(No Model.) 3 Sheets—Sheet 1.

J. W. EISENHUTH.

EXPANSION GAS ENGINE.

No. 574,311. Patented Dec. 29, 1896.

Fig. 1.

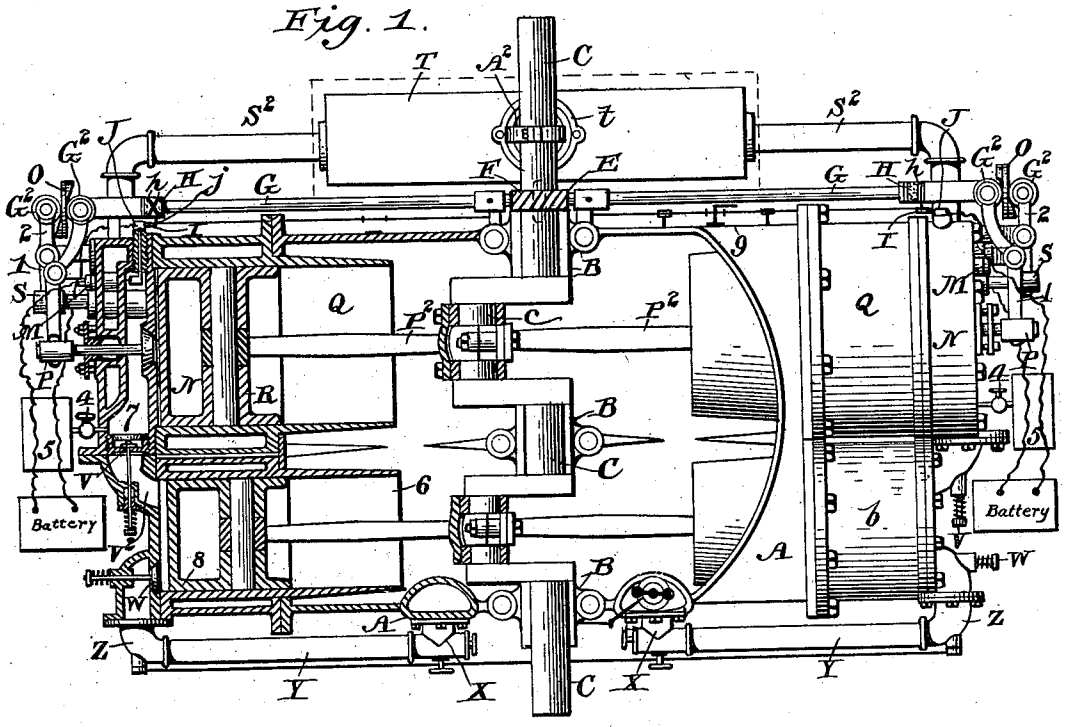
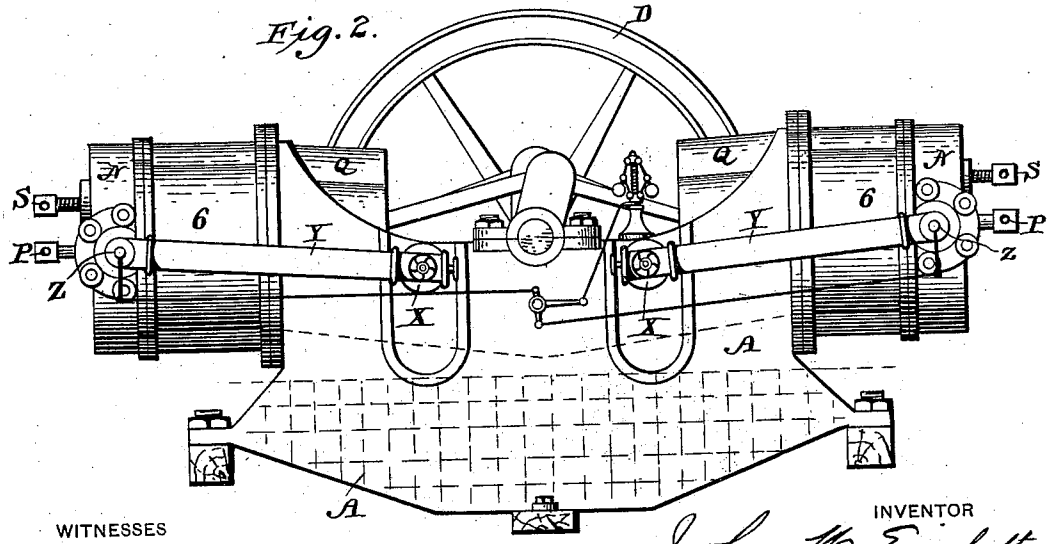


Fig. 2.



WITNESSES

Geo. Reverance.

N. S. Hockman.

INVENTOR

John W. Eisenhuth

by his Attys

Wilson Fenwick Reverance

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

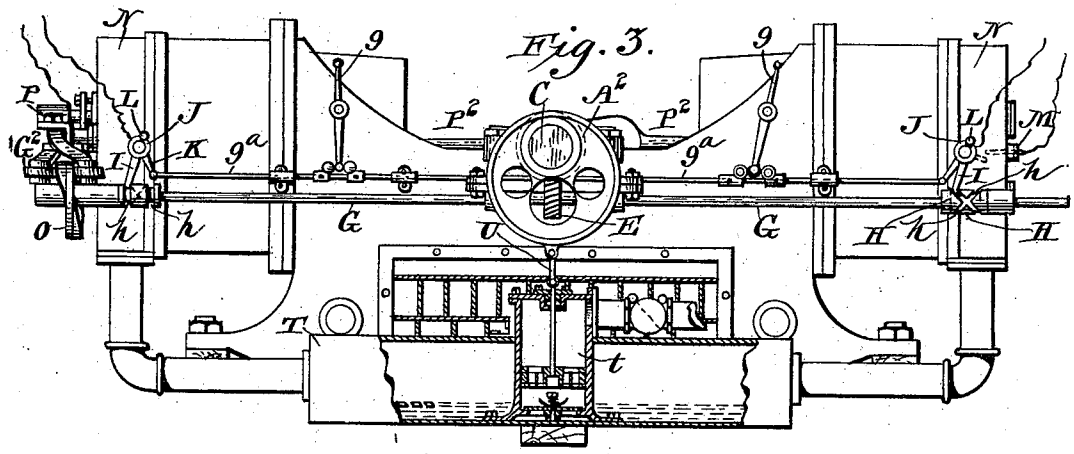


Fig. 5.

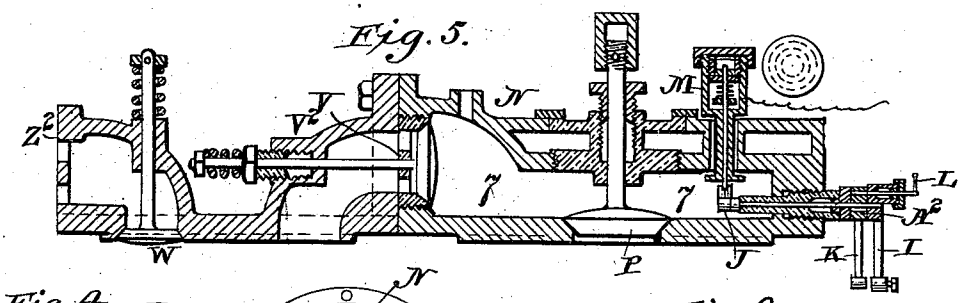


Fig. 4.

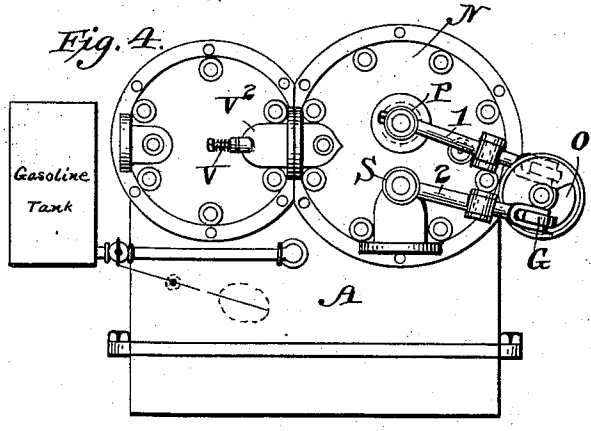


Fig. 6.

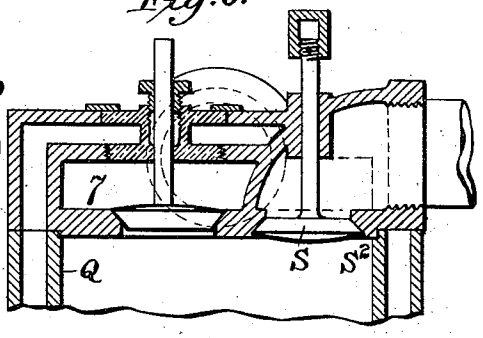


Fig. 7.

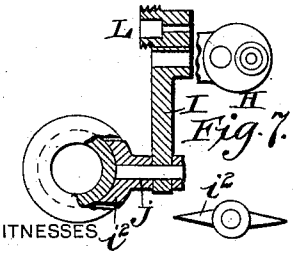


Fig. 8.

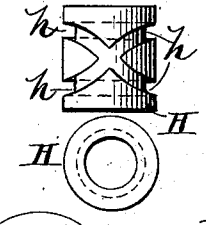


Fig. 11

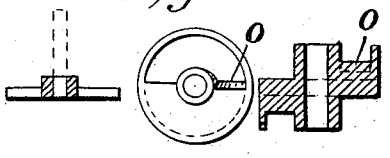
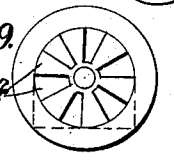


Fig. 10.

Fig. 9.



WITNESSES

Geverance

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J. W. EISENHUTH.

EXPANSION GAS ENGINE.

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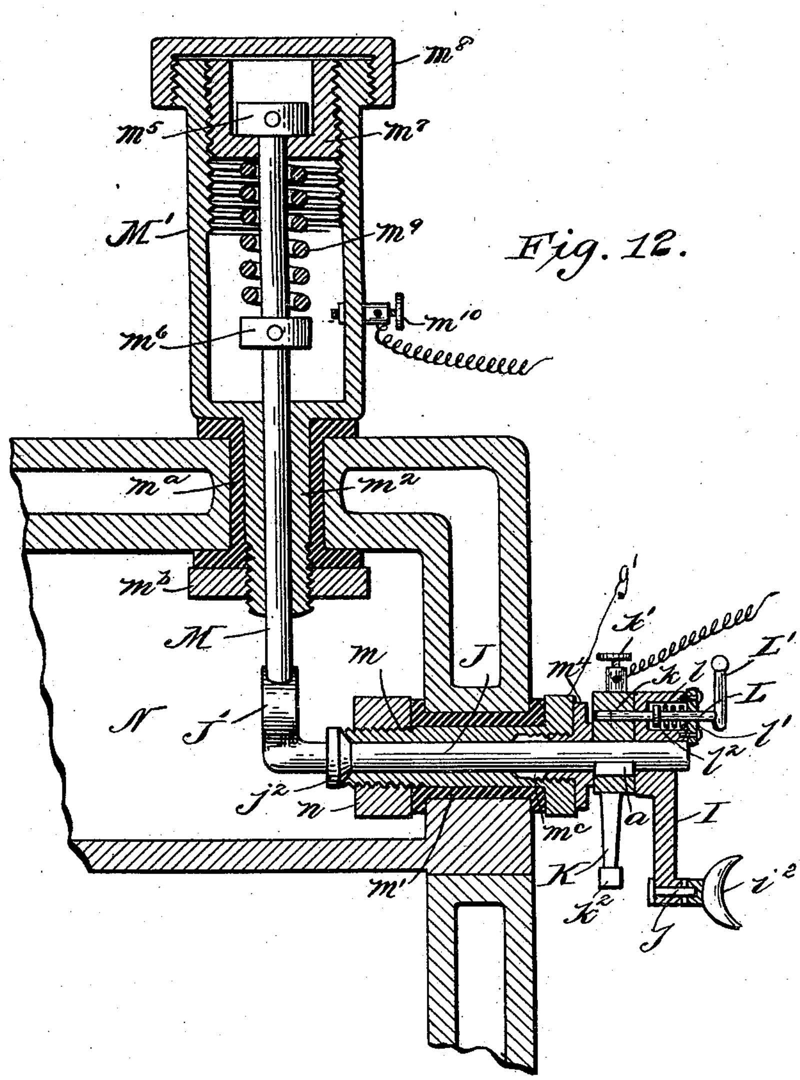

Fig. 12.

WITNESSES

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Mason Fenwick & Lawrence

UNITED STATES PATENT OFFICE.

JOHN WASHINGTON EISENHUTH, OF SAN FRANCISCO, CALIFORNIA.

EXPANSION GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 574,311, dated December 29, 1896.

Application filed October 5, 1893. Renewed May 7, 1896. Serial No. 590,630. (No model.)

To all whom it may concern:

Be it known that I, JOHN WASHINGTON EISENHUTH, a citizen of the United States, residing at San Francisco, State of California, have invented a new and useful Expansion Gas-Engine, of which the following is a specification.

My invention relates to improvements in expansion gas-engines, and has particular relation to that class of engines in which the accumulated gases are exploded, thereby producing the power for operating the engine.

The invention consists of the combination, with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, a measuring-cylinder connected to said chamber, a gas-supply connected to said latter cylinder, means for operating the measuring-cylinder to force its contents into the compression-chamber, and sparking devices mounted in the compression-chamber.

It also consists of the combination, with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, a condenser connected to said cylinder, a measuring-cylinder connected to said chamber, a carbureter connected to said measuring-cylinder, means for operating the measuring-cylinder to force its contents into the compression-chamber, and electrodes mounted in the compression-chamber for producing a spark therein.

It also consists of certain other novel constructions, combinations, and arrangements of parts, all of which will be hereinafter more particularly set forth and claimed.

The objects of my invention are, first, to provide an expansion electric-ignition gas-engine that will work the gases expansively and utilize the advantages of the atmospheric pressure in conjunction with a vacuum held in a condenser; second, to furnish reliable electric-ignition devices for the ignition of the gases in the valve-controlled receiving gas-chambers; third, to furnish a gas-engine that will start immediately by producing in the valve-controlled receiving gas-chamber an explosion of the gases compressed therein by producing an electric spark on the electrodes in said chamber by hand-operated means; fourth, to furnish means for generating gas from gasolene in a carbureter and feeding said gas in predetermined quantities to a compression-chamber, in which it is exploded by a sparking device, and, fifth, to furnish the necessary means to supply the valve-controlled receiving gas-chamber with the proper mixture of air and gas necessary to start the engine after it has been standing idle any length of time without having to first run the engine. I attain these objects by the devices illustrated in the accompanying drawings, forming part of this specification, and in which—

Figure 1 is a plan and part sectional view of my expansion gas-engine. Fig. 2 is a side elevation of the engine and base with the governor in place, showing the connections from the governor to the gas-supply-controlling valves on the cylinder-heads of the engine. Fig. 3 is a side elevation of the engine, showing the hand-operated devices for causing the electrodes to spark when starting the engine, and also the carbureter, as constructed in the base of the engine, and a sectional view of the condenser and air-pump and the connection of said air-pump to the engine. Fig. 4 is an end elevation of the base of the engine, the valve-controlled receiving gas-chamber, and cylinders, showing the valves and levers which operate the inlet and exhaust valves in conjunction with a double-faced cam-wheel. Fig. 5 is a horizontal section through the cylinder-heads and the valve-controlled receiving gas-chamber with the electric-ignition devices in place. Fig. 6 is a detail central vertical section of the valve-controlled gas-receiving chamber, showing the inlet-valve to the expansion-cylinder and the exhaust-valve from the same. Fig. 7 is a detail section view of the oscillating electrode-lever and the insulated piece that engages the frog cam-switch. Fig. 8 represents a side elevation and plan view of the frog cam-switch, showing the grooves therein. Fig. 9 is a plan view of the valve-seat on which works the gas-regulating valve. Fig. 10 is a plan view of said gas-regulating valve. Fig. 11 represents a central vertical section and top plan view of the double-faced cam-wheel that operates the valve-controlling levers;

and Fig. 12 represents a detail sectional view, partly in elevation, of the electrodes and insulating-supports therefor.

A in the drawings represents the base of the machine, and this base forms the casing for a carbureter and is provided with bearings or journal-supports B B. A crank-shaft C is mounted in said bearings and is provided with a fly-wheel D and a gear-wheel E, which latter meshes with a gear-wheel F, mounted upon a shaft G, that carries at each end a cross-grooved frog-switch H. Engaging the cross-grooves $h\,h$ of said frog-switch is an insulated segmental block i^2, which is attached to a lever I by an insulating-pin j. The lever I works loosely upon an electrode J, except when it engages a lever K through the agency of a spring-controlled pin L in the boss of the lever I. The spring l that controls said pin is mounted in a recess in the boss of the lever I and is confined therein by a screw-cap l', the inner end of said spring bearing against a collar l^2, rigidly secured to the said pin L. This pin is provided with a handle L', by which it can be withdrawn to disengage it from a recess k in lever K, said pin normally engaging said recess by the action of the coil-spring, which forces said pin inward.

The lever K is keyed to the electrode J by a key a and is provided on its extended boss with a binding-post k', to which one of the wires of an electric circuit is attached. (See Fig. 12.) The lower end of the lever K is provided with an apertured sleeve k^2, the use of which will be hereinafter set forth.

The electrode J is loosely mounted in a headed sleeve m, which passes through an insulating-sleeve m' in the wall of the chamber N and is secured by a nut n engaging its screw-threaded end. The forward end of the sleeve m is centrally recessed at m^c to form a packing-receiving chamber having an inclined or conical bottom, its inner wall near its outer end being screw-threaded. The packing is secured in said recess by the screw-threaded gland m^4, which engages the screw-threads upon the walls of the recess m^c and is provided with a conically-recessed bottom. The action of said gland and the conical bottom of the recess, when the gland is tightened, is to force the packing closely about the electrode J and prevent any of the gas or air from escaping from the chamber N. The electrode J is provided with a collar j^2, which is adapted to bear against the inner end of the sleeve m, and thus prevent the electrode from slipping longitudinally in said sleeve. The outer end of the electrode J is provided with a contacting finger or arm J', which is adapted to engage the end of the electrode M, which is also mounted in the wall of the chamber N. This electrode is movably mounted in a hollow stem m^2 of an electrode-casing M', said stem passing through an insulating-sleeve m^a, which is rigidly mounted in the wall of the chamber N. The lower end of the stem m^2 is screw-threaded and is provided with a securing-nut m^b. The upper end of said electrode is provided with two separated collars m^5 m^6, respectively, rigidly secured thereto. The upper end of the casing M' is open, and both the interior and exterior are screw-threaded, the threads of the interior to engage a hollow screw-threaded nut m^7 and the threads of the exterior to engage a screw-cap m^8, which closes the top of the casing. The electrode M passes through the hollow nut m^7, with the collar m^5 in said nut and the collar m^6 below said nut. A spiral spring m^9 is interposed between the collar m^6 and the bottom of the nut m^7, so as to hold the electrode M normally down, so that it will be engaged by the arm of the electrode J when the latter is oscillated. The electrode M rises to allow the arm of the electrode J to snap by when said electrode J is oscillated, and then descends again to its normal position by the action of the spiral spring. A binding-post m^{10} is provided on the side of the casing M', so that one of the wires of an electric circuit may be attached thereto. By means of the cap m^8 the chamber for the electrode M is made air-tight, so that none of the gases can escape from the chamber N through said electrode-chamber.

When the lever K is engaged by the spring-controlled pin L in the boss of the lever I, an oscillating movement is obtained through the revolving of the grooved frog-switch H, thereby producing the electric spark by bringing the electrode J in contact with the electrode M.

Double-faced disk cams O are keyed to the shaft G and operate pivoted levers 1 and 2, which are provided with antifriction-rollers G^2, that bear upon the cam-faces of said disks. Lever 1 is connected to and operates an inlet-valve P, through which passes the working pressure from the valve-controlled receiving gas-chamber N into cylinders Q, thereby operating pistons R, which impart the working power through pitman-rods P^2 to the cranks c of the crank-shaft C. Both the cylinders and the compression-chamber are surrounded by hollow walls forming water-jackets to prevent the said walls from becoming heated and prematurely exploding the gases.

The lever 2 operates the exhaust-valves S S, which exhaust the spent gases into the pipes S^2 S^2, and through them into the vacuum held in the condenser T, which vacuum is produced by and through the operation of an air-pump t, connected to said condenser and operated by an eccentric A^2, mounted on the crank-shaft and connected to the piston of the pump by a pitman-rod U.

A spring-controlled valve V admits the mixture of gas and air into the chamber N from a measuring-cylinder 6.

A storage-tank 5 communicates with the compression-chamber N through a pipe provided with a regulating-cock 4. This tank is stored with a gas, so that after the machine has been idle for some time a sufficient quan-

tity of gas may be admitted to the chamber N to start the engine.

The valves X X control the flow of the gas that is taken out of the carbureter in frame A, mixed with air and passed through pipes Y Y into and through the governor-regulating valves S^a S^a, the spring-controlled valves W, into the measuring-cylinders 6. The gas is then forced by the pistons 8 through the valves V into the valve-controlled gas-receiving chamber N, where it is ignited by the electric sparks produced by the electrodes J and M, thus causing the expansion of the gases to run the engine, which gases are admitted to the expansion-cylinders through the valves P and exhausted after doing the work through the exhaust-valves S. The valves S^a are seated in valve-seats Z^2 and are connected to the governor by suitable rods and levers, so that they may be opened or closed by the same and thus lessen or increase the flow of the gas through the valve W. The levers K are adapted to be actuated by hand by means of pivoted hand-levers 9, which are connected to and adapted to operate longitudinally-sliding rods 9^a, which latter are connected to the ends K^2 of the levers K, and when starting the engine it is simply necessary to pull out the pins L, which disconnects the levers K from the levers I and oscillates the levers 9, which will cause the electrodes to spark in the gas-charged chamber N, and thus cause an explosion of said gases.

The two sides of my machine are exact duplicates of each other and each works in exactly the same manner, with the exception that when the power-cylinder of one side is working the cylinder of the opposite side is forcing the spent gases into the condenser, or rather the vacuum in said condenser is drawing the spent gases from the cylinder, so as to leave it free for the next explosion.

What I claim as my invention is—

1. In a gas-engine the combination, with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, a measuring-cylinder connected to said chamber, a gas-supply connected to said latter cylinder, means for operating the measuring-cylinder to force its contents into the compression-chamber, electrodes mounted in the compression-chamber, and a cross-grooved frog-switch connected to the moving parts of the engine and adapted to oscillate one of the said electrodes against and past the other to produce an electric spark, substantially as described.

2. In a gas-engine the combination, with a suitable base, of an operating-cylinder, valves for the same, pivoted levers for operating said valves, a double-faced cam connected to the moving parts of the engine for operating said levers, a valve-controlled compression-chamber connected to the operating-cylinder, means for supplying gas in predetermined quantities to said compression-chamber, and electrodes mounted in the said chamber for producing a spark therein, substantially as described.

3. In a gas-engine the combination with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, means for supplying gas to said chamber, a longitudinally-moving electrode projecting into said chamber, a spring restraining the movements of the same, an oscillating electrode connected to the movable parts of the machine and adapted to engage, elevate and snap by the spring-restrained electrode to produce a spark, substantially as described.

4. In a gas-engine the combination with a suitable base of an operating-cylinder, a valve-controlled compression-chamber connected to the same, a measuring-cylinder connected to said chamber, a gas-supply to said latter cylinder, an independent gas-supply to the compression-chamber, electrodes movably mounted in the walls of the compression-chamber, means for operating one of the electrodes by hand and means for connecting one of the electrodes with the moving parts of the engine whereby said electrode is oscillated to produce a sparking in the compression-chamber, substantially as described.

5. In a gas-engine the combination with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, means for supplying gas to said chamber, electrodes mounted in said chamber for producing a spark therein, an operating-lever keyed to one of said electrodes, a hand-operated lever connected to said keyed lever, an operating-lever loosely mounted on said electrode, means for connecting said operating-lever and said keyed lever at will and means for connecting the operating-lever with the moving parts of the engine, substantially as described.

6. In a gas-engine the combination, with a suitable base, of an operating-cylinder, valves for the same, pivoted levers for operating said valves, a double-faced cam connected to the moving parts of the engine and operating said levers, a valve-controlled compression-chamber connected to the operating-cylinder, a condenser also connected to said cylinder, a measuring-cylinder connected to said compression-chamber, a carbureter connected to said measuring-cylinder, means for operating the measuring-cylinder and electrodes mounted in the compression-chamber for producing a spark therein, substantially as described.

7. In a gas-engine the combination with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, a condenser connected to said cylinder, a pump for creating a vacuum in said condenser, a measuring-cylinder connected to said chamber, means connecting the measuring-cylinder with the moving parts of the engine, electrodes for producing a spark in the compression-chamber, means for oper-

ating said electrodes by hand, means for connecting said electrodes to the moving parts of the engine, and a gas-supply to the measuring-cylinder, substantially as described.

8. In a gas-engine, the combination with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, means for supplying gas to said chamber in predetermined quantities, electrodes mounted in the walls of said compression-chamber, means for oscillating one of said electrodes by hand and means connecting said electrode to the moving parts of the engine whereby it is oscillated upon the movement of the same, substantially as described.

9. In a gas-engine, the combination with a suitable base, of a crank-shaft mounted thereon, operating-cylinders having their pistons connected to said crank-shaft so as to alternately operate the same, valve-controlled compression-chambers connected respectively to said cylinders, a condenser connected to said operating-cylinders, a pump operated by the crank-shaft for creating a vacuum in said condenser, measuring-cylinders connected to the respective compression-chambers and having their pistons connected to the crank-shaft, a carbureter connected to said measuring-cylinders, governor-controlled valves for regulating the supply from said carbureter to said measuring-cylinders and electric devices for producing a spark in the compression-chambers, substantially as described.

10. In a gas-engine, the combination with a suitable base, of an operating-cylinder, a valve-controlled compression-chamber connected to the same, means for supplying gas to said chamber in predetermined quantities, electrodes mounted in said compression-chamber, means for oscillating one of said electrodes during one-half of the revolution of the engine; said means permitting the electrode to remain stationary during the remainder of the revolution, substantially as described.

JOHN WASHINGTON EISENHUTH.

Witnesses:
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LEE D. CRAIG.