No. 753,003. PATENTED FEB. 23, 1904.

A. G. RONAN.

GAS ENGINE.

APPLICATION FILED JAN. 24, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

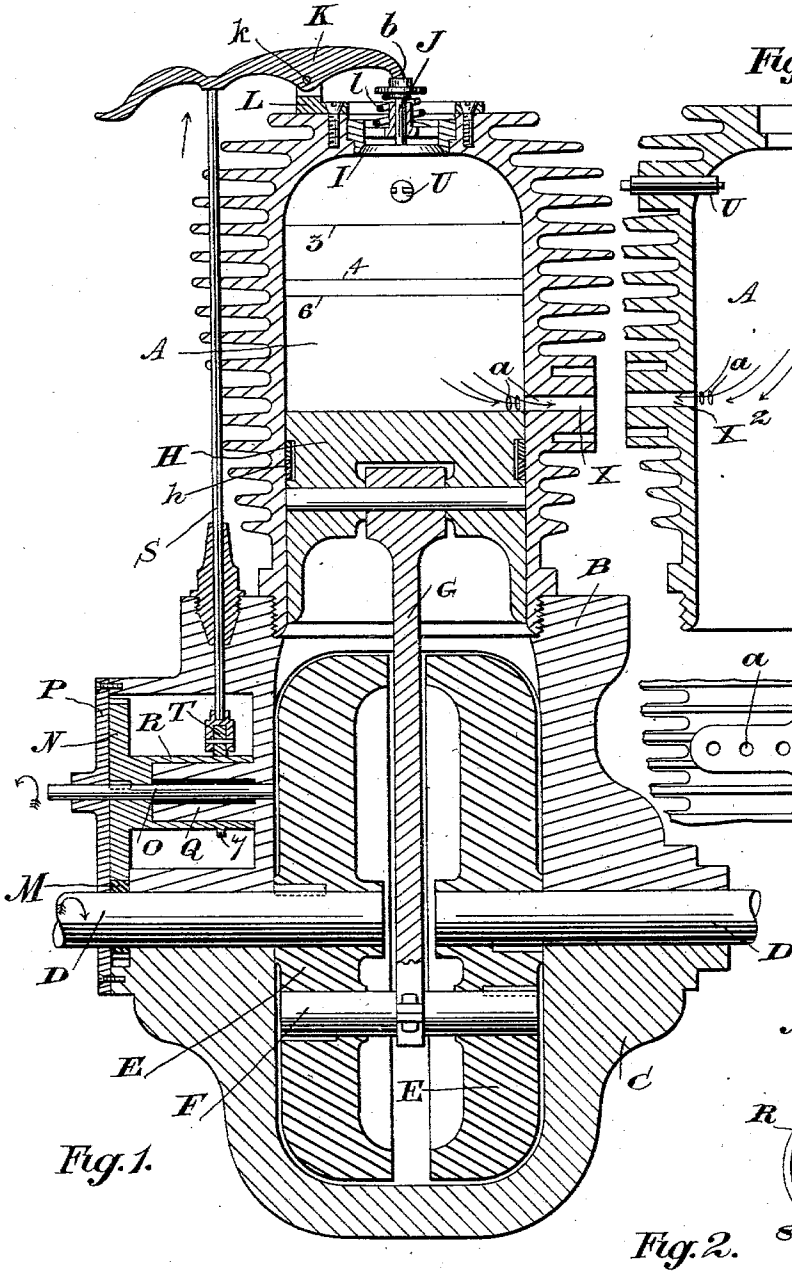

Fig. 1.

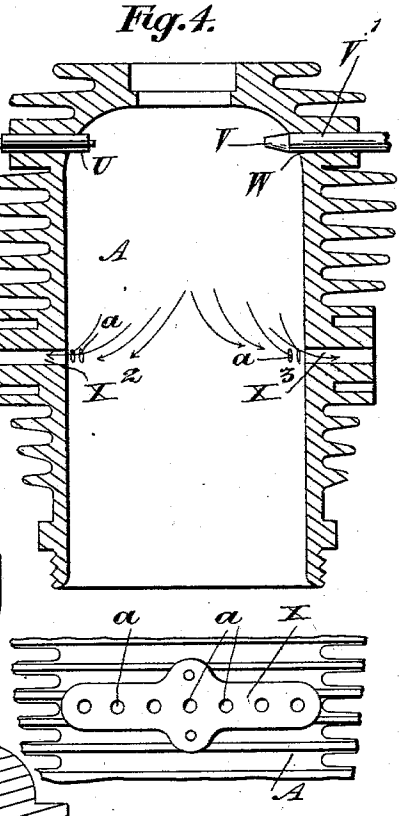

Fig. 4.

Fig. 3.

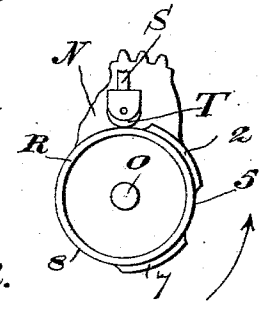

Fig. 2.

Witnesses.

W. B. Smith

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NO MODEL. 2 SHEETS—SHEET 2.

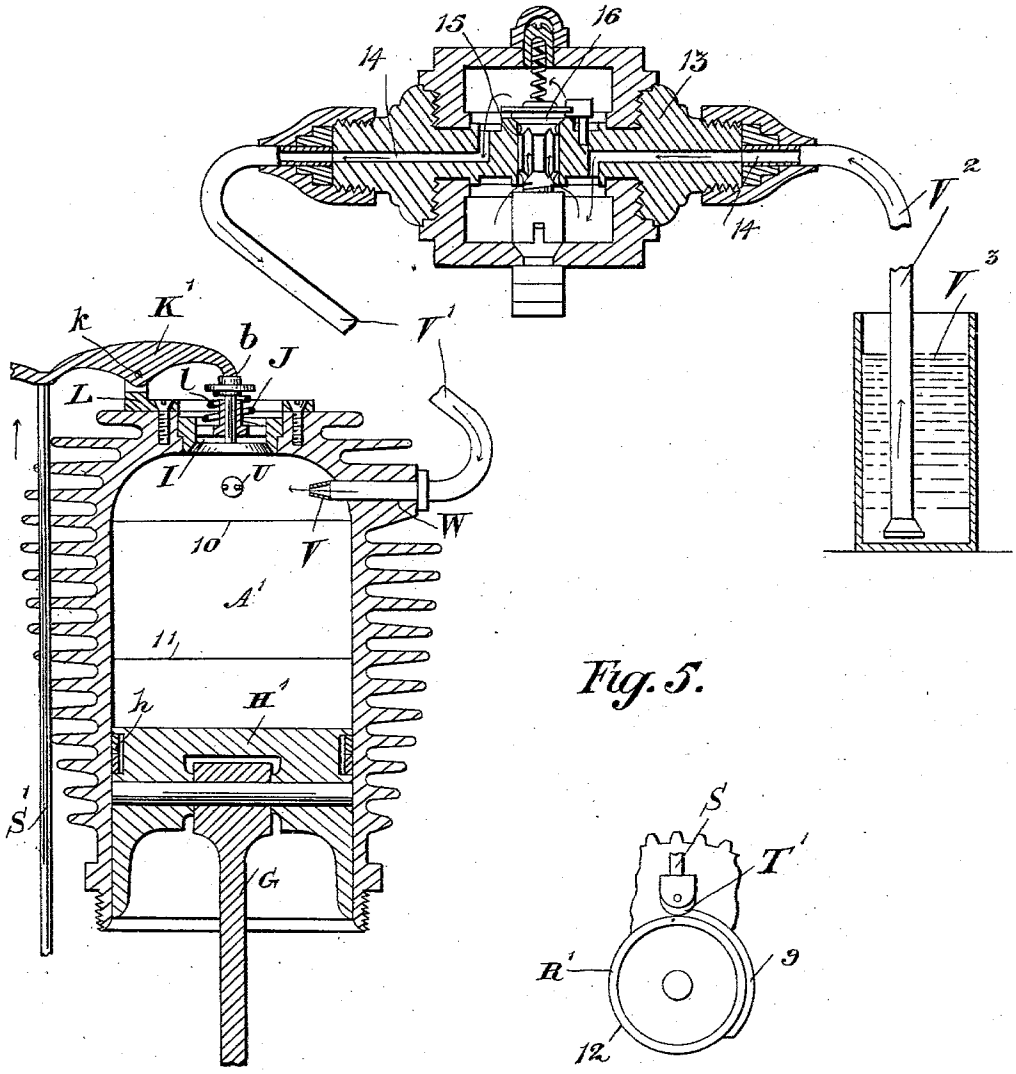

Fig. 5.

Fig. 6.

Witnesses.
W. H. Smith.
Alice Belcher

Inventor:
A. G. Ronan
by Egerton R. Case,
Atty.

No. 753,003. Patented February 23, 1904.

UNITED STATES PATENT OFFICE.

ANSON GROVES RONAN, OF TORONTO, CANADA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 753,003, dated February 23, 1904.

Application filed January 24, 1903. Serial No. 140,378. (No model.)

To all whom it may concern:

Be it known that I, ANSON GROVES RONAN, a subject of the King of Great Britain, residing in the city of Toronto, in the county of York and Province of Ontario, Canada, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to improvements in gas-engines; and the objects of my invention are, first, to remove as much as possible of the waste products of combustion from the explosion-chamber, so that the succeeding charges of the explosive mixture will be as free as possible of the spent gases, thus producing a powerful engine and one that can be easily and quickly started, and, secondly, to reduce the number of valves used in gas-engines; and it consists, essentially, of a suitable explosion-chamber provided with a valve controlling a port therefrom to the atmosphere and a separate opening for raw liquid fuel, means combined with said explosion-chamber for operating said valve so that same will perform one function of permitting the escape of waste products of combustion from the explosion-chamber and a further function of admitting pure air thereinto, and the further combination of elements, as hereinafter more particularly explained. I preferably make use of the piston-head to operate during its suction-stroke or portion thereof the measuring means containing the raw liquid fuel; but I lay claim to using any means for feeding said fuel to the engine.

Figure 1 is a vertical central section through the preferred form of explosion-chamber constructed after my invention, showing same attached to a suitable engine-casing provided with suitable power-transmitting parts. Fig. 2 is an enlarged detail view of the mechanism for operating the valve. Fig. 3 is a side view of a portion of the explosion-chamber, showing the form of main exhaust-port used in the preferred form of cylinder. Fig. 4 is a vertical central section through an alternative form of explosion-chamber. Fig. 5 is a vertical central section through another alternative form of explosion-chamber. This figure also shows a longitudinal section through the measuring device used and tank for same. Fig. 6 is an enlarged detail view of the mechanism for operating the valve in the explosion-chamber shown in Fig. 5.

In the drawing, like characters of reference indicate corresponding parts in each figure.

I preferably use an explosion-chamber the walls of which are constructed so as to be air-cooled; but it must be distinctly understood that I do not confine myself to any particular construction of explosion-chamber for cooling purposes. It will be understood from this that I may use a water-jacket, if desired; but I preferably use an explosion-chamber A, constructed of a single wall or shell, so that same may be air-cooled.

B is the upper portion of the engine-casing, to which the explosion-chamber is suitably secured, and C the lower portion of same.

D is the engine-shaft, the inner ends of which are keyed to the fly-wheels E, which by means of the pin F are secured to the piston-rod G, provided with the usual piston-head H. Preferably in the head of the explosion-chamber I construct an opening I and operate therein in order to open and close said opening a suitable valve J, preferably spring-controlled. This valve is mechanically operated by any suitable means, such as a lever K, (and other parts hereinafter described,) pivoted at *k* to a suitable plate L, which is suitably secured to the head of the explosion-chamber. Keyed to the shaft D is a spur-gear M, which meshes with the spur-wheel N, journaled on the rod O, which has bearing in the plate P, secured to one side of the engine-casing and the boss Q, which forms part of the engine-casing, as shown. The spur-wheel N is preferably provided with a sleeve R, which incloses the boss Q and has bearing thereon.

S is a rod held in any suitable bearings, against the upper end of which rests the lever K. In the lower end of the rod S is suitably pivoted a roller T, which operates upon the sleeve R and its cams, as hereinafter described.

U is an igniter, preferably an electric one, and V the delivery end of the conduit V′ of

the fuel-measuring device, which enters said explosion-chamber through opening W.

The fuel-measuring device I use in connection with my engine is fully described in my application, Serial No. 116,559, filed July 22, 1902.

Formed in one side of the preferred form of explosion-chamber A is a suitable main exhaust-port X, which is designed to be fully opened when the piston-head H is at the limit of its outward movement. As will be seen, the main exhaust-port comprises a number of holes *a*, which lead from the explosion-chamber. I may, if desired, construct the main exhaust-port in several ways without departing from the spirit of my invention; but in order to prevent the packing-rings *h*, with which the usual piston-head is provided, from being obstructed in their movement I preferably provide the series of holes *a*, before described. The shaft D and its connecting parts are of course operated by hand in starting up the engine. I will suppose that an explosion has already taken place and forced the piston-head H down into the position shown in Fig. 1. As the piston-head opens the main exhaust-port X, waste products of combustion exhaust through the several holes *a* of same, and by the time the piston-head moves upward and closes said main exhaust-port the major portion of the waste products of combustion have passed from the explosion-chamber. Simultaneously the piston-head H closes the main exhaust-port X the valve J is opened by reason of the cam 2, secured to or forming part of the sleeve R, abutting the roller T, thus moving the rod S upward in the direction indicated by ar. row and depressing the end *b* of the lever K. The valve is kept open while the piston-head H moves to the limit 3 of its inward stroke, thus discharging a second volume of the waste products of combustion through the valve. The said valve still remains open during the movement of the piston-head H from line 3 to approximately line 4, thus permitting a charge of pure air to rush into the explosion-chamber on top of the residue of the waste products of combustion therein, thus keeping same next the piston-head. Immediately the cam 2 escapes the roller T the said roller drops onto the uniform periphery of the sleeve R and rests in contact with same for the space 5 shown between the cam 2 and the other cam, thus permitting the said valve to be closed by its spring 1. The length of the space 5 is approximately indicated by the distance between the lines 4 and 6. During the length of this space the required charge of raw liquid fuel is discharged through the delivey end of the conduit of the fuel-measuring device into the explosion-chamber into the body of pure air above the residue of the waste products of combustion. Immediately the cam 7, secured to or forming part of the sleeve R, abuts the roller T the rod S is moved upward, depressing the lever K, so that the valve J is opened, and as the piston-head continues in its outward movement a volume of fresh air simultaneously rushes into the explosion-chamber. From the time the piston-head again opens the main exhaust-port X and until it closes same on its return movement the residue of the waste products of combustion are removed from the explosion-chamber. Simultaneously the piston-head H closes the main exhaust-port X the roller T escapes the cam 7 and rests again upon the periphery of the sleeve R for the space 8 between the cams 2 and 7, thus closing the valve. During the continued movement of the piston-head the explosive mixture is compressed, ignited, and exploded, and the piston-head H forced down into the position shown in Fig. 1, when the above-described cycle takes place again. By opening the valve J by the cam 7, thus permitting pure air to rush into the explosion-chamber from the atmosphere, it will be seen that I am assured of the proper proportion of air to be mixed with the raw gasolene in order to provide an explosive mixture.

From this specification it will be distinctly understood that in my preferred form of invention I actually keep the valve J open and the main exhaust-port X open, while I have within the explosion-chamber a charge of raw gasolene. The piston-head H is of course timed to close the main exhaust-port X before any of the gasolene escapes from the explosion-chamber therethrough.

On reference to Fig. 4 it will be seen that I provide the explosion-chamber with two main exhaust-ports X^2 and X^3 for the purpose of enabling me to exhaust the waste products of combustion from the explosion-chamber as quickly as possible. The best practice in gasolene-engine construction is to get rid of the waste products of combustion as soon as possible in order to keep the explosion-chamber at the minimum temperature.

By dispensing with the usual valve-chamber and inserting the igniter into the explosion-chamber directly above the piston-head therein it will be understood that the ignition and explosion of the explosive mixture takes place wholly within the explosion-chamber, thus increasing the efficiency of the engine. By reducing the number of valves used and doing away with the ordinary valve-chamber I reduce the weight and expense of gas-engines.

In the alternative form of explosion-chamber shown in Fig. 5 I dispense with an exhaust-port and exhaust the waste products of combustion through the valve J. I will suppose that an explosion has taken place in the explosion-chamber A′. Simultaneously the piston-head reaches the limit of its outward stroke the cam 9, secured to or forming part

of the sleeve R′, abuts the roller T′, suitably journaled in the lower end of the rod S′, and raises said rod upward in the direction indicated by arrow, thus depressing the lever K′, so as to open the valve J. This operation permits the waste products of combustion to exhaust through said valve. The said valve is kept open while the piston-head moves to the limit 10 of its inward stroke, thus discharging a further volume of the waste projects of combustion from the explosion-chamber. The said valve is still kept open until the piston-head moves outward to approximately the line 11, thus permitting a fresh charge of pure air to be drawn into the explosion-chamber. Simultaneously the piston-head reaches the approximate line 11 the roller T′ escapes the cam 9 and rests upon the uniform periphery of the sleeve R′, thus closing the valve J. As the piston-head continues to move to the limit of its outward movement the required charge of raw gasolene is fed into the explosion-chamber through the end V of the conduit V′, leading from the fuel-measuring device. The space 12 on the periphery of the sleeve R′ represents the time during which the feeding of fuel, compression, ignition, and explosion of the gas in the explosion-chamber takes place. This describes the cycle operating in the alternative form of explosion-chamber shown in Fig. 5. As will be understood, the pressure within the explosion-chamber during the outward movement of the piston-head H when an explosion is not taking place is much below that of the outside atmosphere, thus permitting the fuel-measuring device to operate so as to measure and feed the required amount of raw gasolene into said explosion-chamber. A device for measuring and delivering a charge of raw gasolene directly into the explosion-chamber is an essential element of my invention.

The preferred form of fuel-measurer is broadly described as follows: 13 is any suitable casing provided with two ducts 14 and a central passage-way 15, in which central passage-way operates any suitable valve 16. V^2 is a conduit leading from any suitable reservoir V^3 to the fuel-measurer. The reservoir is preferably constructed so that the fuel therein may be under atmospheric pressure. Immediately the pressure within the explosion-chamber is below that of the atmosphere the gasolene is forced in the direction indicated by arrow through the fuel-measurer into the explosion-chamber. Immediately the charge is being compressed in the explosion-chamber the pressure therein presses against the gasolene in the conduit V′, thus preventing same from passing into the explosion-chamber during this operation. This pressure on the gasolene moves the valve 16 into the position shown in Fig. 5, thus preventing the gasolene in the measuring device and its connecting passage-ways and conduits being forced therefrom.

The operating parts of the engine will of course be provided with oil in the usual manner.

I do not confine myself to means shown and described for operating the valve J.

The essential elements of my invention are an explosion-chamber provided with a separate inlet for fuel, a single valve which performs the function of carrying off a portion of the waste products of combustion and a further function of introducing fresh air into the explosion-chamber, the piston-head operating in relation to said valve, means for measuring and delivering a charge of raw gasolene into said explosion-chamber, and means for operating said valve as described.

I do not confine myself to the construction of the parts herein shown and described, as same may be altered in many ways without departing from the spirit of my invention.

The spur-gear M revolves twice as often as the spur-wheel N.

What I claim as my invention is—

1. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; means for feeding raw liquid fuel into said explosion-chamber through said fuel-opening, and a valve controlling a port from said explosion-chamber to the atmosphere, of means whereby the valve is opened to permit the piston-head to remove waste products of combustion from explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port, so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke.

2. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; means operated by the suction-stroke or portion thereof of said piston-head, for feeding raw liquid fuel into said explosion-chamber through said fuel-opening, and a valve controlling a port from said explosion-chamber to the atmosphere, of means whereby the valve is opened to permit the piston-head to remove waste products of combustion from explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-

chamber, then closed while the raw liquid fuel is fed into the explosion-chamber; and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port, so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke.

3. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; a valve controlling a port from said explosion-chamber to the atmosphere, and means whereby said valve is opened to permit the piston-head to remove waste products of combustion from the explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port, so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke, of means for measuring and delivering a charge of raw liquid fuel into said explosion-chamber through said fuel-opening.

4. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port, opened and closed by the piston-head; said piston-head; a valve controlling a port from said explosion-chamber to the atmosphere, and means whereby said valve is opened to permit the piston-head to remove waste products of combustion from the explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port, so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke, of means, operated by the suction-stroke or portion thereof of said piston-head, for feeding raw liquid fuel into said explosion-chamber through said fuel-opening.

5. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; means for feeding raw liquid fuel into said explosion-chamber through said fuel-opening, and a valve, situated in the head of the explosion-chamber, controlling a port from said explosion-chamber to the atmosphere, of means whereby the valve is opened to permit the piston-head to remove waste products of combustion from explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port, so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke.

6. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; means for feeding raw liquid fuel into said explosion-chamber through said fuel-opening, and a valve controlling a port from said explosion-chamber to the atmosphere, of a bearing; a revolving member operating on said bearing, and means intermediate said revolving member and said valve, the said revolving member being constructed so as to operate said intermediate means so that the said valve is opened to permit the piston-head to remove waste products of combustion from the explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke.

7. The combination with an explosion-chamber, provided with an opening through which fuel only is fed, and a main exhaust-port opened and closed by the piston-head; said piston-head; means for feeding raw liquid fuel into said explosion-chamber through said fuel-opening, and a valve controlling a port from said explosion-chamber to the atmosphere, of a bearing; a revolving member operating on said bearing; a rod resting against said revolving member, and means intermediate said rod and said valve, the said revolving member being constructed so as to operate said rod and said intermediate means so that the said valve is opened to permit the piston-head to remove waste products of combustion from the explosion-chamber during one of its inward movements, and kept open while the piston-head is moved a certain distance outward so as to admit fresh air into the explosion-chamber, then closed while the raw liquid fuel

is fed into the explosion-chamber, and then opened and kept open until the piston-head has moved to the limit of its outward stroke and opened the main exhaust-port so as to remove the residue of the waste products of combustion, and then closed when the piston-head closes said exhaust-port on the return stroke.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ANSON GROVES RONAN.

Witnesses:
EGERTON R. CASE,
W. H. SMITH.