(No Model.) 2 Sheets—Sheet 1.

C. SINTZ.

GAS ENGINE.

No. 509,255. Patented Nov. 21, 1893.

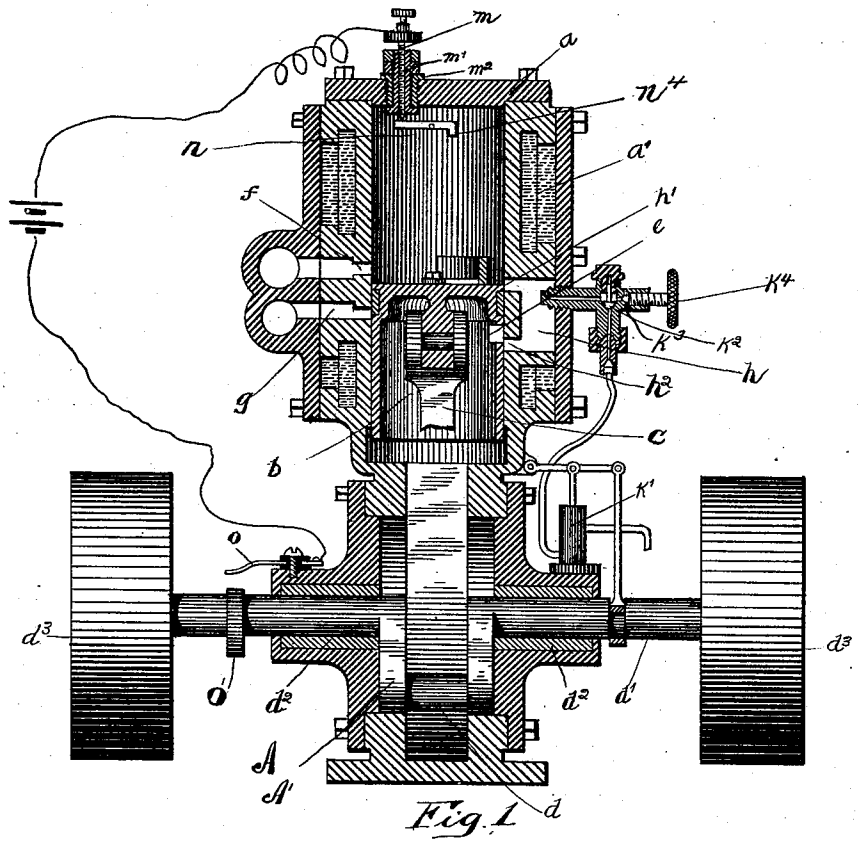

Fig. 1

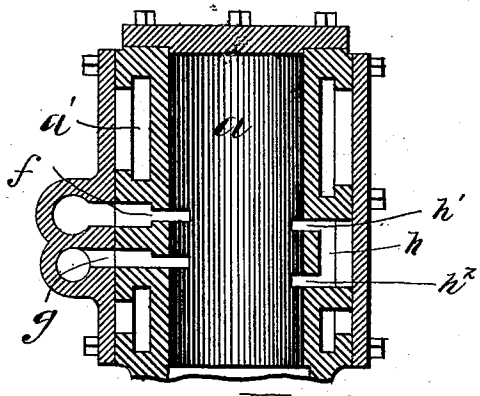

Fig. 2

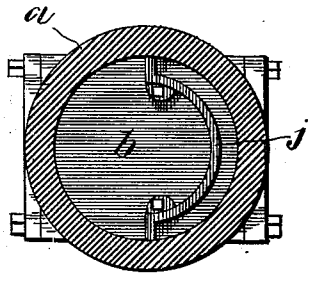

Fig. 3

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Frank Watt

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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

C. SINTZ.

GAS ENGINE.

No. 509,255. Patented Nov. 21, 1893.

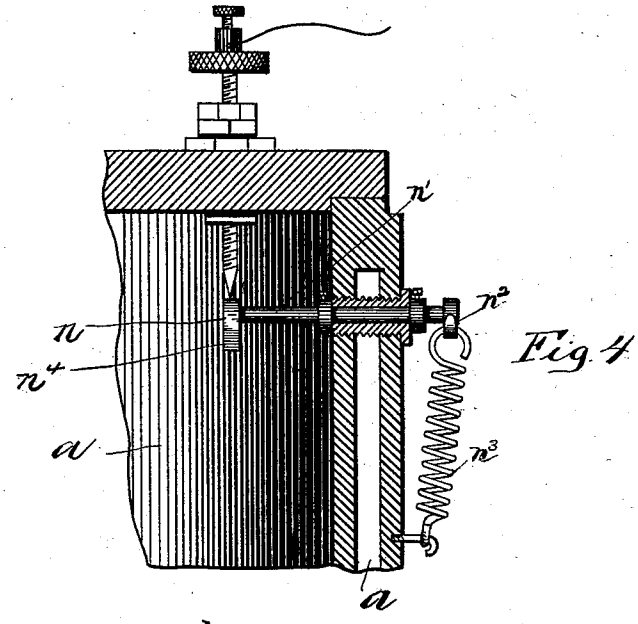

Fig. 4

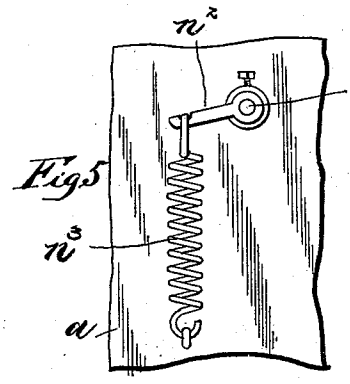

Fig. 5

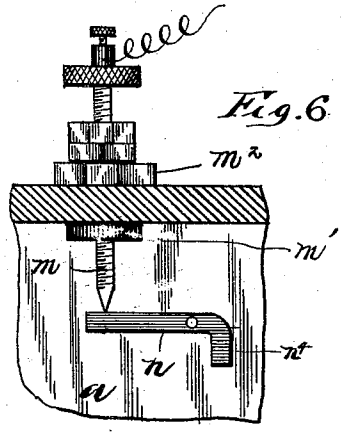

Fig. 6

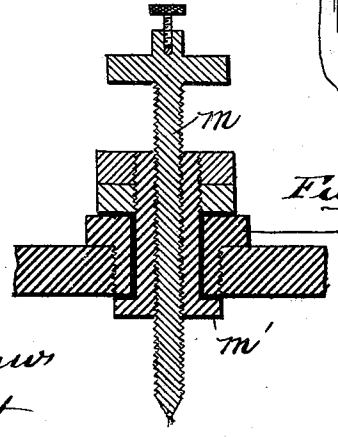

Fig. 7

WITNESSES:

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UNITED STATES PATENT OFFICE.

CLARK SINTZ, OF SPRINGFIELD, OHIO.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 509,255, dated November 21, 1893.

Application filed October 27, 1892. Serial No. 450,095. (No model.)

To all whom it may concern:

Be it known that I, CLARK SINTZ, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to gas engines, and the object of my invention is to provide a gas engine in which a high speed may be attained and maintained.

A further object of my invention is to provide means whereby an explosion may be secured at each piston stroke.

A further object of my invention is to provide a novel arrangement of the supply and exhaust ports in connection with the piston, whereby a substantially valveless engine is secured.

A further object of my invention is to provide a novel arrangement in the construction of the exploder or ignitor.

I attain these objects by the constructions shown in the accompanying drawings, in which—

Figure 1 is a sectional elevation view of an engine embodying my invention. Fig. 2 is a longitudinal sectional view of the engine cylinder. Fig. 3 is a transverse section of the same, showing the interior thereof and the top of the piston. Fig. 4 is a longitudinal sectional view of a portion of the cylinder, showing the arrangement of the ignitor. Figs. 5 to 7 inclusive, are detail views of the same.

Like parts are represented by similar letters of reference in the several views.

In the said drawings *a*, represents the cylinder, which is provided with an annular water-chamber surrounding the same, in the usual way; *b*, is the piston arranged therein, and connected by a pitman *c*, to the crank *d*, on the main shaft *d'*, which shaft preferably extends through the lower portion of the main frame which supports the cylinder and turns in suitable bearings d^2, therein; said shaft being supplied with suitable fly or driving-wheels d^3. The piston *b*, is made of considerable length and chambered out so that the pitman *c*, is connected thereto near the upper end or head thereof. Extending through the walls of the piston thus formed is an opening or port *e*.

Arranged in the side of the cylinder and opposite to the port *e*, of the piston, are exhaust and supply ports *f*, *g*, which ports are opened and closed successively and are never open to the cylinder at the same time, one or the other being constantly closed by the piston *b*; the exhaust port *f*, being adapted to open into the upper part of the cylinder just before the piston reaches the limit of its downward stroke, the supply port *g*, being adapted to communicate with the lower portion of the cylinder when the piston reaches the limit of its upward stroke. On the opposite side of the cylinder is a chamber *h*, formed in the walls of the cylinder, which communicates with the interior of the cylinder through ports *h'* h^2 (which I will designate as the direct and indirect supply ports.) The port *h'*, is adapted to communicate with the upper end of the cylinder and above the piston, as the piston reaches the limit of its downward stroke, while the port *e*, which opens directly to the explosive chamber through the walls of the piston, communicates with the port h^2, at the same time, and thus establishes a communication from the lower end of the cylinder to the upper end of the cylinder through the chamber *h*, as the piston reaches the limit of its downward stroke.

The base of the engine A, which forms the main frame and supports the cylinder is preferably formed with a chamber A', which incloses the crank *d*, and which is completely closed by side plates which support the bearings d^2. This chamber A', preferably communicates directly with the lower end of the cylinder which is left open for this purpose.

Arranged on the top of the piston is a curved deflector *j*, which extends about half way around the said piston, concentric with the periphery of the piston and a slight distance therefrom, said deflector being turned outwardly at each end to form radial projections which approach in close proximity to the inner walls of the cylinder. This deflector stands opposite the port *h'*, when said port is opened by the downward movement of the piston, and serves to deflect the air and gases admitted through said port to the cyl-

inder, and causes them to rise upwardly and circulate around the top and sides of the cylinder when so admitted, in the manner hereinafter more fully described.

I have shown this engine especially arranged for use with gasoline which is mixed with the air to form the explosive mixture. It is obvious, however, that it may be used with any suitable gas or liquid which will secure the desired result by slightly modifying the construction and regulating the supply and introduction of the material forming the basis of the explosive mixture.

At one side of the cylinder and extending into the chamber h, is a supply valve k, through which the gasoline is supplied from a pump k', which may be operated from any suitable connection with the running parts of the engine. This supply or gasoline valve k, is provided with a check k^2, which permits the passage of the gasoline into the chamber h, but prevents any backward flow therefrom; it is also preferably provided with an outlet opening k^3, controlled by a valve k^4, by which the presence of the gasoline within the supply valve may be determined. From the check k^2, the gasoline passes directly into the chamber h, through a passage which is preferably inclined at the outer end, to give an upward and outward discharge to the gasoline in the direction of the port h'.

The operation of the device as thus described is as follows: The piston being at the limit of its downward stroke, with the supply port g thus closed by said piston, motion is imparted to the shaft which causes the piston to ascend, thus forming a partial vacuum in the lower end of the cylinder and in the chamber A', connected thereto. This continues until the lower end of the piston passes the port g, when the air immediately rushes in to supply the partial vacuum thus formed. As the shaft continues to revolve the piston descends, thus compressing the air in the lower end of said cylinder and in the chamber connected thereto until the port e, comes opposite the port h^2, which occurs simultaneously with the opening of the port h', by the upper end of the piston. The air from the lower end of the cylinder, owing to the slight pressure thereon, caused by the downward stroke of the piston, rushes through the respective ports h', h^2, in the chamber h, into the cylinder, carrying with it a supply of gasoline which is introduced through the supply valve at this point in the form of a spray and becomes thoroughly and intimately mixed and impregnated therewith. The port f, has, by the downward movement of the piston, been opened, furnishing an exit opening, but the deflector j, prevents a passage of the explosive mixture directly through the port f, and causes it to pass upward along the side of the cylinder to the top thereof, and, as the piston immediately begins its upward stroke, the exhaust port f, is closed, and the charge thus introduced is compressed by the upward movement of the piston. Arranged in the top of the cylinder is an electric ignitor or exploder, which consists essentially of an electrode m, preferably screw-threaded and adjustable through an insulated sleeve m', arranged within a suitable screw-threaded supporting casing m^2, which screws into the top of the cylinder. Arranged within the cylinder is an oscillating bar n, on the end of a rock-shaft n', which is supported in a suitable bearing in the side of the cylinder and is connected on the outside, through the medium of an arm n^2, to a spring n^3, this spring being so arranged that one extremity of the bar n, is held normally in contact with the electrode m. The opposite end of the bar n, is preferably provided with a lug or projection n^4, adapted, as the piston ascends, to come in contact with the top of said piston or with the deflector j, which is preferably employed in this instance for that purpose. This causes the bar n, to be withdrawn from the electrode and produces a spark at this point, just as the piston has reached the limit of its upward stroke, and just as the compression of the explosive charge has been completed. The result is: an explosion follows and the piston is driven downwardly until it passes the exhaust port f, when the products of combustion are discharged. This occurs just prior to the opening of the port h', by the piston, the lower end of the exhaust port f, being substantially on a line with the upper edge of the port h', so that the exhaust port is wide open at the time the supply port h', begins to open. The in-rushing charge, which, by the aid of the deflector is given the upward and circulating motion, described, assists in driving out the products of combustion through the exhaust ports, these ports being momentarily open at the same time.

In order to insure the rapid movement of the bar n, away from the electrode and thus the formation of the spark instantaneously, I preferably form the electric contact end of the bar n, considerably longer than the end which contacts with the piston, which causes it to move more rapidly than the shorter end. The electrode m, as before noted, is insulated from its supporting casing and thus from the other parts of the engine. The bar n, is not insulated so that the other electrical connection can be made to any of the metal portions of the engine. To provide for shutting off the battery, except just as it is required, and thus preventing its deterioration, I provide for automatically making and breaking the circuit before and after the spark is formed in the manner described. This I accomplish by connecting one pole of the battery to the electrode m, and the other to an insulated contact device o, secured in any suitable position to the engine and adapted to contact intermittently with one of the moving parts of the engine, so that a connection will be formed therewith just prior to the time that the spark is to be formed, the connection being broken as soon as the spark has

been formed. This may be accomplished as shown in Fig. 1, by a cam or eccentric *o'*, arranged on the main shaft and adapted to contact with the contact device, *o*, formed in the nature of a spring just before the spark is to be formed and to be withdrawn from contact therewith just after. The arrangement, however, can be modified, so that it may be applied to any portion of the engine and adapted to contact intermittently with any moving part.

It is obvious that the constructions herein described admit of various modifications which would readily suggest themselves to an ordinary mechanic. I do not, therefore, limit myself to the exact constructions shown and described but

I claim as my invention—

1. In a gas engine cylinder having supply and exhaust ports, and a moving piston in said cylinder adapted to alternately open said supply and exhaust ports to opposite ends of said cylinder, and a communicating chamber, adapted, by the movement of said piston, to be opened simultaneously to the opposite ends of said cylinder and thus form a communication from one end of the cylinder to the other, substantially as specified.

2. In a gas engine, a cylinder having supply and exhaust ports arranged near the center thereof and approximate to each other, and a piston adapted to normally close both of said ports, said piston being adapted to uncover one of said ports and cause it to communicate with one end of the cylinder, as it approaches the limit of its movement in one direction, and to uncover the other port and cause it to communicate with the opposite end of the cylinder, as it approaches the limit of its movement in the other direction, and a communicating chamber adapted to form a communication from one end of said cylinder to the other, as the piston reaches the limit of its movement in one direction, substantially as and for the purpose specified.

3. In a gas engine, a cylinder, a moving piston therein, supply and exhaust ports arranged on one side of said cylinder, a chamber *h*, on the opposite side, a port *h'* controlled by the piston communicating directly with the cylinder from said chamber, when the piston is at the limit of its downward stroke, an opening in the wall of the piston and a second port from said chamber *h* communicating with the opening in the wall of the piston when said piston is at the end of its downward stroke, whereby communication is made between the ends of the cylinder around the piston head, through the chamber *h*, substantially as described.

4. In a gas engine, the combination with the cylinder and the moving piston therein, of supply and exhaust ports arranged on one side of the cylinder, and the communicating chamber having ports on the opposite side of said cylinder, and an opening through the walls of said piston adapted to form a communication with said chamber, and thus establish a communication from one end of said cylinder to the other, the exhaust port being arranged slightly in advance of the port which opens through the cylinder to said communicating chamber, so that the exploding chamber is permitted to exhaust prior to the time the charge is admitted thereto, substantially as specified.

5. In a gas engine, an electric ignitor consisting essentially of an insulated electrode extending through the cylinder head, a rock-shaft arranged at right angles to said electrode extending through the cylinder walls and carrying on its inner end a rocking bar which is arranged within the cylinder and adapted to normally contact with the electrode, a projecting arm on said rock-shaft on the outside of said cylinder, and a spring extending from said arm to a stationary connection on the outside of said cylinder, so as to hold the rocking bar in contact with the electrode, said rocking bar being adapted to contact with the moving piston and break the contact with said electrode, substantially as specified.

6. In an explosive engine and in combination, a piston, and a cylinder having a direct supply and an exhaust port both arranged to be closed by the piston on its upward or compression stroke and to be opened by the piston at the limit of its power or downward stroke, the said ports being opened and closed successively by the movement of the piston, substantially as described.

7. In an explosive engine and in combination, a piston and a cylinder, an exhaust port in said cylinder opened by the piston before the limit of its downward or power stroke, an indirect supply port opened by the piston at the limit of its power stroke and a direct supply port connected with the indirect supply port leading to the opposite end of the cylinder, the said piston being arranged to close the exhaust and indirect supply ports successively at the beginning of its upward or compression stroke and to open the direct supply port only at the limit of its downward or power stroke, all substantially as described.

8. In combination in an explosive engine, a cylinder having an exhaust port and a direct supply port arranged to be opened successively by the piston at the end of its down or power stroke, communication between the direct supply port and the opposite end of the cylinder through an indirect supply port, and a piston having an opening arranged to form connections with the supply ports at the end of the power stroke, substantially as described.

9. In combination in an explosive engine, a cylinder having an exhaust port and direct supply port both arranged to be opened by the piston at the end of its down or power stroke, communication between the direct supply port in the cylinder below the limit of the upward or compression stroke, and a piston having an opening arranged to connect

with the direct supply port at the end of the power stroke, said piston in its movements covering and uncovering all the ports, substantially as described.

10. In combination in an explosive engine, a cylinder having an exhaust port and supply port, a direct supply port leading to a chamber which is also in connection with the interior of the cylinder, and with the gas or other explosive supply, and an indirect supply port having connections with said chamber, and a piston arranged to open and close said ports and to draw and force the supply, substantially as described.

In testimony whereof I have hereunto set my hand this 22d day of October, A. D. 1892.

CLARK SINTZ.

Witnesses:
ROBERT C. RODGERS,
FRANK WATT.