(No Model.) 2 Sheets—Sheet 1.

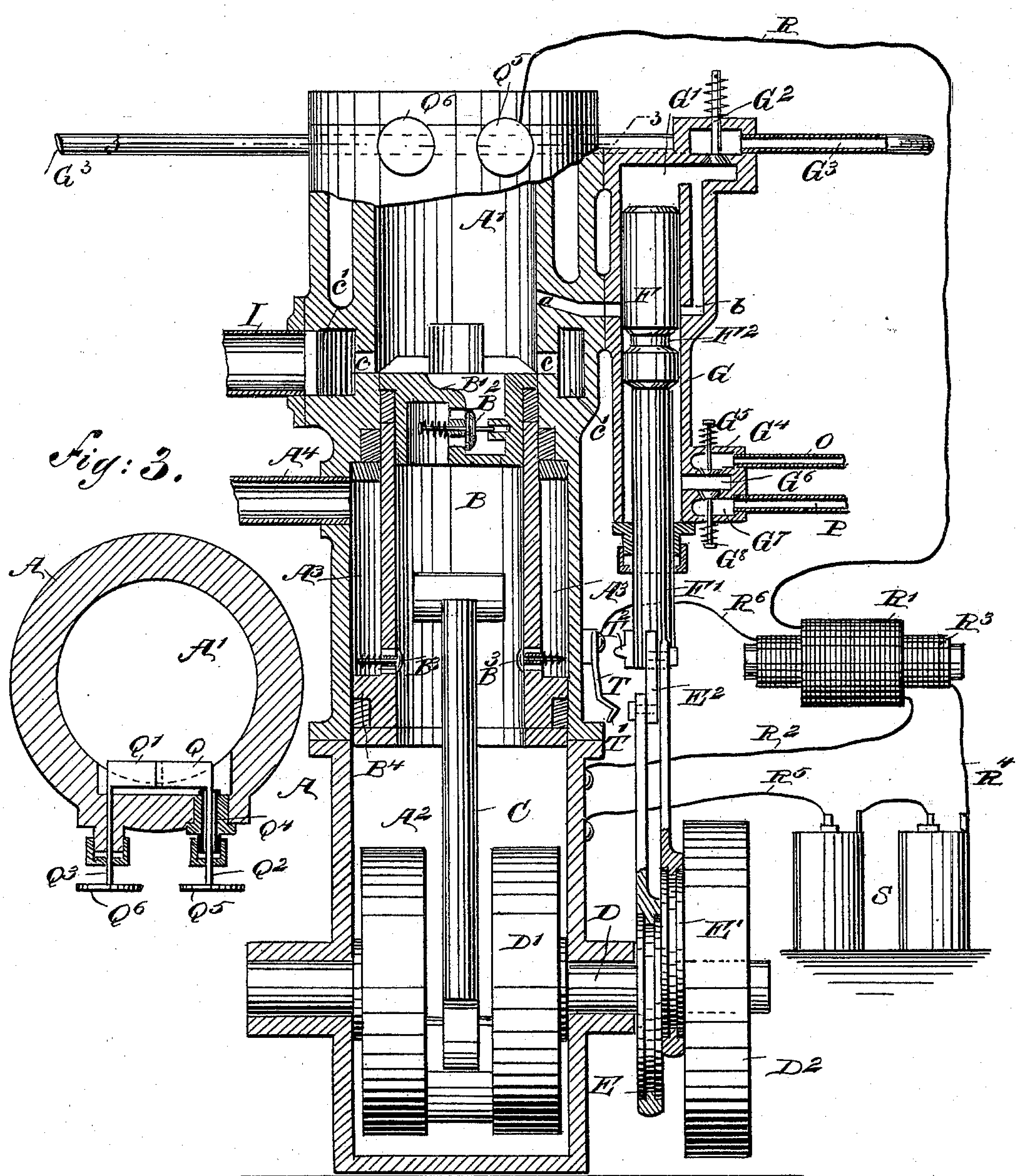
F. S. MEAD.

GAS ENGINE.

No. 541,773. Patented June 25, 1895.

Fig: 1.

Fig: 3.



WITNESSES:

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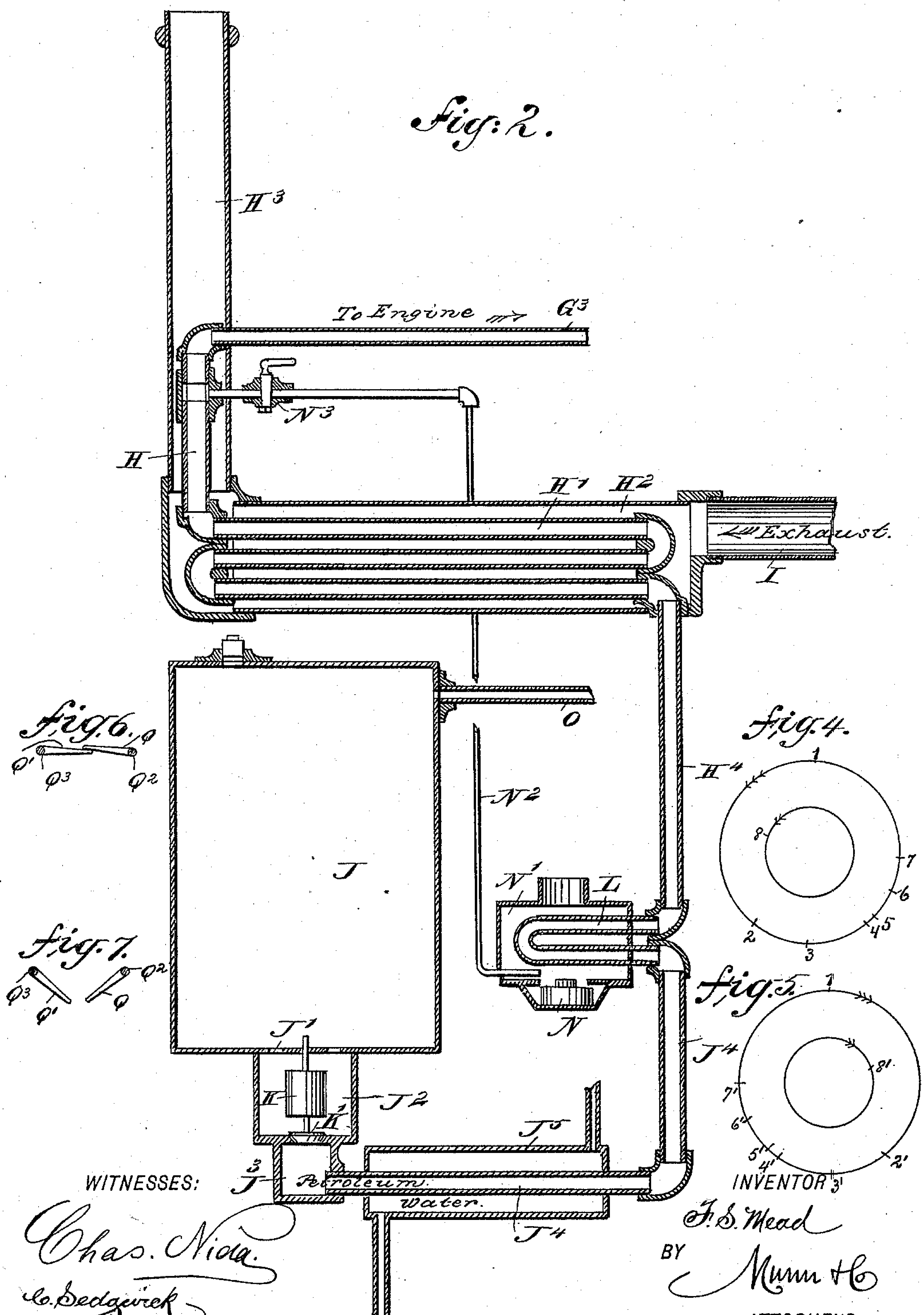

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UNITED STATES PATENT OFFICE

FRANK S. MEAD, OF MONTREAL, CANADA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 541,773, dated June 25, 1895.

Application filed January 17, 1894. Serial No. 497,147. (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 in Montreal, in the Province of Quebec and Dominion of Canada, have invented a new and Improved Gas-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 engine, which is comparatively simple and durable in construction and arranged to utilize the motive force to the greatest advantage.

The invention consists of certain parts and details, and combinations of the same, as will be hereinafter 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 and numerals of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is a similar view of the vaporizer or gas generator. Fig. 3 is a sectional plan view of the improvement on the line 3 3 of Fig. 1. Figs. 4 and 5 are diagrammatic views showing the relative positions of the cylinder pump crank arms, and their pistons; and Figs. 6 and 7 are sectional side elevations of the electrodes.

In my improved engine presently to be described, I compress the air on the back or crank side of the piston, so as to use the annular chamber for the double purpose of conveying the air to the proper chamber and also by means of the passage of this cold air through the annular chamber, the walls of the piston of the compressing cylinder are kept sufficiently cool to avoid the necessity of extending the water jacket beyond the power or working chamber. The delivery of this compressed air to the working or power chamber of the cylinder is usually accomplished by a passage made in the cylinder connecting the compressing and working chambers with each other or by means of a disk valve arranged in the piston. The passage mentioned is difficult and expensive to make and offers considerable frictional resistance to the passage of the air. The valve in the piston on account of being set with its spindle or stem in line with the piston, has the same movement as the latter and consequently is influenced to a great extent by the movement of the piston, the inertia of the latter causing it to adhere to its seat at the very time that it should respond most promptly to the pressure in the compressing chamber. To obviate this difficulty I provide a special construction of the piston by which the valve is placed so that its movement is across—or perpendicular to that of the piston, which leaves it free to respond promptly to the pressure of the air behind it and its own spring, without any appreciable detention from the movement of the piston.

As illustrated in the drawings, the gas engine is provided with a cylinder A, formed in its upper end with a working or explosion or ignition chamber A′, and in its lower part with a compression chamber A^2, somewhat larger in diameter than the working chamber A′. In the cylinder A reciprocates the hollow piston B, connected by the usual pitman C with the crank arm D′ of the main driving shaft D, carrying at one outer end a fly wheel D^2. On the main driving shaft D are held two eccentrics E, E′, connected with a reversing link E^2, attached to the stem F′ of the plunger F, reciprocating in the cylinder of the gas supply pump G, similar in construction to the one shown and described in my application for Letters Patent, Serial No. 492,856, filed by me on December 5, 1893.

In the head B′ of the piston B is arranged a spring-pressed valve B^2, having its stem arranged transversely or at right angles to the movement of the piston, so that the said valve is not influenced in opening and closing by the piston's inertia as previously mentioned. This valve B^2 serves to connect the compression chamber A^2 with the working chamber A′, whenever the pressure of the compressed air in the compression chamber A^2 is sufficient to open the valve B^2, which takes place at the time the piston B moves into a lowermost position. The lower end of the piston B is formed with an exterior flange B^4, engaging the inner surface of the compression chamber A^2 so as to form a chamber A^3 between the wall of the piston B and the cylinder A, as will be readily understood by reference to Fig. 1. This chamber A^3 is connected by a pipe A^4 with the outer air, and by spring-pressed valves B^3 with the interior of the piston B, the said valves B^3 being arranged in the wall of the piston and opening inwardly. By this arrangement, air from the outside can pass through the pipe A^4, chamber A^3 and valves B^3 into the hollow piston B and to the compression chamber A^2. The working chamber A′ is adapted to be connected by the port *a* with a port *b* arranged in the cylinder G, the ports being controlled by the plunger F having an annular recess or groove F^2 so as to connect or disconnect the ports *a* and *b* with and from each other. The port *b* extends to the upper or compressing end G′ of the cylinder G so that gas or vapor compressed by the plunger F on its upward stroke passes through the port *b*, recess F^2 and port *a* into the working chamber A′ at the time the said piston F nears the end of its upward stroke.

The compression end G′ of the cylinder G connects by an inlet valve G^2 with the gas supply pipe G^3 connected with the vaporizer H, see Fig. 2. The valve G^2 opens on the down stroke of the plunger F, to admit gas or vapor to the end G′ of the cylinder G, and the said valve closes on the up-stroke of the plunger. The vaporizer illustrated in Fig. 2 and forming part of the engine, is provided with a coil of pipe H′ contained in a casing H^2 having a chimney H^3 and connected with the exhaust pipe I of the cylinder A. The exhaust pipe I opens into an annular chamber *c′* formed in the cylinder A, the said chamber being connected by the exhaust ports *c* with the interior of the chamber A′. Thus, the exhaust gases from the working cylinder A′ pass through the port *c* and chamber *c′* into the exhaust pipe I and from the latter into the casing H^2, to heat the vapors passing through the coil of pipe H′ and the pipe H connected with the supply pipe G^3. The oil used for forming the vapors is contained in a vessel J formed in its bottom with openings J′ discharging into a chamber J^2 containing a float K carrying a valve K′, adapted to connect the said chamber J^2 with a second chamber J^3, from which leads a pipe J^4 passing through a water jacket J^5, as plainly shown in Fig. 2.

The end of the pipe J^4 outside of the water jacket J^5 connects with a **U**-shaped vaporizing pipe L, adapted to be heated by a lamp N contained in a casing N′ carrying the said vaporizing pipe L. The latter discharges into a pipe H^4 connected with the coil of pipe H′, as will be readily understood by reference to Fig. 2. A small pipe N^2 provided with a valve N^3 leads from the pipe H into the casing N′, and is provided in the latter with a burner so as to burn gas in the casing N′ instead of the lamp N to heat the oil passing through the pipe L so as to vaporize the same.

The water jacket J^5 keeps the part of the pipe J^4 near the chamber J^3 cool to prevent heating of the oil contained in the chamber J^3, J^2 and the vessel J. The float K keeps the valve K′ unseated as long as oil is contained in the said vessel J, but as soon as the latter becomes empty the float K will sink, thus seating the valve K′ and disconnecting the chambers J^2 and J^3.

Into the upper end of the vessel J leads a pipe O connected with a chest G^4 formed on the cylinder G, the said chest G^4 being adapted to connect by a valve G^5 with a port G^6 opening into the lower part of the said pump cylinder G. The port G^6 is also connected by a spring pressed valve G^8 with an inlet chest G^7 into which opens a supply pipe P connected with the outer air or a source of gas supply of any description. The valve G^5 opens outwardly, while the valve G^8 opens inwardly, so that on the upstroke of the plunger F the valve G^8 opens to draw in air or gas, while on the downstroke of the plunger the drawn in air or gas is forced out into the chest G^4 and through the pipe O passes into the vessel J, to exert a pressure on the top of the oil contained in the said vessel, to cause the oil to flow through the pipe J^4 and pipe L to insure proper vaporization.

The igniting device in the upper end of the explosion or working chamber A′ is arranged as follows: Two electrodes Q and Q′ extend into the said chamber A′ and are provided with stems Q^2 and Q^3 respectively, mounted to turn in the wall of the cylinder A, the stem Q^2 being insulated in a suitable insulated bearing Q^4, as plainly shown in Fig. 3. On the extreme outer ends of the stems Q^2 and Q^3 are held hand wheels Q^5 or Q^6 to enable the operator to properly set the electrodes Q and Q′ in such a manner as to cause their free ends either to contact as shown in Fig. 6, or to be out of contact as illustrated in Fig. 7, for generating the spark to cause an explosion in the chamber A′ of the gases compressed therein.

The stem Q^2 is connected by a wire R with the coil R′ connected by a wire R^2 with the cylinder A the said coil R′ containing a smaller coil R^3 connected by the wire R^4 with the battery S connected by a wire R^5 with the cylinder A. The small coil R^3 is also connected by the wire R^6 with a spring T attached to and insulated from the cylinder A, as plainly shown in Fig. 1. The free end T′ of the said spring T is adapted to be engaged by a projection or lug T^2 held on the lower end of the plunger stem F′ of the vapor pump G so that the said stem F′ in moving into a lowermost position engages by the lug T^2 the said free end T′ to press the latter in contact with the cylinder A, so as to complete the circuit, it being understood that the stem Q^3 of the electrode Q′ on account of being directly mounted in the cylinder A takes the electricity from the latter and the spark is produced between the free ends of the electrodes Q and Q′. When the plunger F moves upward the lug T^2 moves away from the free end T′ of the spring T so as to release the latter, whereby the contact of the insulated spring with the cylinder is broken and consequently the current is interrupted. In order to insure proper formation of the spark, it is necessary to rub the free ends of the electrodes one on the other, and for this purpose the stems Q^2 and Q^3 are provided with the hand wheels Q^5 and Q^6 to enable the operator to move the free ends of the electrodes over each other, in order to clean the electrodes and insure a proper spark.

The operation is as follows: When the several parts are in the position illustrated in Figs. 1 and 2, and heat is applied to the pipe L by the lamp N in the casing N', then sufficient vapor is formed in the vaporizing pipe H for the first few strokes of the engine. The main driving shaft D of the engine is turned so that the piston B moves downward and the air in the compression chamber A^2 passes through the valve B^2 in the hollow piston B into the explosion or working chamber A', whereby the dead air in the chamber A' is driven out through the exhaust port *c*, the chamber *c'* and pipe I, and at the same time, the said chamber A' is filled with pure or nearly pure air. As the piston B ascends, the exhaust ports *c* are covered, and the pump plunger F with its recess F^2 is sufficiently raised to open communication between the ports *a* and *b* and consequently between the working chamber A' and the compression chamber G' of the cylinder G. As the plunger F in its upward movement compresses the previously drawn in gas or vapor the latter passes through the said registering ports into the working chamber A', so as to fill the same. The plunger F is now at its down-stroke so that the ports *a* and *b* are disconnected and supply of compressed gas or vapor is shut off. The piston B continues to ascend so as to compress the air and gas contained in the chamber A' until it reaches the limit of its upward stroke, at which time the charge in the said chamber is ignited so as to drive the piston B downward, thus giving impulse to the piston B to actuate or drive the shaft D. With the aid of the balance wheel D^2 the driving shaft D is further revolved so as to cause the crank arm D' to move the pitman C and piston B upward, thus repeating the previously described operation, and thus receiving an impulse at each revolution.

It is understood that as the piston B ascends in the cylinder A, air is drawn into the compression chamber A^2 through the valves B^3 connected with the chamber A^3 containing the inlet pipe A^4. The piston B on its descent or downward stroke, compresses the air in the compression chamber A^2 until the valve B^2 is opened, and the compressed air passes from the compression chamber A^2 into the working chamber A', as previously described. It is understood that this takes place at the time the piston B uncovers the exhaust ports *c*. By this arrangement, the remaining exhaust and burned products in the working chamber A' are driven out through the exhaust ports *c* by the incoming fresh compressed air from the chamber A^2. The plunger F in the pump has meanwhile filled the chamber G' with a certain quantity of gas or vapor drawn in through the supply pipe G^3, and this gas or vapor is finally compressed on the upward stroke of the plunger, to be admitted into the chamber A' as soon as the plunger has moved upward sufficiently to move its recess F^2 in register with the ports *a* and *b*. This takes place at the time the piston B is on its upward movement and has just covered the exhaust ports *c*. The reduced end or stem F' of the plunger F working in the lower part of the cylinder G of the pump, has forced a sufficient quantity of air into the vessel J to replace the amount of oil which has flowed through the vaporizer, so as to maintain in the said vessel a slight pressure above atmospheric pressure. When the pump plunger F draws into and fills the chamber G' with the vapor from the vaporizer, then the pressure is somewhat relieved allowing a little more oil to be forced into the vaporizer from the vessel J, and the oil now coming in contact with the heated surface of the vaporizer is converted into vapor, thus re-establishing the pressure in the vaporizer and preventing further flow of oil until more vapor is withdrawn from the vaporizer.

It is understood that in my vaporizer as shown and described, I require the pipe J^4 between the vaporizer and the oil in the vessel J to be absolutely free from pumps, valves or other obstructions to the free flow of oil between the said two parts in either direction, so as to maintain a slight air pressure above the oil in the vessel J. Now, as the vapor is drawn from the vaporizer and the pressure reduced at that end, the oil will flow to the heating surface and vaporize to maintain the same pressure in the vaporizer, as in the oil vessel J, and in case the oil from any cause should flow forward too freely, then an excess of vapor would be generated, driving the oil back to the vessel J and away from the heating surface.

By reference to the diagram shown in Fig. 4, it will be seen that when the main piston B leads to top center position at 1 and proceeds downward to 2, then it uncovers the exhaust ports *c* to finally pass to its lowermost position at 3. On its upward stroke the exhaust ports are closed at 4 at a time when the vapor pump plunger F has arrived near its top center to open the delivery port at 5 to pass finally its top center at 6 and to close its delivery port at 7. The main piston B then compresses the mixed air and gas from 7 to 1, and the vapor pump plunger F proceeds in the meantime to draw in and compress another charge ready for delivery at 5, as above described.

By reference to the diagram shown in Fig. 5 it will be seen that the engine is readily reversible by changing the movement of the plunger F, by reversing the lever E^2 connected with the two eccentrics E and E'. The main piston leaving its top center 1' proceeds downward to 2' where it uncovers the exhaust ports, and passing its lower center at 3′ closes the exhaust ports at 4′, at the time when the vapor pump plunger F, having arrived near its top center, opens its delivery port at 5′, passes its top center at 6′ and closes its delivery port at 7′. The main piston B then presses the mixed air and gas up to 1′ and the vapor pump proceeds to draw in and compress another charge ready for delivery at 5′.

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

1. A gas engine, comprising a cylinder having a working or explosion chamber and a compression chamber, a hollow piston reciprocating in the said cylinder, and provided with a flange in the compression chamber so as to form an annular chamber between the piston and the wall of the cylinder, said annular chamber communicating with the outer air, and inwardly opening valves arranged in the wall of the piston to admit air from the said annular chamber into the interior of the piston, substantially as described.

2. A vaporizer, comprising a vessel adapted to contain oil, an outlet in the wall of the vessel, a float arranged in the vessel, a valve operatively connected with the float and opening inwardly into the vessel, to close the outlet when the liquid sinks to a predetermined level, and a vaporizer proper connected to the outlet by means of a pipe having imperforate walls, so that the pressure of the vapor generated in the vaporizer will control the outflow of oil from the oil vessel substantially as described.

3. In a gas engine, the combination with a vapor pump, of a vaporizing pipe connected with the suction end of the said pump, a vessel containing oil for supplying the said vaporizing pipe therewith, means for heating part of the said vaporizing pipe to vaporize the oil supplied from the said vessel, and a connection between the said pump and the said vessel to supply the latter with air to force the oil through the said vaporizing pipe, substantially as shown and described.

4. In a gas engine, the combination with a vapor pump, of a vaporizing pipe connected with the suction end of the said pump, a vessel containing oil for supplying the said vaporizing pipe therewith, means for heating part of the said vaporizing pipe to vaporize the oil supplied from the said vessel, a connection between the said pump and the said vessel to supply the latter with air to force the oil through the said vaporizing pipe, and a float valve for disconnecting the said vaporizing pipe and vessel at the time the latter empties of the oil, substantially as shown and described.

5. In a gas engine, the combination with a vessel adapted to contain oil, of a vaporizing pipe connected with the said vessel, and a water jacket surrounding the said vaporizing pipe near its connection with the said vessel to prevent heating of the oil in the vessel, substantially as shown and described.

6. A gas engine, provided with a vaporizer comprising a continuous closed pipe surrounded for most of its length by the exhaust from the engine, and arranged to permit the free flow of the oil from and to the oil storing vessel, the said pipe being supplied with oil as vapor is withdrawn therefrom, substantially as shown and described.

7. A gas engine, provided with a vaporizer comprising a continuous closed pipe surrounded for most of its length by the exhaust from the engine, and arranged to permit the free flow of the oil from and to the oil storing vessel, the said pipe being supplied with oil as vapor is withdrawn therefrom, and a device, substantially as described, for heating part of the said pipe to change the oil into vapor, as set forth.

8. A gas engine provided with a vapor pump, comprising a cylinder connected with a gas supply at one end, a plunger reciprocating in the said cylinder to draw in the gas and compress the same, an air chest arranged on the said cylinder and connected with an air supply, and provided with an air inlet valve and an air discharge valve, so that the said plunger draws in air and discharges the same at the time it draws in gas and compresses the same, substantially as shown and described.

9. A gas engine, provided with an ignition device comprising two electrodes that are normally stationary when the engine is in operation, and spaced so as to produce a spark between them when an electric current of sufficient potential is sent through them, stems carrying the said electrodes and projecting to the outside of the engine, the stems being journaled in the walls of the cylinder, and being movable with the electrodes for the purpose of adjusting the latter, and of occasionally bringing them into frictional contact to clean their adjacent surfaces, and thus insure the formation of the spark, the electrodes being adapted for electrical connection with a secondary coil, and a contact making device, separate from the said electrodes, adapted to be operated by one of the moving parts of the engine and to be connected with a primary coil, and a source of electrical energy, substantially as described.

10. In a gas engine, the combination with the main driving shaft, of two eccentrics held on the said shaft, a reversing link connected with the said two eccentrics, and a vapor pump having its plunger connected with the said reversing link, substantially as shown and described.

FRANK S. MEAD.

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