L. T. HAGAN.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 20, 1912.

Patented June 30, 1914.

1,102,045.

2 SHEETS—SHEET 1.

Fig. 1

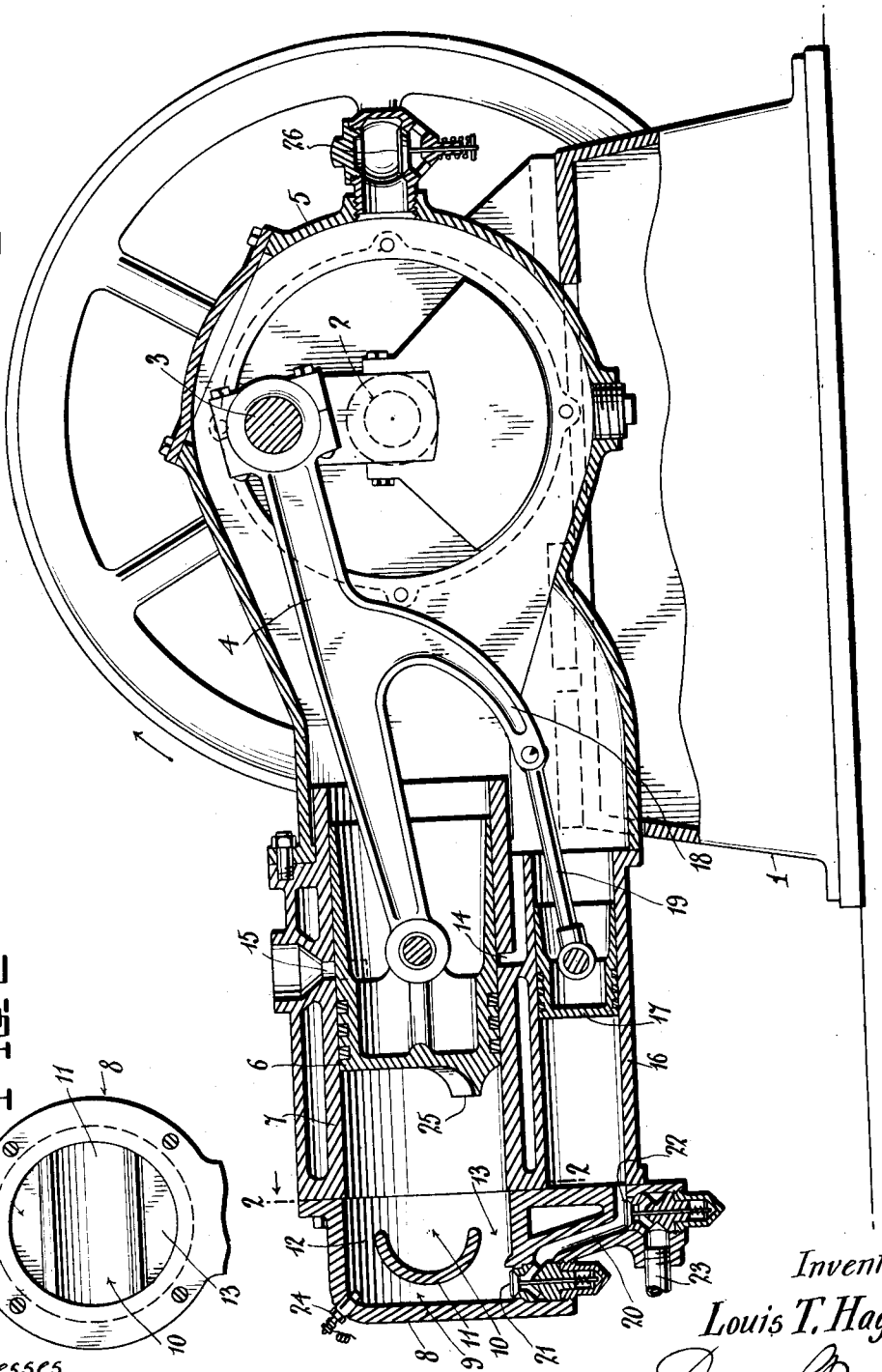


Fig. 2

Witnesses

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2 SHEETS—SHEET 2.

FIG. 3

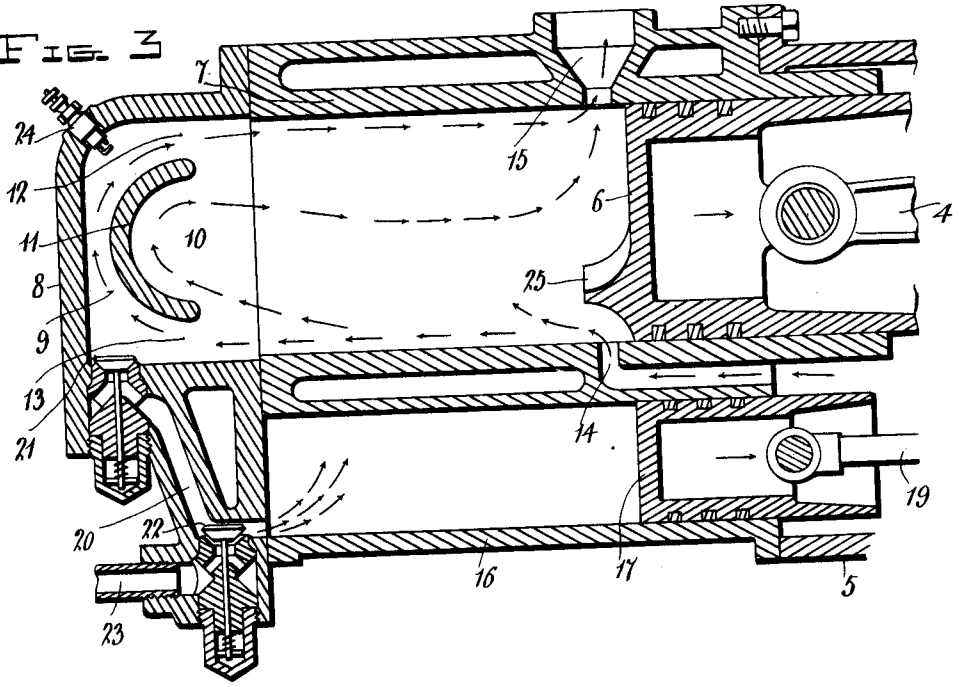
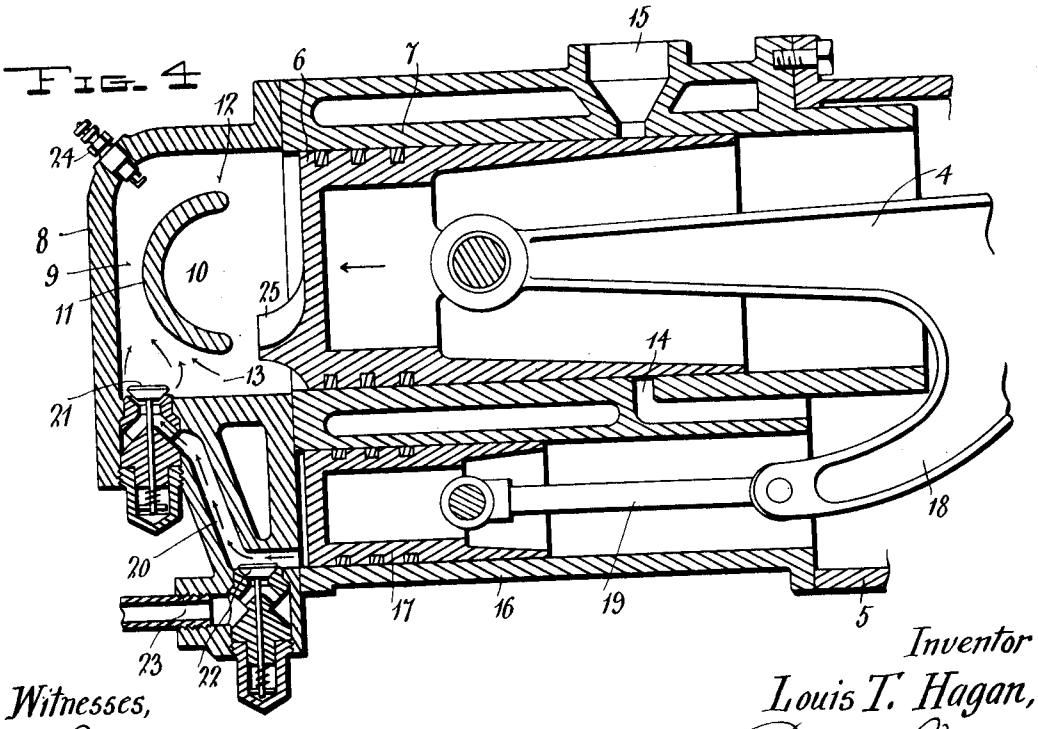


FIG. 4



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UNITED STATES PATENT OFFICE.

LOUIS T. HAGAN, OF WINCHESTER, KENTUCKY, ASSIGNOR TO HAGAN GAS ENGINE & MANUFACTURING COMPANY, OF WINCHESTER, KENTUCKY, A CORPORATION.

INTERNAL-COMBUSTION ENGINE.

1,102,045. Specification of Letters Patent. Patented June 30, 1914.

Application filed July 20, 1912. Serial No. 710,727.

To all whom it may concern:

Be it known that I, LOUIS T. HAGAN, a citizen of the United States, residing at Winchester, in the county of Clark and State of Kentucky, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My present invention relates to improvements in internal combustion engines and more especially to those of the two-cycle type, and the primary object of the invention is to provide improved means for introducing the gas or explosive medium into the cylinder whereby such gas will not mix with the exhaust of the preceding charge nor will the fresh gas be wasted by passing out of the exhaust port, the gas, according to the present invention, forming a correct mixture with the air irrespective of the load upon the engine or the extent to which the throttle is opened, thereby insuring greater economy and uniformity in the operation of the engine.

To these and other ends, the invention consists in certain improvements, and combinations and arrangements of parts, all as will be hereinafter more fully described, the novel features being pointed out particularly in the claims at the end of the specification.

In the accompanying drawing:—Figure 1 represents a vertical longitudinal section of an internal combustion engine constructed in accordance with the preferred embodiment of the invention; Fig. 2 represents a section on the line 2—2 of Fig. 1 and looking in the direction of the arrows; Figs. 3 and 4 represent axial sections of the engine cylinders showing respectively the improved means for introducing the gas and air to the power cylinder.

Similar parts are designated by the same reference characters in the several views.

The preferred embodiment of the invention is shown in the accompanying drawing and will be hereinafter described in detail. It will be understood, however, that the invention is not limited to the particular details shown, as modifications and changes may be made or equivalent constructions used embodying the principles of the invention.

In the present instance, 1 designates the base of the engine which supports the crank shaft 2, the crank 3 of which is connected to a connecting rod 4, the crank and the coöperating end of the connecting rod being contained in a closed crank case 5. The connecting rod 4 is connected to the piston 6 which operates in the main or power cylinder 7, the latter being shown attached to the crank case and base. The head 8 of the cylinder 7 contains the combustion chamber for that cylinder and this combustion chamber, according to the present invention, is divided into two compartments 9 and 10 by a wall or partition 11, this wall or partition extending transversely across the combustion chamber and forming diametrically opposite openings 12 and 13. This wall or partition 11 is also in the present instance curved on an axis transverse to the axis of the cylinder. The cylinder 7 is provided with an air inlet port 14 which serves to conduct compressed air from the crank case into the cylinder and such cylinder is also provided with an exhaust port 15 through which the waste gases are discharged, the ports 14 and 15 being uncovered in the usual way by the piston 6 as the latter approaches the end of its outward stroke. A gas feeding cylinder 16 is also provided, it having a piston 17 which is mounted to reciprocate therein, and the gas piston 17 may be reciprocated in proper relation to the movements of the piston 6 by different means, it being preferable, however, to employ substantially the construction shown, that is to say, to employ a connecting rod 4 which is provided with a laterally offset and rigid arm 18 which is attached to the piston 17 by the connecting rod 19 whereby the pistons 6 and 17 will reciprocate substantially in unison. A passage 20 is adapted to form communication between the gas cylinder 16 and the combustion chamber of the cylinder 7, an inlet check valve 21 being fitted in the head 8 and in rear of the wall or partition 11 to permit gas to enter the combustion chamber, this check valve closing during the working stroke of the piston 6, and a check valve 22 permits a charge of gas to be drawn into the gas cylinder 16 at each suction stroke of its piston 17 from the gas supply pipe 23, the valve 22 closing during the working or compression stroke of the piston 17.

24 designates an igniter in the form of

the usual spark plug which serves to explode each charge in the combustion chamber of the power cylinder, this igniter being preferably placed in rear of the wall or partition 11 and at the opposite side of the compartment 9 relatively to the inlet valve 21. The head of the piston 6 is provided with a deflector 25 to properly direct the charge of air entering the cylinder 7 through the port 14. An inwardly opening check valve 26 is provided to control the admission of air to the crank case.

The operation of the engine may be briefly described as follows:—While the piston 6 moves inwardly or toward the head of the cylinder, it causes a charge of air to be drawn into the crank case through the check valve 26, this operation taking place during a half revolution of the crank shaft, and during the next half revolution of the crank shaft and while the pistons 6 and 17 are moving outwardly or away from the heads of their respective cylinders, a charge of gas is drawn into the cylinder 16 from the supply pipe 23, the valve 22 during this operation being open while the valve 21 is closed, and during said operation the charge of air in the crank case is compressed, the compression of the charge of air continuing until the piston 6 uncovers the port 14. At this moment, the compressed air in the crank case rushes through the port 14 and into the cylinder 7, this entering air striking the deflector 25 on the piston 6, as shown diagrammatically in Figure 3, thus causing the inflowing air to travel along the wall of the cylinder until it reaches the cylinder head, at which point the flowing body of air divides, part thereof entering the opening 13 and passing around through the compartment 9 in rear of the wall or partition 11 and returning to the cylinder through the opening 12, while the other portion of this body of air strikes the concave or curved face of the wall or partition 11, it being thereby deflected and returned to the main chamber of the cylinder, both bodies of air serving to thoroughly clear the combustion chamber and the cylinder of all burnt gases or waste products, and these gases are forced out through the exhaust port in advance of the inflowing air. The cylinder and the compartments 9 and 10 of the combustion chamber will then be filled with pure fresh air. During the next half revolution of the crank shaft, the pistons 6 and 17 move inwardly or toward the heads of their respective cylinders, causing the charge of air in the cylinder 7 to be compressed and causing the charge of gas in the cylinder 16 to be forced from this cylinder through the passage 20 and into the chamber 9, this operation being shown diagrammatically in Fig. 4. While the charge of gas is being forced from the cylinder 16 into the chamber 9, the valve 22 will be closed and the valve 21 will be lifted from its seat, spring-pressed valves being preferably used in both cases. As this charge of gas is forced through the vale 21 under pressure, the moving body of gas causes a current of air to flow into the chamber 9 through the opening 13 therein, the currents of gas and air mixing in proper proportions to form an explosive mixture which fills the chamber 9 and any surplus gas mixture will pass out of the chamber 9 through the opening 12 and into the main chamber of the cylinder. If the engine is running under a full load and with the throttle opened accordingly, a comparatively large volume of gas will be introduced into the compartment 9 to form an explosive mixture with the entire quantity of air contained in the compartment 9 as well as that contained in the main chamber of the cylinder. However, if the engine is running under a light load and with the throttle practically closed, a diminished amount of gas will be introduced into the compartment 9 and a greater amount of this gas and air will remain in the compartment 9, the main chamber of the cylinder being filled with pure or unmixed compressed air. As the igniter is arranged to operate upon the gas mixture in the compartment 9, it is obvious that the greatest efficiency in the explosion is insured, as this compartment 9 will be supplied with a perfect explosive mixture irrespective of whether the engine is running light or under a heavy load, whereas with the ordinary two-cycle engine, the injected gas mixes with the entire quantity of air in the cylinder, requiring the use of a greater amount of gas and resulting in less efficiency in the power derived from the explosions. The mixture of gas and air in the compartment 9 is exploded by the igniter just before the piston 6 starts its outward stroke, the exploded gas driving the piston on its outward stroke, and when the limit of this stroke is reached, the piston 6 uncovers the air inlet port 14 and the exhaust port 15, allowing the burnt gases to escape and a new charge of air to be introduced in the manner before stated.

I claim as my invention:—

1. In an internal combustion engine, the combination of a cylinder provided with means for admitting air thereto and having its combustion chamber provided with a partially separated compartment, means for directing a current of such air through said compartment to expel products of combustion therefrom, and means for injecting a charge of gas into said compartment and inducing a flow of air into said compartment from the cylinder to mix with such gas in said compartment.

2. In an internal combustion engine, the combination of a cylinder provided with

means for admitting air thereto and having a combustion chamber provided with a compartment which is partially separated from the main chamber, means for injecting gas into said compartment and thereby inducing a flow of air from the cylinder into said compartment by the injected gas, and means operative in said compartment for igniting the resulting explosive mixture therein.

3. In an internal combustion engine, the combination of a cylinder and piston working therein, the cylinder having a combustion chamber provided with a compartment which communicates with and is partially separated from the main chamber, and having means for introducing air into the cylinder, means for directing a current of such air through said compartment to expel products of combustion therefrom, and means for injecting gas into said compartment to mix therein with air drawn into such compartment by the injected gas.

4. In an internal combustion engine, the combination of a cylinder and piston working therein, the cylinder having means for admitting air thereto, the combustion chamber of the cylinder having an imperforate partition having openings at opposite ends forming therein a partially separated explosive mixture compartment, means for directing a current of air through said compartment, and means for introducing gas into one of the openings of said compartment to mix therein with air drawn into such compartment by the gas.

5. In an internal combustion engine, the combination of a cylinder and piston working therein, the cylinder having means for admitting air thereto the combustion chamber of the cylinder having a partition extending transversely therein and having openings at opposite sides which establish communication between the compartment formed at one side of the partition and the main chamber of the cylinder, means for directing a flow of such air through said compartment to expel products of combustion therefrom, and means for injecting gas into said compartment at a point adjacent to one of said openings to cause a body of air to be drawn into the compartment and to mix therein with the injected gas.

6. In an internal combustion engine, the combination of a cylinder and piston working therein, the combustion chamber of the cylinder having a partition forming a compartment and having openings adjacent to the opposite walls of the cylinder which establish communication between the compartment and cylinder, the cylinder also having air inlet and exhaust ports in opposite walls of the cylinder and substantially in line with the respective openings, whereby the inrushing air from its port will flow through said compartment and expel the burned gases therefrom, and means for injecting gas into said compartment to cause air to be drawn from the cylinder into said compartment and to be mixed therein with the injected gas.

7. In an internal combustion engine, the combination of a cylinder and piston working therein, the combustion chamber of the cylinder being provided with a transversely arranged partition which forms a compartment in rear thereof, openings being provided at opposite sides of the partition adjacent to opposite walls of the cylinder, the cylinder walls having an air inlet port and an exhaust port in substantial alinement with the respective openings, means for introducing compressed air into the cylinder through said inlet port and causing such air to flow past both sides of said partition to expel the burned gases and fill the combustion chamber with air, means for injecting gas into said compartment and causing air to be drawn therein and mixed with the injected gas, and means operative in said compartment to explode the mixture.

8. In an internal combustion engine, the combination of a cylinder having means for admitting air thereto and provided with an imperforate partition forming a compartment which compartment communicates at its opposite ends with the cylinder, means for directing a flow of such air through said compartment to expel products of combustion therefrom, and means for inducing a flow of combustible gas through said compartment whereby air is drawn into said compartment from the cylinder and mixed in said compartment with the gas.

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

LOUIS T. HAGAN.

Witnesses:
J. W. PACE,
V. W. BUSH.