G. W. BAYLEY.

GAS ENGINE.

APPLICATION FILED JAN. 2, 1912.

1,193,753.

Patented Aug. 8, 1916.

2 SHEETS—SHEET 1.

Fig. 2.

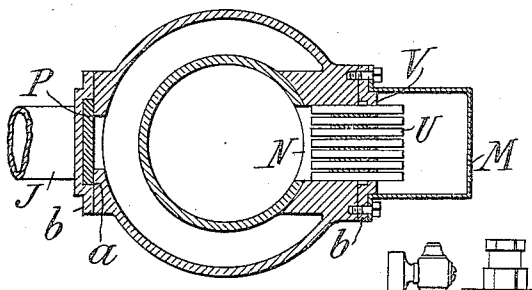


Fig. 4.

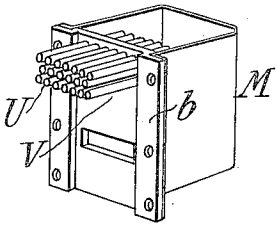


Fig. 3.

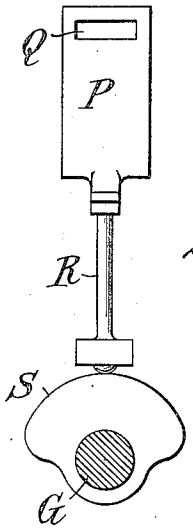


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 5.

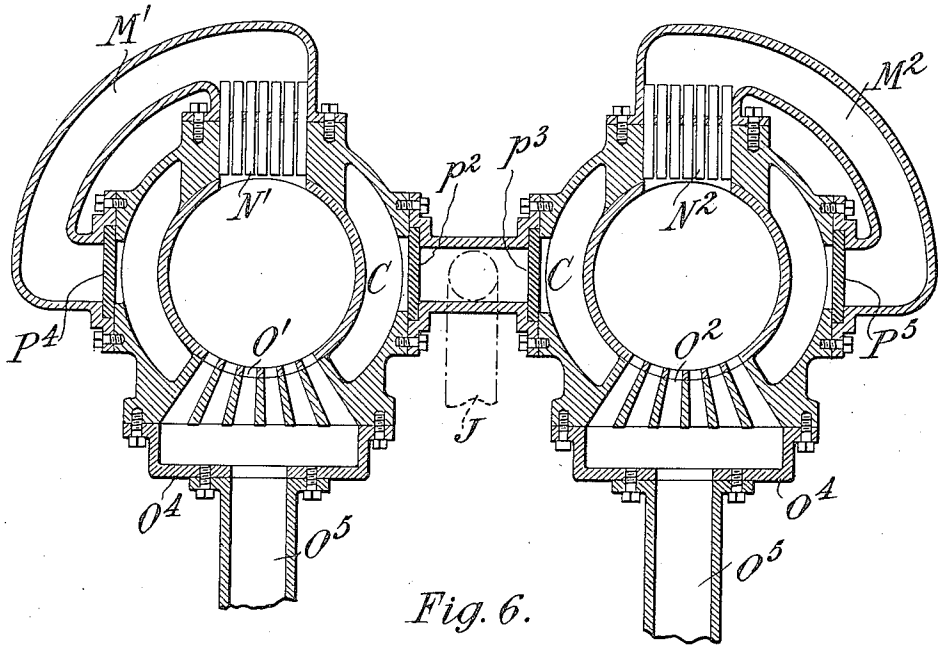
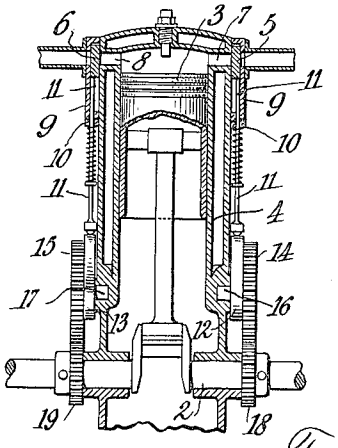


Fig. 6.



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

1,193,753. Specification of Letters Patent. Patented Aug. 8, 1916.

Application filed January 2, 1912. Serial No. 669,073.

To all whom it may concern:

Be it known that I, GEORGE WILLIAM BAYLEY, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to gas engines, particularly of the explosive type, and aims to provide certain improvements therein.

The invention is more particularly directed to explosive engines of the two-cycle type, although in some features it may be utilized in connection with four-cycle engines.

The principal object of the invention is to improve the efficiency of the engine and its economy in running. To this end I provide a construction in which all of the operations of the engine are positively controlled by simple means which are not liable to get out of order. I also provide a means by which the incoming explosive mixture may be fed into the cylinder at any desired pressure, thereby improving the scavenging of the engine and decreasing the amount of spent gases in the mixture. I also provide a construction in which the incoming gases are given a preliminary compression by the piston, so that it is not necessary to provide an inclosed crank case.

In the preferred construction of my device the power piston is provided with an additional active face which draws in the explosive mixture from the carbureter and compresses it to any desired degree in a compression chamber, from which it is released into the engine cylinder at the proper moment. In engines of the two-cycle type the admission and exhaust ports to the power cylinder may be controlled by the power piston as heretofore, but the admission and exhaust ports to the compression cylinder are controlled by sliding shutter valves which receive their movements from the crank shaft.

Other features of invention will be hereinafter more fully pointed out.

In the drawings which illustrate several forms of my invention as applied to a two-cycle engine,—Figure 1 is a central vertical section of a single cylinder engine. Fig. 2 is a horizontal section taken on the line 2—2 in Fig. 1. Fig. 3 is an elevation of one of the shutter valves. Fig. 4 is a perspective view of the inner side of the compression chamber. Fig. 5 is a horizontal section of a two-cylinder engine, embodying the invention. Fig. 6 is a section of a four-cycle engine, embodying the invention.

Referring first to Figs. 1–4 of the drawings, it is to be noted that I have illustrated an engine of a two-cycle type having a single cylinder, although it is obvious that as many cylinders may be employed as are found desirable for the particular horsepower to be developed.

In the drawings A indicates the casing of the engine, the upper part of which is bored to form a power cylinder B and the lower part a compression cylinder C. The piston D is constructed with a power face E and a compression face F, being suitably packed in the two places shown. I prefer also to provide a split packing ring or rings E′ for the power piston, which rings have a normal tendency to contract, and instead of being connected with the piston are connected with the cylinder by a retaining ring E^2 which is shown as screwed to the cylinder. The effective area of the compression face F of the piston may bear any relation to the face of the outer piston, but I prefer that it shall be somewhat larger. In other words, the cubical contents of the compression space C when the piston is in its lower position preferably exceeds that of the power space B. The piston is connected as usual with the shaft G rotating in bearings formed in the crank case H.

The explosive mixture is drawn into the compression space C through a suitable passage J from the carbureter or other source of supply, through a port hole K, during the downward stroke of the piston. During the upward stroke it is forced outwardly through a similar port hole L into a compression chamber M where it is held compressed until the piston reaches a point near the end of its next downward movement, whereupon the power piston opens the inlet port N leading from the compression chamber M to the power cylinder B, thus filling the latter with fresh mixture and driving the spent gases out through the exhaust port O.

An important feature of the invention is the construction of the valves for controlling the inflow of mixture into the compression cylinder C, and the outflow of mixture from the compression cylinder into the compression chamber M. These valves, according to

the preferred form of my invention, are made as sliding shutter valves P P′ working preferably along the exterior of the engine casing, such valves preferably comprising flat plates of metal provided with ports Q Q′ respectively, adapted to be brought into register with the inlet and outlet ports K and L respectively. By referring to Fig. 2 it will be seen that in the construction shown the sides of the engine cylinder are faced off at *a* to form a flat bearing surface or bed for the valves, and to this bed is bolted a plate *b* which is recessed to receive the valve. In the construction shown this recess is open at its lower end so that the valve may be inserted from beneath and slide up and down through the opening. The plate *b* on the inlet side is provided with an opening which forms a part of the inlet port K and on the outlet side with an opening which forms a part of the outlet port L leading to the compression chamber. The plate *b* on the inlet side may conveniently form a part of the pipe J leading from the carbureter while the plate *b* on the outlet side may conveniently form a part of the chamber M.

Each of the valves P P′ is connected at its lower end with a valve rod R which is shown as extending through the engine casing and as being provided with a ball *c* which engages a cam S or S′ mounted on the crank shaft. Each of the valves is shown as provided with a collar *d* extending around a pin or stud *e*, a spring *f* surrounding each of the pins and pressing against the collar *d*. The cams S S′ and springs *f* constitute in the construction shown the means for moving the valves.

The cams are so shaped that the inlet valve P opens when the piston is at or near the top of its stroke and remains open until it is near the end of its stroke. Thereupon it closes and the outlet valve P′ opens. As the piston rises the mixture drawn into the compression cylinder C is forced into the compression chamber M until the piston reaches nearly the top of its stroke when the valve P′ closes. By means of this construction I am enabled to entirely avoid the use of puppet valves which are noisy in their action and which are subject to excessive wear. Moreover I am enabled to provide an engine in which all automatic check valves are avoided. Such valves, being operated by pressures (usually assisted by springs) are uncertain in action, easily becoming clogged, and often sticking to their seats. By my present construction the pressures against the valves are at right angles to their paths of movement so that they are not hammered against their seats by the pressures, and such valves are positively actuated so that there is no liability of clogging or sticking.

When the invention is employed in connection with a two-cycle engine, to which it particularly relates, the compressed mixture in the chamber M flows under pressure into the power cylinder B when the piston E uncovers the inlet port N.

It will be noted that little clearance is present in the compression cylinder C when the piston is at the top of its stroke, so that practically all of the mixture which is taken into the compression cylinder is forced into the compression chamber M. By a proper proportioning of the compression cylinder and the compression chamber a wide range of pressures may be obtained in the compression chamber. By this means the mixture may be introduced into the power cylinder under considerably higher pressures than are possible with the present type of two-cycle engine, wherein a large clearance is necessarily present in the crank case. The usual preliminary compression given in the present type approximates 6 pounds, and this pressure is all that is available in driving out the spent gases when the exhaust port is open. According to my invention this pressure may be very materially increased so that the gases enter into the power cylinder with a momentum not now attainable, thus much more effectually driving out the spent gases. In addition to this by a proper arrangement of the inlets and exhaust ports the fresh mixture retained in the cylinder after the exhaust port is closed may be of higher pressure than is now common, so that the engine in fact receives not only a better mixture, but one of higher initial compression.

An important feature of the invention is the provision of means whereby back-firing into the compression chamber is avoided. The means I prefer to employ for this purpose comprise a series of fine tubes U, preferably of considerable length, open at one end to the compression chamber M and at the other end to the inlet port N of the power cylinder. For convenience these are mainly located within the compression chamber, their inner ends fitting within the inlet port to a point nearly flush with the interior wall of the cylinder. The tubes are so mounted in their supporting plate V (which may conveniently form a part of the plate *b*) that the mixture cannot be forced between the tubes. Hence any ignited gases must pass through the full length of the tubes in order to reach the interior of the compression chamber M. This they cannot do against the pressures which are present in the chamber when the inlet port N is uncovered.

In Fig. 5 I have shown the invention as applied to a two-cylinder engine. In this construction the two intake valves to the compression cylinders C C are arranged adjacent to each other, being designated by the reference letters P^2 P^3. On the other hand the outlet valves from the compression cylin-

ders C C to the compression chambers are arranged on opposite sides of the cylinders, being designated by the reference letters P^4 P^5. In this construction the compression chambers M' M^2 are preferably in the form of manifolds which lead quarter way around the cylinders as shown, so that the inlet passages N' N^2 to the power cylinders, instead of being immediately above the shutter valves, are displaced around the cylinders. The exhaust passages O' O^2 are preferably arranged opposite to the inlets N' N^2. These passages are shown as numerous in order that a free exhaust may be obtained. Preferably the sides of the cylinders are faced off to receive the exhaust connections O^4 which are bolted to the cylinders, the exhaust being led to the point of delivery by exhaust pipes O^5. The inlets N' N^2 and the exhaust passages O' O^2 are in practice arranged above the plane of the valves P^2 P^3 P^4 and P^5. In Fig. 5 they are shown for clearness in the same horizontal plane.

It will be apparent that my improved valves may be used to control the direct inlet and exhaust to the cylinder of a gas engine, in which case they are of most value in connection with engines of the four-cycle type.

In Fig. 6 of the drawings I have illustrated one form of the invention as applied to an engine of this type. In this figure 2 indicates the crank shaft, 3 the piston and 4 the engine cylinder. The shutter valves 5 and 6 are arranged to slide along the exterior of the casing to control inlet and outlet ports 7 and 8 respectively. Each of the valves is inclosed in a housing 9 which is preferably provided with a stuffing box 10 through which the valve rod 11 extends. Each of the valve rods is surrounded by a spring which tends normally to move the valve downwardly while the upward movements are effected as shown by cams 12, 13. Preferably these cams are fixed to large gears 14, 15 which turn on fixed studs 16, 17 connected in any suitable manner to the engine cylinder or frame. The gears 14, 15 receive their motion from small gears 18, 19 keyed to the crank shaft. Obviously other means for operating the valves can be adopted.

The valves 5 and 6 may be in the form shown in Fig. 3, or may be imperforate as shown in Fig. 6, their housings 9 and the outer face of the cylinder upon which they move being accurately fitted to the valves so that there is no substantial leakage.

The cams or their equivalents are so shaped as to produce the requisite movements of the valves in a four-cycle engine, which construction of cams is too well-known to require illustration.

It will be seen that by my invention I provide a construction of engine which is practically noiseless in so far as the operation of the engine is concerned, and in which the intake and exhaust are controlled by positively actuated valves which when closed receive the pressures at substantial right angles to their paths of movement.

It will also be seen that my invention provides an engine of increased efficiency in that the exhaust gases are more completely expelled and a richer and better mixture is obtained.

While I have described in detail one form of the invention, it is to be understood that I do not wish to be limited thereto, since various changes can be made therein without departing from the invention.

What I claim is:—

1. The combination in a two cycle engine, of a power cylinder, and a compression cylinder, a power piston and a compression piston, a compression chamber, a crank shaft, an inlet to said compression cylinder and an outlet from said compression cylinder into said compression chamber, said inlet and outlet being located substantially in a plane with said crank shaft, slide valves controlling said inlet and outlet, and actuating means therefor on said crank shaft, said valves having projections directly engaging said actuating means.

2. The combination in a two-cycle gas engine of a plurality of power cylinders, a plurality of compression cylinders, a plurality of pistons, each having a power face and a compression face, inlet ports to the compression cylinders, said inlet ports being arranged on adjacent sides of the cylinders, outlet ports from said compression cylinders, said ports being arranged on opposite sides of the cylinders, sliding shutter valves controlling said ports, an inlet port to each power cylinder, and a compression chamber for each power cylinder leading from the outlet from said compression cylinder to said inlet port.

3. The combination in a two-cycle gas engine of a plurality of power cylinders, a plurality of compression cylinders, a plurality of pistons, each having a power face and a compression face, inlet ports to the compression cylinders, said inlet ports being arranged on adjacent sides of the cylinders, outlet ports from said compression cylinders, said ports being arranged on opposite sides of the cylinders, sliding shutter valves controlling said ports, an inlet port to each power cylinder, and a compression chamber for each power cylinder leading from the outlet from said compression cylinders to said inlet port, said compression chamber being constructed in the form of a manifold and leading substantially quarter way around the cylinder.

4. In a gasolene engine, the combination of a working cylinder, a piston therein, a fuel-charge compressing cylinder, and a

fuel-charge receiving chamber, said compressing cylinder being adapted to empty into said receiving chamber, and said receiving chamber being adapted to empty into said working cylinder, said piston controlling the admission from said receiving chamber to said working cylinder, and a power operated valve controlling the admission from said compressing cylinder to said receiving chamber, said valve being located in a plane passing through the axis of the main shaft of the engine.

5. In a gasolene engine, the combination of a working cylinder, a piston therein, a fuel-charge compressing cylinder, and a fuel-charge receiving chamber, said compressing cylinder being adapted to empty into said receiving chamber, and said receiving chamber being adapted to empty into said working cylinder, said piston controlling the admission from said receiving chamber to said working cylinder, a power operated valve controlling the admission from said compressing cylinder to said receiving chamber, and a power operated valve controlling the inlet to said compressing cylinder, said valves being located in a plane passing through the axis of the main shaft of the engine.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

GEORGE WILLIAM BAYLEY.

Witnesses:

THOMAS F. WALLACE,

FRED WHITE.