igniting may also be obtained by a sufficient compression of the mixture in the chamber F, it being understood that the heat remaining in the chamber from the explosion of previous charges causes ignition, and thereby renders the latter automatic.

When the piston B rises, the air contained in the cylinder A is forced out through the exhaust-ports *c*, then through the auxiliary exhaust-port *d*, until the latter is cut off by the rising piston B. The remaining air is now compressed in the cylinder A by the still upwardly-moving piston B, and a small quantity of oil, vapor, or gas is forced into the chamber F by the pump G. As the oil strikes the hot surface of the chamber F it is immediately vaporized, and in meeting the hot compressed air from the cylinder A it is mixed with the same, to form an explosive charge, which is now ignited by suitable means, as previously explained.

The force of the explosive charge passes through the neck F' into the cylinder A, so that the heated gases drive the piston B again on its downward stroke. The piston B finally uncovers the exhaust-ports *c*, so that the gas can pass from the cylinder through the said ports into the annular chamber *b*, and from the latter to the exhaust-pipe L. The piston B, on its downward stroke, compresses the air in the lower part of the cylinder A, and at a time when the exhaust-ports *c* are opened then the pressure is reduced in the upper end of the cylinder A, so that the compressed air in the lower part of the cylinder A passes through the hollow piston B and valve B^2 into the upper end of the cylinder A to drive the products of combustion through the exhaust-ports *c* out of the upper end of the cylinder A, at the same time filling this latter with fresh air. The momentum of the fly-wheel O causes a return of the piston B, whereby surplus air in the upper end of the cylinder A is forced out through the ports *c* and *d*, as previously explained, and the remaining amount of air is compressed to be finally mixed with the fuel in the chamber F.

The eccentric-disk N is set about ninety degrees in advance of the crank-arm D, so that the valve K' and rod K are half-way up on their upstroke at the time communication is established between the cylinder A and the exhaust-pipe L by way of the ports *d* and *a* and piston K' in the cylinder K^2. As the piston-rod K proceeds on its upward stroke the pawl J engages the teeth of the rack I^3 to impart an upward swinging motion to the lever I, which raises the plunger G' of the pump G, so as to draw into the latter a certain amount of fuel. The lever I is finally released by the pin J^2 being pushed outward by the fixed projection J^4, so that the spring I^2 pulls the pump-plunger downward, so that the pump injects a certain amount of fuel into the chamber F. Now when the speed of the engine exceeds a normal rate, then the centrifugal governor connected with the eccentric N reduces the throw of the latter, so that the pawl J does not rise far enough to catch the teeth of the rack I^3, whereby the pump G will remain at a standstill and no fuel is pumped into the chamber F until the speed of the engine falls to the normal rate.

As illustrated in Figs. 5 and 6, I have applied a form of pump for the chamber F, fully described and claimed in the application for Letters Patent of the United States for a gas-engine, Serial No. 519,288, filed by me on the date of August 2, 1894. This pump is particularly adapted either for pumping in the oil in liquid form, or, by sufficiently enlarging its proportions, to take the vapor of the oil previously heated, or gas, and force that into the chamber F. As the pump-rod moves downward the sliding plunger rests against the enlarged part of the pump-rod, and being thus forced down, draws into the pump-cylinder a charge of oil, oil-vapor, or gas, as the case may be. On its upward stroke the sliding plunger merely advances in proportion to the difference in areas between itself and the enlarged end of the pump-rod, the spring being compressed behind it until the enlarged part of the rod passes and opens the delivery-port of the pump G^2, whereupon the compressed spring expands and forces the sliding plunger up to the enlarged part of the rod, so as to force the contents of the pump-cylinder out into the chamber F.

In order to better adapt the chamber F to be used on a vertical engine, I extend the neck

F′ a short distance into the chamber, so as to form an annular flange to prevent solid particles and residuum of the oil from passing through the neck into the working end of the cylinder. The solid particles and residuum of the oil are cleaned out from time to time. In order to increase the heat capacity of the chamber F, I may provide the same with internal ribs F^3, as indicated in Fig. 5. As shown in Fig. 6, I may provide a second chamber F^4 directly above the chamber F, and pass the fuel through a supply-pipe F^5 into this chamber F^4, to heat the fuel before drawing it by the pump G^3 and forcing it into the chamber F.

It will be understood that the constructions of the vaporizing-chamber shown in Figs. 5 and 6 may be employed in connection with a pump such as represented in Fig. 1.

It is understood that the auxiliary exhaust-port *d* and piston K′, as well as the cylinder K^2, are not absolutely necessary for running the engine, but the said parts assist materially in an economical way by allowing a smaller charge to be used with greater expansion.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. An explosive-engine provided with a main exhaust-port, an auxiliary exhaust-port located in advance of the same, a valve controlling the said auxiliary exhaust, and a governor for moving the said valve according to the speed of the engine, substantially as described.

2. In a gas or oil engine having a main exhaust-port, an auxiliary exhaust-port located in advance of the main exhaust-port, a valve controlling the auxiliary exhaust, a governor consisting of a radially-sliding eccentric, and one or more weighted arms actuated by centrifugal force derived from the speed of the engine and arranged to control the said auxiliary exhaust-valve, substantially as shown and described.

3. In a gas or oil engine, an oil-pump, whose plunger is normally held by a spring, an eccentric-rod having a hook or catch for operating same, and a ratchet-lever so arranged that the eccentric-rod may catch into it and thereby draw the pump-plunger out to a predetermined point and then release it, substantially as shown and described.

4. In a gas or oil engine, an oil-pump, a ratchet-lever for drawing out the plunger of said pump, an eccentric and hooked eccentric-rod engaging in said ratchet, and an automatic governor controlling the stroke of said eccentric-rod and thereby the stroke of the pump, substantially as shown and described.

5. In a gas or oil engine, having a vaporizing-chamber connected to the working cylinder, an oil, oil-vapor, or gas pump, and a pump-rod having a sliding plunger thereon and adapted to control positively the discharge-port of said pump, substantially as shown and described.

6. In a gas or oil engine, an extension vaporizing-chamber having a flange projecting from the working cylinder into the said chamber around the opening which leads to the working cylinder, as and for the purposes herein described.

7. In an explosive-engine, an upright working cylinder, an explosion-chamber at the upper end thereof, and a flange projecting upwardly into the said chamber around the opening which leads to the working cylinder, substantially as described.

8. In a gas or oil engine, the combination of a working cylinder and a piston reciprocating therein and provided with a passage extending therethrough from one face to the opposite face, a vaporizing-chamber opening into the said working cylinder, an air-compression chamber located at the opposite end of the cylinder to the said vaporizing-chamber, and a laterally-moving check-valve in the said passage of the working piston to control the admission of air from the compression-chamber to the working cylinder through the piston, substantially as shown and described.

9. In a gas or oil engine having an extension vaporizing or exploding chamber communicating with the working cylinder thereof through an opening of reduced area, an outer chamber attached to or partly surrounding said vaporizer and utilizing the heat escaping from the surface thereof, said chamber being entirely separated from the vaporizer by imperforated walls, so as to be in no direct communication therewith substantially as shown and described.

10. In an explosive-engine, an exploding-chamber open to the cylinder, a heating-chamber attached to, but not in direct communication with, the said exploding-chamber and connected with a fuel supply, and a pump whose suction-port is connected to the heating-chamber while its delivery-port connects with the exploding-chamber, substantially as described.

11. In a gas or oil engine, the combination of a working cylinder, an air-compression cylinder, an extension vaporizing and igniting chamber such as herein described, a second vaporizing-chamber on the outside thereof, and the valve controlling the supply of vapor to the inside chamber, substantially as shown and described.

FRANK S. MEAD.

Witnesses:
LEWIS P. MEAD,
FRANK E. MEAD.