J. G. WILLET.

GAS ENGINE.

APPLICATION FILED APR. 28, 1906.

914,366.

Patented Mar. 2, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

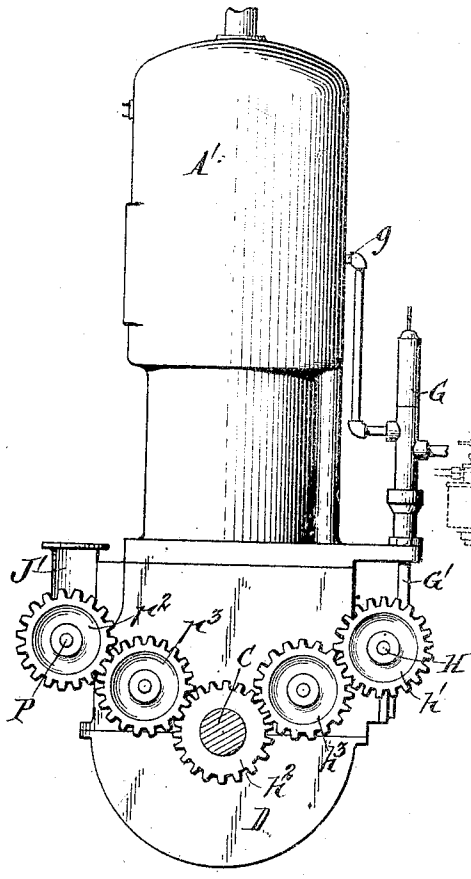
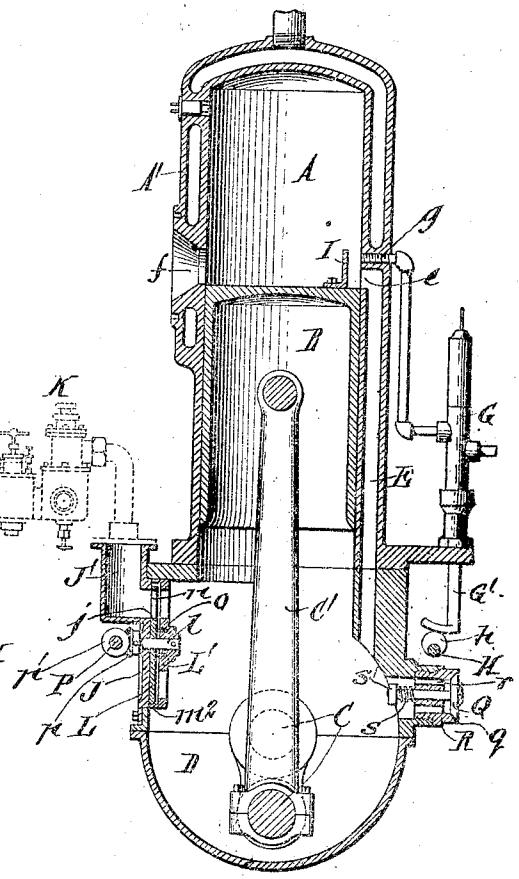


Fig. 2.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

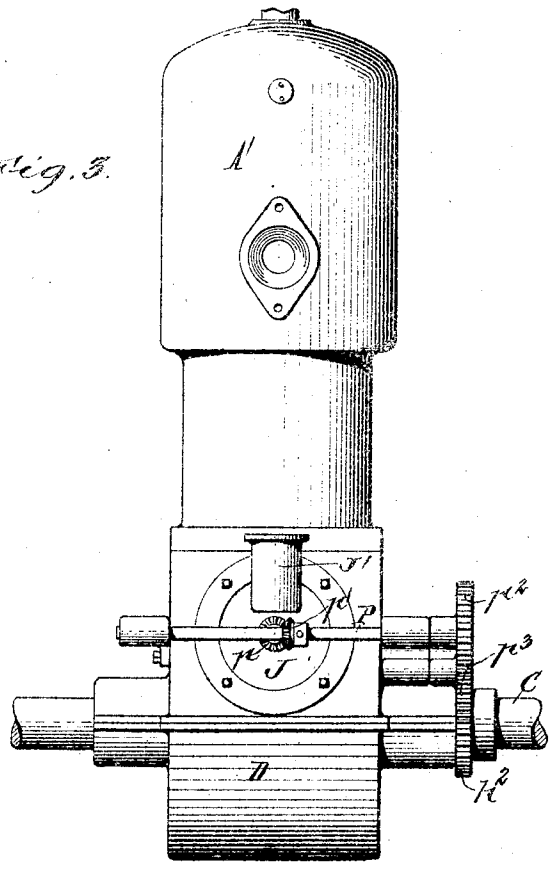


Fig. 4.

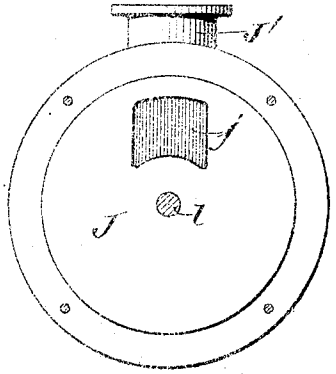


Fig. 5.

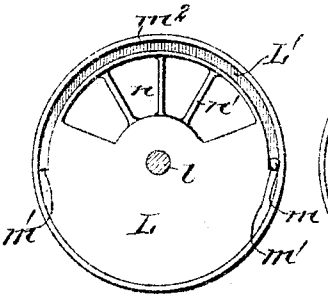
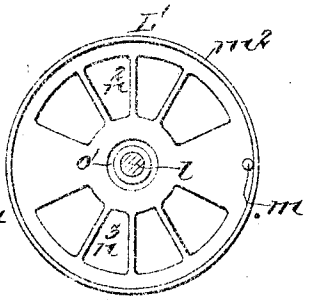


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN G. WILLET, OF BUFFALO, NEW YORK, ASSIGNOR OF EIGHTEEN ONE-HUNDREDTHS TO ISIDORE MICHAEL, EIGHTEEN ONE-HUNDREDTHS TO EDWARD MICHAEL, EIGHTEEN ONE-HUNDREDTHS TO CLARK L. INGHAM, AND EIGHTEEN ONE-HUNDREDTHS TO ELGOOD C. LUFKIN, OF BUFFALO, NEW YORK.

GAS-ENGINE.

No. 914,366. Specification of Letters Patent. Patented March 2, 1909.

Application filed April 28, 1906. Serial No. 314,259.

To all whom it may concern:

Be it known that I, JOHN G. WILLET, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification.

This invention relates more particularly to explosive engines of the two-cycle type.

The object of my invention is to provide the engine with a reversible inlet valve which is positive and reliable in action and permits full charges of air or explosive mixture to be delivered into the crank chamber, in order to obtain the highest efficiency.

In the accompanying drawings consisting of 2 sheets: Figure 1 is an end elevation of a two-cycle engine embodying the invention. Fig. 2 is a sectional elevation thereof. Fig. 3 is a side view of the same. Fig. 4 is a detached interior view, on an enlarged scale, of the plate which carries the inlet valve. Fig. 5 is a detached interior or face view of the valve-disks, on an enlarged scale. Fig. 6 is a similar view of the rear valve-disk.

Similar letters of reference indicate corresponding parts throughout the several views.

A indicates the engine-cylinder which may have the usual water jacket A^1, B is the piston connected with the crank shaft C by the customary pitman C^1, and D is the crank case or chamber into which the lower end of the cylinder opens.

E is a longitudinal by-pass or transfer passage arranged in the wall of the cylinder and extending from the crank chamber upwardly to about the middle of the cylinder where it opens laterally into the same, as shown at *e*. Opposite the upper end of this passage, the cylinder is provided with an exhaust-port *f*.

g is a pipe or inlet for supplying suitable charges of oil or other hydrocarbon fuel into the cylinder. This pipe preferably enters the side of the cylinder immediately above or adjacent to the upper end of the connecting passage E, so that the incoming oil meets and commingles with the air issuing into the cylinder from the upper end of said passage. Oil is supplied to the inlet pipe *g* by any suitable means. In the construction shown in the drawings, a suitable pump G is employed for this purpose, the plunger G^1 of which is moved in one direction by an internal spring, not shown, and in the opposite direction by a cam or eccentric *h* secured to a countershaft H supported on the crank chamber. This countershaft is driven from the main shaft by spur gears h^1, h^2 and an intermediate idler gear h^3.

I is a baffle-plate mounted upon the upper end of the piston B at the side thereof facing the passage E and adapted to stand in front of or extend across the oil inlet *g* and the delivery end of said passage when the piston uncovers the same, as shown in Fig. 2. This baffle plate prevents the explosive mixture from being expelled directly through the exhaust port *f* and also serves as an abutment against which the incoming oil is sprayed and by which it is vaporized.

It is well known that the best results are obtained when the mixture of the air and hydrocarbon takes place at a high temperature. In my improved construction, this mixture is effected within the central or upper portion of the cylinder where the temperature is comparatively high and uniform, thus obtaining a better and more efficient explosive compound than when the mixture takes place in a connecting passage, such as E, or in a separate chamber periodically placed in communication with the cylinder.

j is an inlet port for air or a mixture of air and gasolene which leads to the closed crank chamber and is preferably formed in a removable plate J secured in an opening in one side of the chamber. This inlet is connected with a branch or flanged pipe J^1 with which the outlet of a carbureter K of any suitable construction is adapted to communicate, the carbureter being indicated by dotted lines in Fig. 2. The port *j* is controlled by an inlet valve, preferably composed of a pair of rotary disks L, L^1 mounted side by side on a transverse shaft *l* journaled in the removable plate J. The front disk L is mounted loosely on this shaft, while the rear disk L^1 is secured to the shaft to positively turn therewith and provided on its front side near its edge with a forwardly-projecting pin *m* adapted to abut against either of a pair of stops or shoulders m^1 arranged on the front disk L, as shown in Fig. 5, so as to compel the front disk to rotate with the rear one in both directions. In the construction shown

in the drawings, these shoulders are formed by recessing the edge of the front valve-disk, said edge being preferably inclosed by a marginal flange m^2 on the rear disk. The front disk has a segmental port n arranged to register with the inlet port j of the crank chamber once during every revolution of the shaft l, the valve port shown in the drawings being divided by strengthening webs n^1. The rear valve disk L^1 is provided on diametrically opposite sides with similar ports n^2, n^3, one of which is adapted to register with the port n of the other valve disk, so long as the engine runs forward, while the other port is adapted to register with the port n when the ingine is reversed. The ports n^2, n^3 may also be divided by stiffening webs, as shown in Fig. 6.

o is a spring interposed between the two valve disks and serving to closely seat the front disk L against the flat inner side of the plate J. This spring is seated in an annular socket o^1 formed in one of the valve disks around the shaft l.

The valve-shaft is caused to turn in unison with the crank shaft C by any suitable driving means, that shown in the drawings consisting of a counter shaft P which is geared with the valve-shaft by bevel gears p, p^1 and which is in turn driven from the gear wheel h^2 of the crank shaft by spur gears p^2, p^3.

The parts are so timed and the coöperating ports of the valve disks L, L^1 are so arranged relatively to the inlet port j, that the latter is opened during the upward stroke and closed during the downward stroke of the piston.

The operation of the engine is as follows: When oil is used as fuel, the supply of gasolene to the carbureter is cut off and only air is allowed to pass through the same and the inlet j into the crank chamber. Assuming oil to be used and the engine to be started, air is drawn through the inlet port j and the registering ports of the valve disk L, L^1 on the up-stroke of the piston. On the down-stroke of the piston, the air in the crank chamber is compressed until the piston reaches the lower end of its stroke, when it uncovers the upper end of the passage E, allowing the compressed air in the crank chamber to rush into the cylinder above the piston. During the admission of the last portion of this air, a proper predetermined charge of oil is delivered by the pump G into the cylinder through the inlet pipe g. The stream of oil is sprayed by contact with the opposing baffle plate I and atomized by the charge of incoming air encountered by it, while the baffle plate which becomes comparatively hot vaporizes the oil. On the up-stroke of the piston the upper end of the passage E and the exhaust port f are covered and the mixture above the piston is compressed and finally ignited in a manner common to this type of engines. So long as the engine runs forward, the registering relation between the port of the front valve disk L and the operative port of the rear disk L^1 remains undisturbed, the two disks acting practically as one part with a single port. When, however, the engine is reversed by changing the time of ignition in a well known manner, the rear valve-disk L^1 being geared to the crank shaft, is automatically reversed or turned backward a half turn relatively to the front disk L, thereby bringing that port of the rear disk which was previously inoperative, into register with the port of the front disk and in the proper relation to again admit air to the crank chamber on the up-stroke of the piston and cut off the same on its down-stroke. During this reversal of the valve, the pin m of the rear disk moves idly over the recessed edge of the front disk, until it strikes the previously inoperative shoulder m^1 of the latter, when the front disk is again compelled to rotate with the rear or driving disk of the valve. As shown in Fig. 5, the shoulders are arranged at opposite sides of the valve disk.

In order to insure the admission of a full charge of air into the crank chamber at every revolution of the valve, the ports of the valve disks are considerably longer than the inlet port j, the ports shown admitting air during nearly a half-turn of the crank.

When gasolene is employed instead of oil, the oil inlet g is not used and the explosive mixture is furnished by the carbureter.

My improved inlet valve is not only positive and reliable in operation, but by permitting full charges of air or mixture to enter the crank chamber enables the engine to be run at a high speed.

To prevent injury to the engine in case of a back explosion in the crank chamber, the chamber is provided with a suitable safety valve Q. In the construction shown in the drawings, this valve is carried by a removable plug R screwed into an opening in the wall of the crank chamber. This plug has longitudinal passages r for the escape of the gases, and a central bearing for the stem of the valve Q which latter closes against a seat q at the outer end of the plug. The valve is held closed by a spring s applied to its stem between the inner end of said bearing and a collar s^1 on the stem. This spring is of such power or tension as to prevent opening of the safety valve under normal pressure, but to permit opening thereof under an excessive or abnormal pressure liable to cause injury or breakage of the engine.

I claim as my invention:

1. The herein described inlet valve for gas engines, which consists in two rotary parts, one of said parts having a port adapted to periodically register with the inlet passage,

the other part covering only a part of that first named, and having a limited movement in respect thereto, the connection being such that the second part will not cover the port of the first when the engine is running in either direction, substantially as described.

2. In a gas engine, the combination of a cylinder, a piston, a crank shaft, a crank chamber having an inlet, a revoluble valve for controlling said inlet composed of two members, one of said members having a port arranged to periodically register with said inlet, the other arranged to move on the same center as the first, but covering only a part of the same, means for moving said valve members together but permitting the second part on reversing the engine to move on the first, the connection between the two being such that the second member will not cover the port of the first member when the engine is running in either direction, substantially as described.

3. In a gas engine, the combination of a cylinder, a piston, a crank shaft, a crank chamber having an inlet, a reversible valve controlling said inlet and comprising a movable member having a port arranged to register periodically with said inlet and a second member having ports one or the other of which is arranged to register with the port of the first-named valve-member according as the engine runs forward or backward, means for compelling said valve-members to move together while permitting a limited reverse movement of one member relative to the other, and means for transmitting motion from the crank shaft to one of said valve-members, substantially as set forth.

4. In a gas engine, the combination of a cylinder, a piston, a crank shaft, a crank chamber having an inlet, a reversible valve controlling said inlet and comprising a rotary disk having a port arranged to register with said inlet and a second rotary disk having a pair of ports, one arranged to register with said inlet when the engine runs forward and the other to register therewith when the engine runs backward, the second-named disk being capable of a limited reverse movement independent of the first-named disk, and means for transmitting motion from the crank-shaft to said second-named disk, substantially as set forth.

5. In a gas engine, the combination of a cylinder, a piston, a crank shaft, a crank chamber having an inlet, and a reversible valve controlling said inlet and comprising a rotary shaft and a pair of disks mounted side by side thereon, one of the disks being loose on the shaft and having a pair of reversing shoulders and a port arranged to register periodically with said inlet, the other disk being secured to said shaft and having a projection adapted to engage either of said shoulders and a pair of ports, one arranged to register with the port of the first-named valve-disk when the engine runs forward and the other arranged to register therewith when the engine runs backward, substantially as set forth.

6. In a gas engine, the combination of a cylinder, a piston, a crank shaft, a crank chamber having an inlet, and a reversible valve controlling said inlet and comprising a rotary shaft and a pair of disks mounted side by side thereon, one of the disks being loose on the shaft and having a pair of reversing shoulders and a port arranged to register periodically with said inlet, the other disk being secured to said shaft and having a projection adapted to engage either of said shoulders and a pair of ports, one arranged to register with the port of the first-named valve-disk when the engine runs forward and the other arranged to register therewith when the engine runs backward, and a spring interposed between said valve-disks, substantially as set forth.

Witness my hand this 23d day of April, 1906.

JOHN G. WILLET.

Witnesses:
C. F. GEYER,
E. M. GRAHAM.