J. LOFTUS.

GAS ENGINE.

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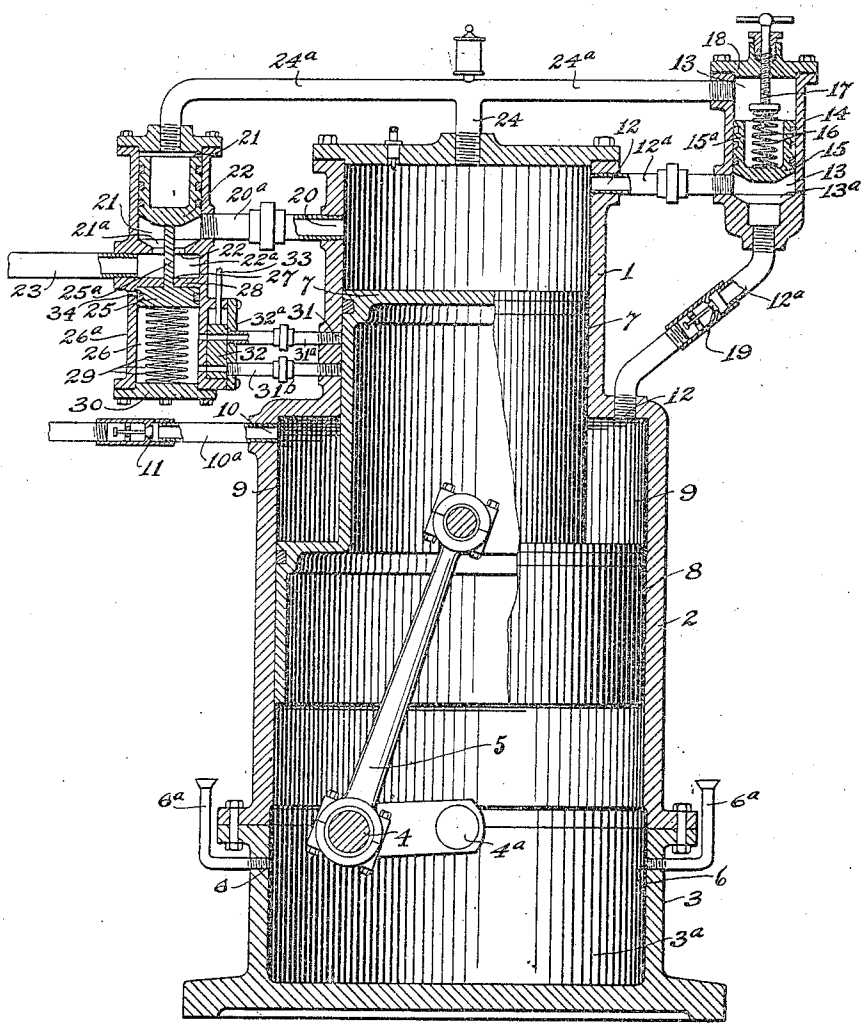
1,022,686. Patented Apr. 9, 1912



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UNITED STATES PATENT OFFICE.

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GAS-ENGINE.

1,022,686. Specification of Letters Patent. Patented Apr. 9, 1912.

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To all whom it may concern:

Be it known that I, JOHN LOFTUS, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, 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, the primary object being to provide a generally improved internal combustion engine of simple, cheap, and efficient construction, and in which the various parts may be readily removed or disassembled for inspection or repair.

A further object of the invention is to improve the control and exhaust valves and ports or passages leading to the power and compression cylinders or chambers as well as to improve the general construction and arrangement of the control and exhaust valves whereby the latter are adapted to be actuated by the operating fluid.

Generally speaking the invention consists in uniting the power and compression cylinders and pistons in integral structures in axial line with each other, the power cylinder being of reduced diameter, and the pistons comprising a piston shell or trunk consisting of a compression or pump piston and a concentric reduced power or working piston operable in said cylinders and forming an annular compression or pump chamber about said power or working piston and within said compression or pump cylinder.

A still further object of the invention is to provide improved means for regulating the admission of the explosive mixture to the compression or pump cylinder and thence to the explosion chamber of the power cylinder by alternately operating fluid actuated valves and regulating the flow of the explosive mixture or charge to the explosion or firing chamber as well as the exhaust from said chamber by and in accordance with the speed of the engine.

With the above mentioned and other ends in view, the invention consists in the novel construction, arrangement, and combination of parts, hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

Referring to the acompanying drawings forming a part of this specification, the figure is a central vertical sectional view of a vertical engine constructed in accordance with my invention, taken through the improved fluid actuated control and exhaust valve chambers and valves thereof.

The improved engine may be cooled or water jacketed in any suitable or convenient manner, the water jacket feature of the engine being omitted for the purpose of clearer illustration of the working parts comprised in this invention.

The improved engine comprises a power or working cylinder 1, and an enlarged compression or pump cylinder 2, the latter being extended and forming the main body portion of the engine and mounted upon a crank case or base 3. The crank case forms a suitable oil containing receptacle 3^a, in which the crank 4, and adjacent end of the crank or pitman 5, are adapted to pass in agitating the contained lubricant and distributing the same to the adjacent parts in a well known and understood manner. The crank shaft 4^a, is mounted in suitable bearings on the crank case or base 3, and as a means for providing a communication between the interior of the crank case 3 below the piston and the atmosphere so as to avoid the formation of a vacuum in the crank case or base 1, one or more vent openings 6, connected if desired to upwardly extending vent pipes 6^a, may be provided.

The improved pistons are preferably formed integral in the form of a shell trunk or structure as shown, said integral shell or structure comprising a compression or working piston 7, adapted to reciprocate in the power or working cylinder 1, and an enlarged concentric compression or pump piston 8, of larger area adapted to reciprocate in the compression or pump cylinder 2, said power and pump cylinders and pistons forming conjointly an annular compression and pump chamber 9.

The explosive mixture is adapted to be received into the pump chamber 9, through an induction port or passage 10, provided in the present instance with an inlet or conduit pipe 10^a, leading to a suitable carbureter, said conduit pipe being provided with a check valve 11, of any suitable or desired construction.

As a means for transferring the explosive charge from the compression or pump chamber 9, to the power or explosion chamber of the working cylinder 1, as well as regulating and controlling the admission of the

explosive charge to the latter said chambers are provided with and intersected by suitable ports or passages 12, said passages being provided in the present instance by means of conduit pipes 12^a intersected by a control valve-chamber 13, formed within a suitable valve body or chest 14. A fluid actuated control valve 15, is adapted to operate within the valve-chamber 13, and to be seated upon a valve seat 13^a.

As a means for adapting the valve 15, to be moved to its seat by the operating fluid as hereinafter explained, said valve is provided with an extended or sleeve portion 15^a, having annular grooves adapted to receive and contain packing rings or material, and as a means for adjusting the sensitiveness of the valve in its movement to and from its seat or closed position, a spring 16, is provided, said spring being adapted to be regulated by means of an adjusting bolt 17, said bolt bearing upon one end of the spring and passing out through a valve body cap or cover 18, as shown.

A check valve 19, is preferably provided in the conduit passage 12, intermediate the control valve chamber 13, and compression or pump chamber 9, as a guard against undue back action of the explosive charge or the liability of the combustion or firing of the combustion charge in the fire chamber or space in the power or working cylinder being carried into the chamber 9, in case of failure or improper working of the control valve 15.

As a means for expelling or exhausting the products of combustion or exploded gas from the working or the power cylinder as well as regulating the exhaust, an exhaust port or passage 20, is provided, said exhaust passage being formed by means of an exhaust pipe 20^a, communicating with an exhaust valve chamber 21, provided with a fluid actuated exhaust valve 22. The exhaust valve 22, has a piston form similar to the control valve 15, and is adapted to be seated on a valve seat 21^a. An exhaust opening 22, and an exhaust base 22^a, leading to an exhaust pipe 23 are provided, and as a means for actuating and closing the control and exhaust valves 15, and 22, just prior to the exploding of the explosive charge in the firing space of the power cylinder 1, as well as holding said valves closed during the active working or explosive movement of the power piston, a communicating passage is provided leading from the firing chamber portion of the power cylinder to the control and exhaust valve chambers 13, and 21, said fluid passage being provided in the present instance by means of a common conduit pipe 24, intersecting a cross or branch pipe 24^a, the ends of said branch pipes 24^a, leading into the valve chambers 13, and 21.

As a means for opening the exhaust valve 22, at the proper time and at or near the conclusion of the working stroke of the pistons, a piston plunger member 25, is provided, said plunger member being adapted to reciprocate within a chamber 26, of a cylinder 26^a, said piston 25, preferably fitting somewhat loosely therein and being adapted to be operated by operating fluid from the power or working cylinder as hereinafter explained. The piston plunger member is provided with an arm 25^a, working through a bearing opening 27, in the partition plate 28, beneath the exhaust valve, said piston plunger member being adapted to work against the resistance of a spring 29, when the exhaust valve 22, is closed by the operating fluid as above explained. The spring 29, is removably contained in the cylindrical body 26^a, by means of a removable head 30, the spring 29, also regulating the action or sensitiveness of the plunger member 25. The piston plunger member 25, is adapted to be actuated by operating fluid from the working cylinder by the uncovering or opening of the inlet port or passage 31, leading from the power cylinder and formed by means of a conduit pipe 31^a.

As a means for regulating the operation of the piston plunger member 25, and valve 22, in accordance with the speed of the engine, a second conduit pipe 31^b is provided (for a slow speed or working of the engine), and the inlet ports 31 of the respective pipes 31^a and 31^b, may be opened or closed by means of a slide valve 32, operating in a valve chest 32^a, said slide valve being provided with a stem 33, adapted to be manually operated in any suitable and convenient manner. An opening 34, in the cylinder 26^a leads into the chamber 26 immediately above the piston ring portion of the plunger member 25, so as to prevent the formation of a vacuum or the compression of air or other fluid intermediate the head of the plunger member and the partition plate 28, when said plunger member is operated.

When the working and pump pistons 7, and 8, are traveling upward, the exhaust valve 22, remains open, thus permitting the exploded charge or dead gases to be forced out of the working cylinder while a fresh charge is being compressed in the compression cylinder 1, and shortly before the working piston covers the exhaust port 20, the valve 15, suddenly opens and the fresh charge under compression in the lower or compression cylinder rushes into the working cylinder and charges the same and during the initial flow of the fresh charge the latter drives out the remaining portion of the spent or dead gases through the exhaust port, and just before the latter is closed by the working piston. When the explosion

is made or shortly thereafter the exhaust valve is closed and the compression piston is moving to reduce pressure and during the downward movement of the compression piston a fresh charge is received in the compression cylinder and the charge retained therein and compressed by the tension of the spring on the valve 15. The purpose of the valve 15, is to retain the compressed gases or charge in the compression cylinder until the pistons reach a predetermined point, the pressure in the compression cylinder being regulated by the tension of the spring 16, on the valve 15. Furthermore, as before stated, the area of the compression piston is greater than that of the working piston, and furthermore, there is more clearance above the working piston than above the compression piston. If both pistons had the same area and clearance a point would be reached where they would balance and no discharge would be made from the compression to the working cylinder.

By reason of the construction shown and described the valve 15, is adapted to be opened at a proper time and when it opens it will be observed that the explosive charge is under high pressure and much exceeding that in the working cylinder by reason of the tension of the spring and the relative construction and arrangement of the parts as above described.

It will be observed that while the valve 32, is in the position shown in the drawings it opens communication between the working cylinder and the plunger cylinder 26, through both of the pipes 31^a, and 31^b, and that when the valve is raised to its elevated position it closes communication through the pipe 31^a, and opens communication through the pipe 31^b, the valve 32, being so proportioned that when raised the lower end uncovers the pipe 31^b.

From the foregoing description, taken in connection with the accompanying drawings, the operation and advantages of my invention will be readily understood.

Having thus described an embodiment of my invention, what I claim and desire to secure by Letters Patent is,—

1. In a gas engine, a power cylinder and a compression cylinder, a valve chamber provided with a port leading to the power cylinder and two ports one leading to the power cylinder and the other to the compression cylinder, a movable member mounted in said valve chamber between the two last mentioned ports and said first mentioned port, and means for maintaining said movable member in a closed position relative to said two ports until a predetermined pressure is reached in said compression cylinder.

2. In a gas engine, the combination of a power cylinder and a compression cylinder, a valve chamber, a movable member in said valve chamber dividing the latter into two compartments, a port leading from one of said compartments to the power cylinder, two ports leading from the other compartment one of said ports communicating with the power cylinder and the other with the compression cylinder, and a spring for maintaining said movable member in a closed position until a predetermined pressure is reached in said compression cylinder.

3. In a gas engine, the combination of a power cylinder and a compression cylinder, a valve chamber, a movable member in said valve chamber and dividing the same into two compartments, a port opening into one compartment and leading to the power cylinder, and two ports opening into the other compartment one port leading to the power cylinder and the other to the compression cylinder, said movable member being adapted to close the port leading to the compression cylinder, and means for maintaining the movable member in a closed potion until a predetermined pressure is reached in said compression cylinder.

4. In a gas engine, a power cylinder and a compression cylinder, a valve chamber, a movable member therein and dividing said chamber into two compartments, said valve chamber being provided with a port leading from one of said compartments to the power cylinder and two ports leading from the other compartment, one of the latter leading to the power cylinder and the other to the compression cylinder, a spring for maintaining said movable member in a closed position relative to said port leading to said compression cylinder until a predetermined pressure is reached in the latter, and means for regulating the tension of said spring.

5. In a gas engine, a power cylinder, a power piston therein, an exhaust passage leading from the power cylinder, a valve chamber located in said exhaust passage, a movable member in the valve chamber adapted to close the exhaust passage and provide a compartment above it, a port opening into said compartment and leading to the power cylinder, a secondary cylinder, a piston in said secondary cylinder adapted to actuate said movable member, and passages leading from the power cylinder to said secondary cylinder and adapted to be controlled by said power piston.

6. In a gas engine, a power cylinder, a power piston therein, an exhaust passage leading from said power cylinder and provided with a valve chamber, a movable member in said valve chamber adapted to close the exhaust passage and provide a compartment above it, a port leading from said compartment to the power cylinder, a secondary cylinder, a piston therein and adapt-

ed to actuate the movable member in said valve chamber, two ports leading to said secondary cylinder and spaced longitudinally of the power cylinder and adapted to be controlled by the power piston, and a valve adapted in one position to open both of said ports and in the other position to close one of said ports and open the other.

7. A gas engine, comprising a compression cylinder and a concentric power cylinder of reduced diameter, a power piston carrying a compression piston and forming an annular compression chamber within said compression cylinder, a fluid inlet port leading to said cylinder, a fuel-charge conduit leading from said compression cylinder to said power cylinder, a fluid control valve located in said fuel-charge conduit, an exhaust conduit leading from said power cylinder, a fluid actuated exhaust valve located in said exhaust conduit, a plunger cylinder, a plunger in said plunger cylinder in coöperative relation to said exhaust valve, power cylinder ports leading to said plunger cylinder and adapted to be opened and closed by said power piston, and a power cylinder conduit leading to said fluid control and exhaust valves and adapted to hold said valves in a closed position while the charge is being compressed.

8. A gas engine, comprising a compression cylinder and a power cylinder, a power piston and a compression piston operable therein, a fluid inlet port leading into said compression cylinder, a fuel-charge conduit leading from said compression cylinder to said power cylinder, a fluid control valve located in said fuel-charge conduit, an exhaust conduit leading from said power cylinder, a fluid actuated exhaust valve located in said exhaust conduit, a plunger cylinder, a plunger in said plunger cylinder in coöperative relation to said exhaust valve, power cylinder ports leading to said plunger cylinder and adapted to be opened and closed by said power piston, and a power cylinder conduit leading to said fluid control and exhaust valves and adapted to hold said valves in a closed position while the charge is being compressed.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN LOFTUS.

Witnesses:

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