G. F. MORT.

EXPLOSION ENGINE.

APPLICATION FILED OCT. 1, 1910.

1,021,697.

Patented Mar. 26, 1912.

4 SHEETS—SHEET 1.

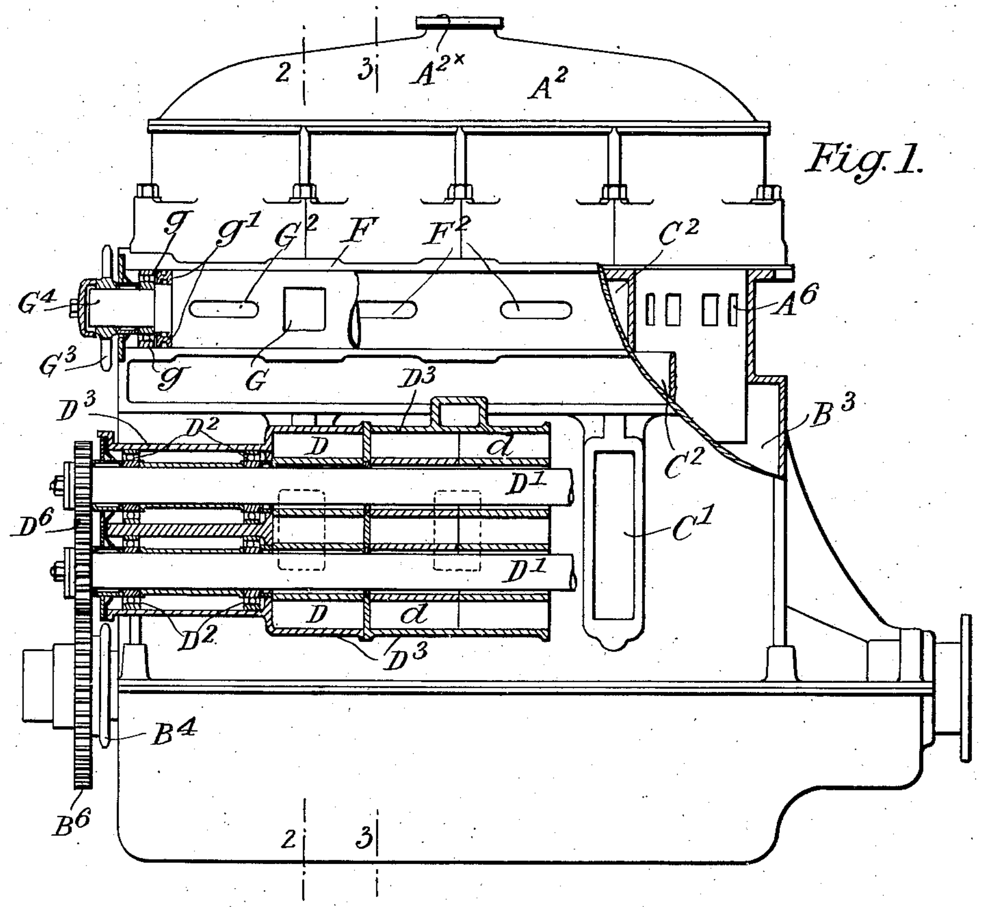

Fig. 1.

Witnesses

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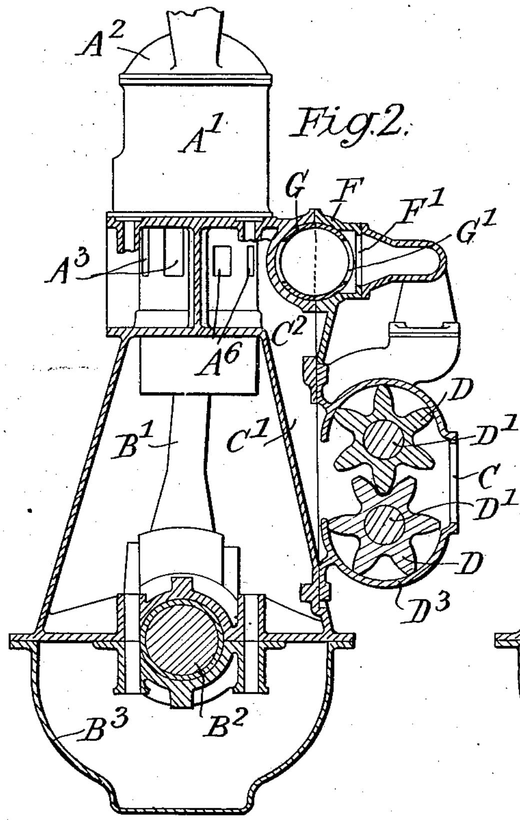

Fig. 2.

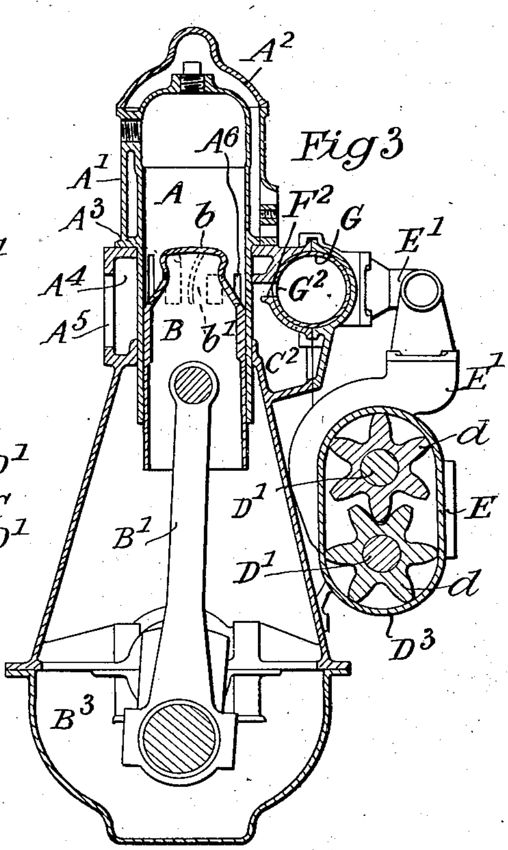

Fig 3

Witnesses

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4 SHEETS—SHEET 3.

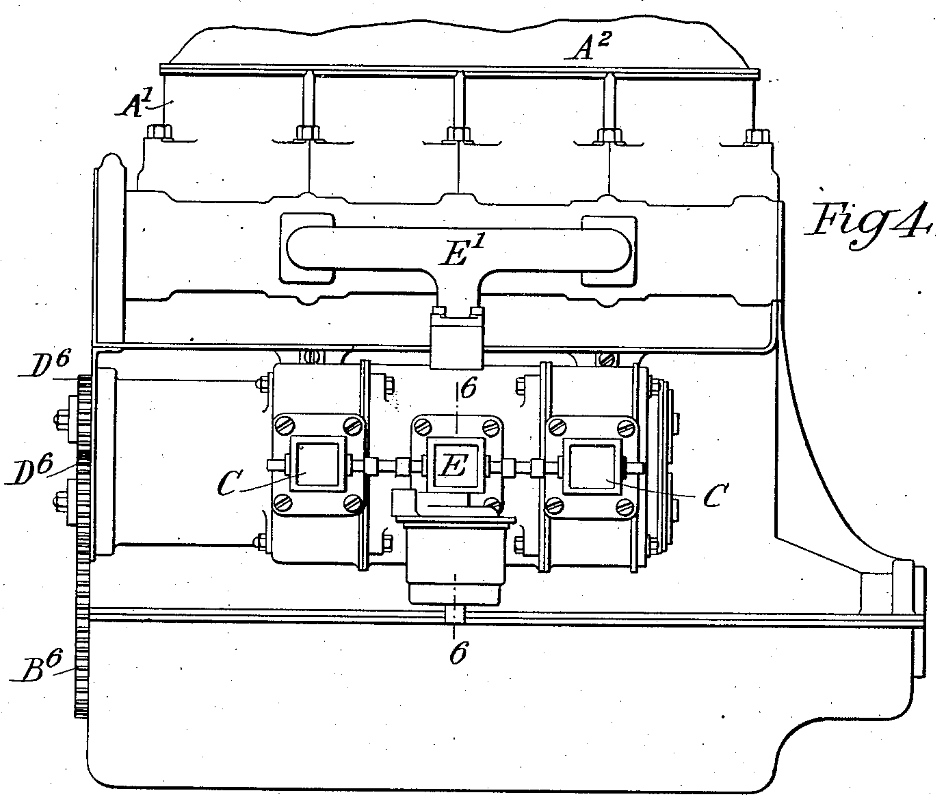

Fig. 4.

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4 SHEETS—SHEET 4.

Fig. 5.

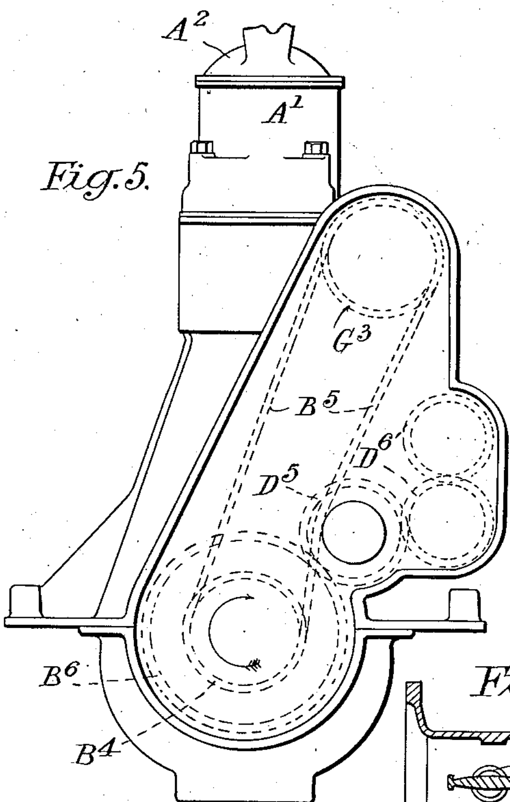


Fig. 6.

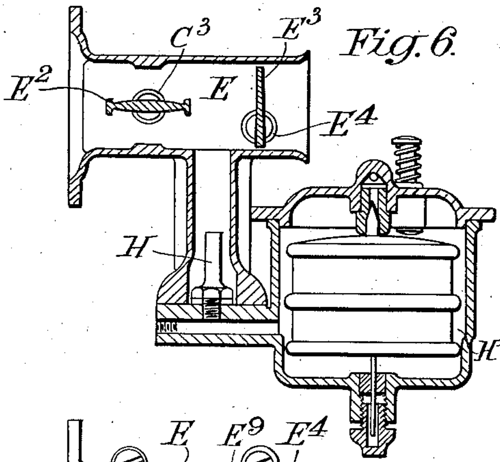


Fig. 7.

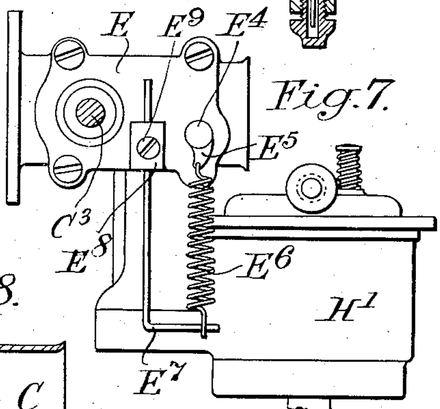
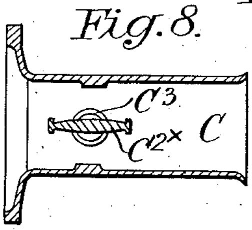


Fig. 8.



Witnesses

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UNITED STATES PATENT OFFICE.

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EXPLOSION-ENGINE.

1,021,697. Specification of Letters Patent. Patented Mar. 26, 1912.

Application filed October 1, 1910. Serial No. 584,887.

To all whom it may concern:

Be it known that I, GEORGE FREDERICK MORT, a subject of His Majesty the King of Great Britain and Ireland, and a resident of Ealing, London, England, have invented a certain new and useful Improvement in Explosion-Engines, of which the following is a specification.

This invention relates more particularly to that class of explosion engine which is adapted to work on what is known as the two cycle system, the object being to simplify the construction and reduce the number of parts subject to wear and to obviate some of the drawbacks existing in engines of this class whether of the single or of the multiple cylinder type.

The invention relates more particularly to that type of engine in which the exhaust gas passes out of the cylinder through ports cut in the wall of the cylinder, these ports being uncovered by the piston in the course of its travel on completion of its work by the gas. These exhaust ports are arranged around approximately half the circumference of the cylinder. The fresh charge of gas enters the cylinder through ports cut in the remaining half of the circumference of the cylinder, and these ports are uncovered by the piston in a similar manner to the exhaust ports, but not until after the uncovering of the exhaust ports. Thus the exhaust gas rushes through the exhaust ports so that when the inlet port is uncovered the pressure in the cylinder is approximately at, or only slightly above, atmospheric pressure. Further, it relates to the type of engine in which a blast of pure air or "scavenging charge" is forced into the cylinder in advance of the fresh charge of fuel, with the double object of driving out the exhaust and providing a portion, or in some cases the whole, of the air necessary for combustion. By suitably timing the entry of the fuel the loss of the fuel through the exhaust ports which is a common feature of many two cycle engines may, by this system, be avoided.

According to this invention it is proposed that not only the air forced into the cylinder to drive out the exhaust but also the gas or mixture supplied to secure the requisite explosion shall be supplied by gear wheel blowers, the passage from the air gear blower to the inlet ports in the cylinder being always open so that the air is free to enter the cylinder the instant the inlet ports are uncovered by the piston, while the gas from its gear wheel blower passes to a rotating valve preferably adjacent to the inlet ports in the cylinder, the ports in which are so arranged as to control the time at which the gas shall enter the cylinder so as to avoid loss of gas through the exhaust ports. This rotating valve is run in suitably arranged bearings so constructed as to be sufficiently isolated from the gas or mixture. That portion of this valve which performs the operation of controlling the inlet of the fuel, that is the valve proper, is so constructed that there is a sufficient clearance between the valve and its casing to prevent any contact between the surfaces. When such a fuel as petrol is used this is of the utmost importance and in any case protects the important surfaces from wear. This arrangement enables the valve to be run without any lubrication except that necessary for the bearings themselves. Owing to the fact that the pressure against which the gas or mixture is delivered into the cylinder is only slightly above atmospheric pressure, the pressures in and about the rotating valve are so light that the leakage due to the clearance around the valve may with good workmanship be reduced to a negligible quantity.

The pressures both in the air passage and in the rotary valve are always quite light, as for example in the air passage say 1½ lbs. and in the rotary valve say 2 lbs. These pressures are however approximate and will vary according to details in the design and the speed of revolutions. But in a well-designed engine running at its normal speed the maximum pressure would probably never rise above 4 lbs. and the difference between the air pressure and the gas pressure would probably never be more than say 1½ lbs. Thus the pressures are always low, and as I term it hereafter substantially the same. Further, if the exhaust and inlet ports are so designed, as described above as to allow the exhaust gases to lose their pressure before the inlet ports are opened, the valve is not liable to be damaged by flames or hot

gases. Also the valve being preferably placed adjacent to a portion of the cylinder which is never exposed to the highest temperature of combustion and being constantly cooled by the passage of the fuel, it is kept in a workably cool state.

The same inlet ports in the cylinder walls may be used for the inlet of both the pure air and the fuel. This admits of the use of the full area of the ports in the cylinder wall for the entry of the pure air prior to the admission of the fuel. In this case the ports from the rotating valve deliver the fuel into that portion of the pure air passage which is immediately adjacent to the cylinder inlet ports. This is conducive to simple construction and leakage of gas into the pure air passage (*i. e.* while the fuel port in the rotating valve is closed) is minimized by the fact that the pressure in the pure air passage is almost equal to that of the fuel in the rotating valve.

It is preferred to place an air blower on each side of the gas blower as the pressure in the former will then practically balance that in the latter and prevent leakage of gas past its spindles. It is also preferable, in some cases, to provide interconnected throttles to both the air and gas blowers so that when the supply of gas or mixture is reduced the pure air is also proportionately reduced, the engine being thus made more easy of control under varying loads.

Among the advantages which result from the above construction may be mentioned that there is no compression in the crank case on the down stroke which is a well known cause of trouble, that there is no compression of air or gas in separate cylinders having reciprocating parts and the substitution of a rotating valve for those of the tappet or reciprocating sliding type avoids much wear and noise, at the same time adequately providing for efficiency.

It is obvious that the invention may be carried into effect in either single or multiple cylinder engines and also to either single or double acting engines.

In the accompanying drawings Figure 1 is a sectional elevation of the inlet side of one construction of two-cycle explosion engine according to this invention; Figs. 2 and 3 are transverse sections taken respectively on the lines 2—2 and 3—3 of Fig. 1; Fig. 4 is an elevation of the inlet side of the said engine; Fig. 5 is a front elevation of the engine; Fig. 6 is a section taken on the line 6—6 of Fig. 4; Fig. 7 is an elevation of the apparatus shown in Fig. 6; and Fig. 8 is a section of a detail.

A are cylinders cast separately and having their water jackets A′ joined up by a domed casting A^2 having one opening A^{2x} at the top. One of the pistons is shown at B (Fig. 3) and this piston is connected by a rod B′ to one of the cranks of a crank shaft B^2, which is mounted in bearings within the crank chamber B^3.

A^3 are exhaust ports which open into the exhaust passage A^4 having an outlet A^5; these exhaust ports are around half of the circumference of the cylinder.

A^6 are inlet ports arranged around the other half of the circumference of the cylinder. The ports A^3 A^6 are uncovered by the piston upon the completion of the working stroke, but since the exhaust ports A^3 are longer than the inlet ports A^6 (Figs. 2 and 3), the former are partly uncovered before the latter; the exhaust gas thus rushes through the exhaust ports A^3 so that when the inlet ports A^6 are uncovered the pressure in the cylinder is approximately at or only slightly above atmospheric pressure.

In Fig. 3 the head of the piston B is shown formed with a domed end *b* having a rib *b′* on the fore side of the end *b* and a second rib *b′* on the aft side thereof; the ribs *b′* are preferably curved as indicated in Fig. 3, and are almost in contact with the cylinder walls. The dome *b* and the ribs *b′ b′* prevent the air and gas from blowing straight across from the inlet to the exhaust ports, deflecting them upward, and causing the head of the cylinder to be completely scavenged of exhaust gas.

C C are passages through which pure air is drawn by gear-wheel blowers D the shafts D′ of which are, in the example shown, mounted at both ends in ball bearings D^2 arranged in a casing D^3. The air drawn in by the blowers D is forced through passages C′ leading to a long passage C^2 which is in communication with the inlet ports A^6.

E is a passage through which air and fuel are drawn by a blower *d* the parts of which are mounted on the shafts D′; this passage E is also employed as a carbureter. The air and fuel are forced by the blower *d* through pipes E′ leading to ports F′ in a casing F in which is mounted a rotary valve G. The valve G is provided with inlet ports G′ adapted to be brought opposite the ports F′ in the casing F; and the said valve is also provided with outlet ports G^2 which are adapted to coincide with outlet ports F^2 in the said casing F, the said outlet ports F^2 opening into the long passage C^2, which, as stated above, is in communication with the inlet ports A^6. It will thus be seen that by suitably timing the rotation of the valve G the air and fuel can pass from the said valve into the cylinder. It will also be seen that the location of the valve is such that it is never exposed to full pressure from the cylinder, nor, as a rule, is it exposed to flame or hot gases, because the exhaust ports will reduce the pressure in the cylinder prior to the opening of the inlet ports by the piston.

The valve G preferably runs on ball bearings g at each end, and a felt or other suitable washer is arranged in a suitable holder g' situated between the bearings g and the actual valve portion. The said actual valve portion or valve proper is so constructed that there is normally sufficient clearance (not shown in the drawings) between the valve and its casing F to prevent contact between the surfaces, for the purposes described above. The amount of the clearance around the rotary valve can, of course, only be decided by experience, since it varies with the quality of workmanship, the size of the valve, the nature of the materials used, etc. It has, in some cases, been found in practice that although the valve has been fitted up with sufficient clearance to prevent any contact when revolved by hand while the engine is cold, yet under running conditions slight and partial contact may occur, caused by the small distortions due to the running heat of the engine or by foreign matter such as dust. In general such slight contacts do not cause any inconvenience if suitable materials are used, and they may be expected gradually to disappear by wear after the engine has been running some little time. The valve G may be driven from a chain wheel B^4 on the crank shaft B^2 by means of a chain B^5 and a chain wheel G^3 mounted on an extension G^4 projecting beyond the casing as shown in Fig. 1. The gear wheel blowers may be driven from the crank shaft B^2 by spur gearing B^6, D^5, and D^6 as shown in Figs. 1 and 5. The admission of air through the passages C may be controlled by throttle valves C^{2x} mounted on a shaft C^3 which also carries a throttle valve E^2 mounted within the passage E to control the quantity of air and fuel drawn in by the gear-wheel blower d. In the passage E there is also mounted a valve E^3 (Fig. 6) which is pivoted on a shaft E^4 having an arm E^5 on its projecting end (Fig. 7); the arm E^5 is acted upon by a spring E^6 which may be adjusted by means of the sliding rod E^7 attached to its lower end and passing through a slide E^8 having a set screw E^9. The valve E^3 is provided to control the suction upon the jet H through which the fuel is drawn from the float chamber H'.

In Fig. 1 only two of the three blower casings are shown, that is to say, the fore pure air blower and the gas blower. The aft pure air blower is omitted in order to show the passage C' formed outside of the crank case and serving to conduct the air from the blower to the long passage C^2 which brings the air into contact with the cylinder walls. The way in which the passages C' and C^2 are connected and conduct the air to the cylinder walls without the air passing into the crank chamber B^3 is best shown in Fig. 2.

In Fig. 1 a portion of the crank case is shown cut away to show a cylinder inserted in the crank case.

What I claim is:

1. In a two-cycle internal combustion engine the combination with a cylinder having inlet and exhaust ports in the walls thereof which are opened and closed by the piston, of means for supplying scavenging air at relatively low pressure to the cylinder, means for supplying gaseous fuel to the cylinder at substantially the same pressure as the scavenging air and through the same inlet ports and a rotary valve separating the scavenging air from the gaseous fuel and controlling the flow of gaseous fuel to the inlet ports; the said rotary valve having a clearance space between it and its casing whereby it may be run at high speeds without lubrication except at the bearings.

2. In a two-cycle internal combustion engine the combination with a cylinder having inlet and exhaust ports in the walls thereof which are opened and closed by the piston, a pressure chamber communicating with said inlet ports and adjacent thereto, means for supplying scavenging air at relatively low pressure to the pressure chamber, means for supplying gaseous fuel to the pressure chamber at substantially the same pressure as the scavenging air, and a rotary valve located in said pressure chamber and separating the scavenging air from the gaseous fuel and controlling the flow of the gaseous fuel to the pressure chamber; the said rotary valve having a clearance space between it and its casing whereby it may be run at high speeds without lubrication except at the bearings.

3. In a two-cycle internal combustion engine the combination with a cylinder having inlet and exhaust ports in the walls thereof which are opened and closed by the piston of a plurality of gear wheel blowers for supplying scavenging air at relatively low pressure to the cylinder, a gear wheel blower for supplying gaseous fuel at substantially the same pressure as the scavenging air and through the same inlet ports, a driving shaft on which all the blowers are mounted, and a rotary valve separating the scavenging air from the gaseous fuel and controlling the flow of gaseous fuel to the inlet ports; the said rotary valve having a clearance space between it and its casing whereby it may be run at high speeds without lubrication except at the bearings.

4. In a two-cycle internal combustion engine the combination with a cylinder having inlet and exhaust ports in the walls thereof which are opened and closed by the piston of a pressure chamber communicating with said inlet ports and adjacent thereto, a plurality of gear wheel blowers for supplying scavenging air at relatively low pressure to

the pressure chamber, a gear wheel blower for supplying gaseous fuel to the pressure chamber at substantially the same pressure as the scavenging air, a driving shaft on which all the blowers are mounted, and a rotary valve located in said pressure chamber and separating the scavenging air from the gaseous fuel and controlling the flow of the gaseous fuel to the pressure chamber the said rotary valve having a clearance space between it and its casing whereby it may be run at high speeds without lubrication except at the bearings.

5. In a two-cycle internal combustion engine the combination with a cylinder having inlet and exhaust ports in the walls thereof which are opened and closed by the piston of two air blowers for supplying scavenging air at relatively low pressure to the cylinder, a gas blower for supplying gaseous fuel to the cylinder at substantially the same pressure as the scavenging air, said gas blower being arranged between the air blowers whereby leakage of the gaseous fuel is prevented, and a valve separating the scavenging air from the gaseous fuel and controlling the flow of gaseous fuel to the cylinder.

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

GEORGE FREDERICK MORT.

Witnesses:

H. CLIFFORD,

H. D. JAMISON.