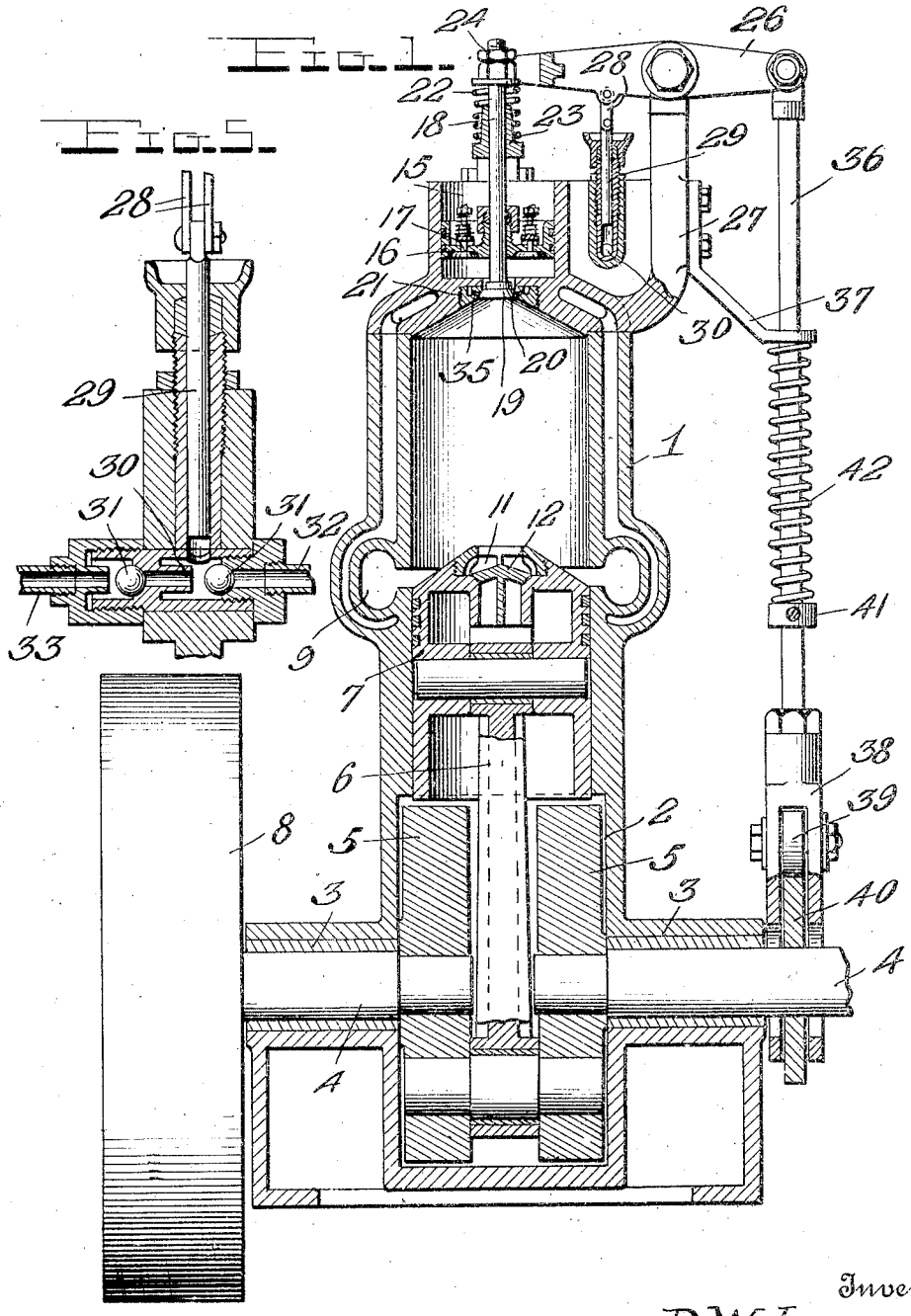
D. W. LYON.

GAS ENGINE.

APPLICATION FILED NOV. 17, 1909.

960,978. Patented June 7, 1910.

3 SHEETS—SHEET 1.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 2

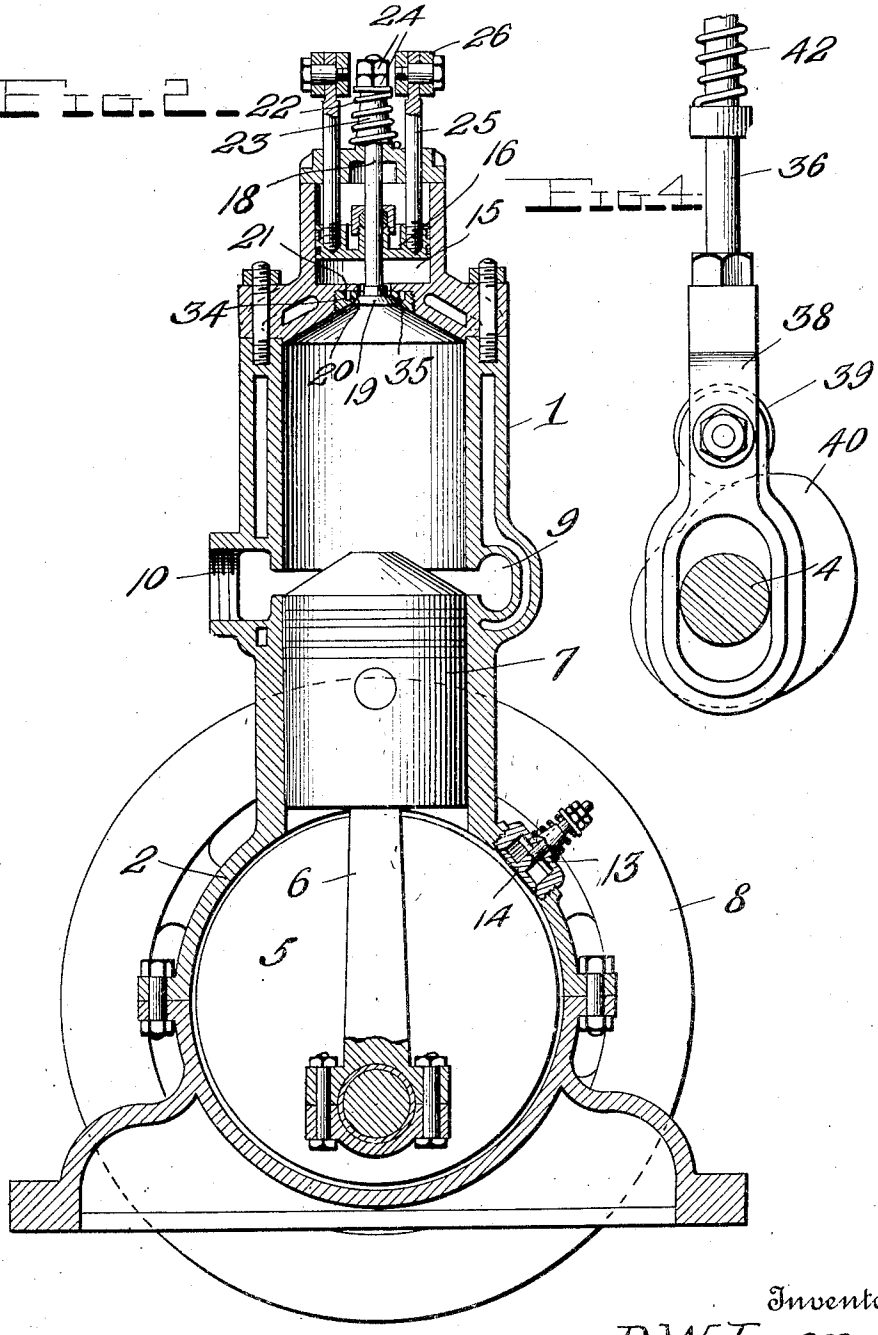

Fig. 4

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3 SHEETS—SHEET 3.

Fig. 2.

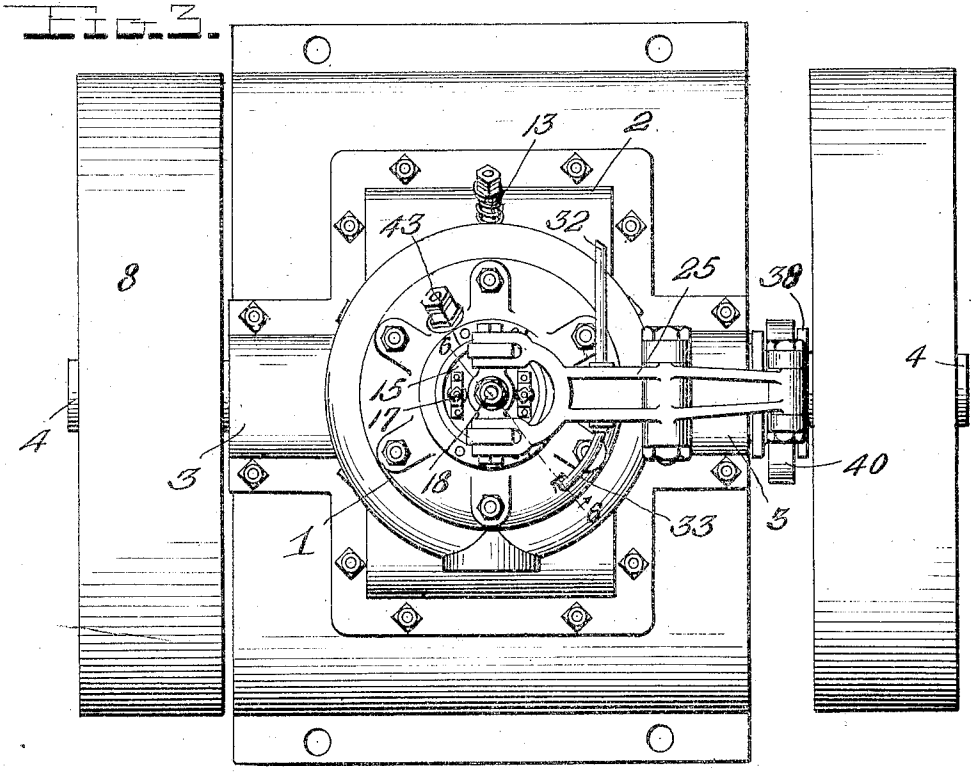
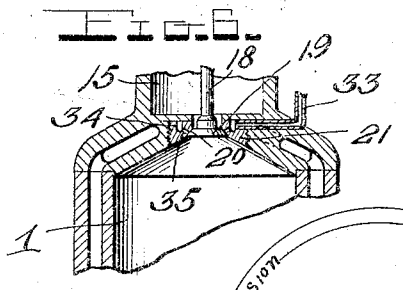
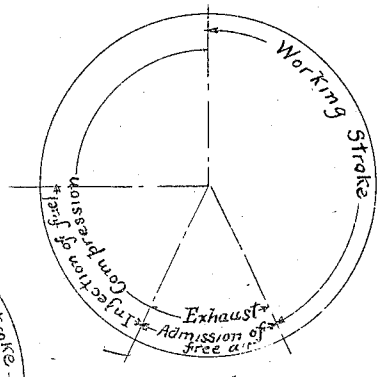


Fig. 6.

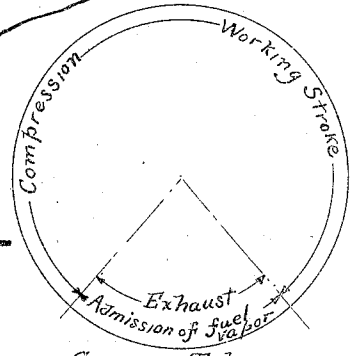




Economic

Fig. 8.

Fig. 7.



Witnesses

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Common Types

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UNITED STATES PATENT OFFICE.

DAVID WALTER LYON, OF ALAMEDA, CALIFORNIA.

GAS-ENGINE.

960,978. Specification of Letters Patent. Patented June 7, 1910.

Application filed November 17, 1909. Serial No. 528,543.

To all whom it may concern:

Be it known that I, DAVID W. LYON, a citizen of the United States, residing at Alameda, in the county of Alameda and State of California, have invented certain new and useful Improvements in Gas-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in gas-engines.

The object of the invention is to provide an engine of this character having an improved construction of fuel injecting mechanism whereby fuel is not admitted to the cylinder until after the exhaust passage has closed, thus preventing any waste of fuel.

With the foregoing and other objects in view, the invention consists of certain novel features of construction, combination and arrangement of parts, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a central vertical section of a gas engine constructed in accordance with the invention; Fig. 2 is a similar view, taken at right angles to Fig. 1; Fig. 3 is a top plan view; Fig. 4 is a detail side view of the cam operating mechanism for the fuel pump; Fig. 5 is a vertical sectional view of the fuel pump; Fig. 6 is a detail vertical sectional view on the line 6—6 of Fig. 3, showing the connection between the fuel pump and the fuel injecting plug; Figs. 7 and 8 are diagrams showing the comparison between the operation of my improved engine and that of the common form of gas engine.

Referring more particularly to the drawings, 1 denotes the cylinder of the engine. On the lower end of the cylinder, is arranged a closed air-tight crank chamber 2, on which are arranged bearings 3 in which is mounted the crank shaft 4 of the engine. The shaft 4 is preferably formed in two sections, on the inner ends of which, within the chamber 2, are mounted crank disks 5, to which is eccentrically connected the outer end of the piston rod 6, the opposite end of which is pivotally connected to the piston 7 which reciprocates in the cylinder 1 in the usual manner. On one end of the crank shaft 4 is mounted the usual pulley wheel 8.

The cylinder 1 is provided with an annular exhaust passage 9, with which is connected a discharge port 10, through which the burned gases are exhausted. The piston 7 is of hollow form and has in its inner end an air discharge passage 11 which is normally closed by a check valve 12 arranged therein, as shown. In one side of the crank chamber is formed an air inlet port 13 which is normally closed by a spring retracted valve 14. By thus constructing the crank chamber and piston and providing the air valves 12 and 14, air is drawn into the crank chamber through the inlet port 13 upon the up-stroke of the piston and is compressed in the chamber on the down-stroke and after being thus compressed to a certain degree, will open the check valve 11 and pass into the upper portion of the cylinder with sufficient velocity to strike the upper end of the cylinder and turn downwardly thus driving the burned gases out of the exhaust passage.

On the upper end of the cylinder is arranged an air compressing cylinder 15 in which is slidably mounted a piston 16 having arranged therein spring retracted check valves 17 which, upon the up-stroke of the piston, open and permit air to enter the cylinder, said air being compressed on the down-stroke of the piston. The piston 16 slides upon the stem 18 of a fuel injecting valve 19 which is engaged with a valve seat 20 formed in the fuel injecting plug 21 screwed in the upper end of the main cylinder 1, as shown. The valve 19 is normally held in closed position by means of a coil spring 22 arranged on a sleeve 23 on the upper portion of the cylinder 15. The upper end of the stem 18 of the valve 19 passes through the sleeve 23 and is provided on its upper end with nuts 24 between which and the base of the sleeve 23 is arranged the spring 22, whereby the pressure of said spring is exerted to normally hold the valve 19 in closed position.

The piston 16 is provided with two piston rods 25, which are connected at their upper ends to the bifurcated end of a rocker arm 26 pivotally mounted in bearing brackets 27 on the upper end of the main cylinder 1. The rocker arm is also operatively connected by a link 28 to the upper end of a piston 29 of a fuel pump 30 which is arranged on the upper end of the cylinder 1, as shown. The pump 30, is provided with oppositely working check valves 31 which operate au-

tomatically upon the movement of the piston 29 to draw in a charge of gasolene or other fuel. One end of the pump is connected to a gasolene supply pipe 32 which in turn is connected to a tank or other source of supply. The opposite end of the pump 30 is connected by a discharge pipe 33 to an annular fuel receiving passage 34 formed in the fuel injecting plug 21, as shown. In the plug 21 is formed a series of needle injecting passages 35, through which the gasolene or other fuel is injected into the cylinder 1 when the valve 19 opens under pressure of the air in the cylinder 15.

When the valve 19 is thus opened, the compressed air in the cylinder 15 rushes through the inlet opening into the injecting plug 21 and coming in contact with the gasolene discharging from the passages 35 thoroughly commingles with and vaporizes the gasolene and forms a rich gas which, upon entering the main cylinder 1, mixes with the free air in the cylinder in such proportion as to cause a perfect combustion when ignited by the sparking mechanism. The outer end of the rocker arm 26 is connected to an operating rod 36 which is slidably mounted in a guide bracket 37 and is connected at its lower end to a slotted yoke 38 which engages the adjacent end of the crank shaft 4. In the upper portion of the yoke 38, is revolubly mounted a bearing roller 39, with which is engaged a cam 40 fixedly mounted on the shaft 4, as shown.

On the operating rod 36, between the bracket 37 and a stop collar 41, is arranged a coiled retracting spring 42, the pressure of which is exerted to retract the operating rod after the same has been projected by the cam 40. By thus connecting the rocker arm 26 with the cam 40, said arm will be rocked and caused to operate the fuel pump 30 and to simultaneously compress the air in the cylinder 15. The cam 40 on the shaft 4 is so timed that the rocker arm will force the piston 16 to the point where the air in the cylinder 15 is compressed to a sufficient extent to force the valve 19 open and thus admit fuel to the main cylinder 1 after the piston 7 therein has moved upwardly far enough to close the exhaust passage so that none of the fuel, thus admitted, can escape through the exhaust passage. By this arrangement, the entire charge of fuel is retained and mixed with the free air which has been previously forced into the upper end of the cylinder 1 by the piston 7.

The engine is provided with the usual or any suitable sparking mechanism 43, whereby the charge of fuel in the main cylinder is ignited at the proper time.

From the foregoing description, taken in connection with the accompanying drawings, the construction and operation of the invention will be readily understood without requiring a more extended explanation.

Various changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention, as defined in the appended claims.

Having thus described my invention, what I claim is:

1. In a gas engine, a main cylinder having an exhaust passage, a piston slidably mounted therein, and adapted to open and close said exhaust pasage, an air tight crank chamber connected with said main cylinder, a valved piston arranged in said main cylinder and adapted to open and close the exhaust passage therein, an air compressing cylinder arranged on said main cylinder, a fuel inlet valve arranged between said air compressing and said main cylinders, a valved piston in said air compressing cylinder, a fuel injecting pump connected with the main cylinder, and means operated by the crank shaft of the engine to simultaneously operate said fuel pump and said air compressing piston, and timed to open the fuel inlet valve when the piston has closed the exhaust passage.

2. In a gas engine, a main cylinder having formed therein an annular exhaust passage, an air tight crank chamber connected to the lower end of said cylinder, an air inlet valve in said chamber, a piston in said main cylinder adapted to open and close the discharge passage therein, an air inlet valve in said piston whereby the air drawn into said chamber is forced into said main cylinder, and caused to drive the burned gases therefrom, an air compressing cylinder arranged on said main cylinder and communicating therewith, a fuel injecting plug arranged in the opening between said cylinders, a fuel inlet valve to open and close said opening, an air compressing piston in said air cylinder, a fuel pump communicating with said fuel injecting plug, a rocker arm connected with said piston and with said fuel pump, a spring retracted operating rod connected with said rocker arm, and a cam arranged on said crank shaft to project said operating rod at the proper time for simultaneously operating said fuel pump and piston whereby the fuel is admitted to the main cylinder through the fuel valve after the exhaust passage has been closed.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

DAVID WALTER LYON.

Witnesses:
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M. V. COLLINS.