A. S. KROTZ.

GAS ENGINE.

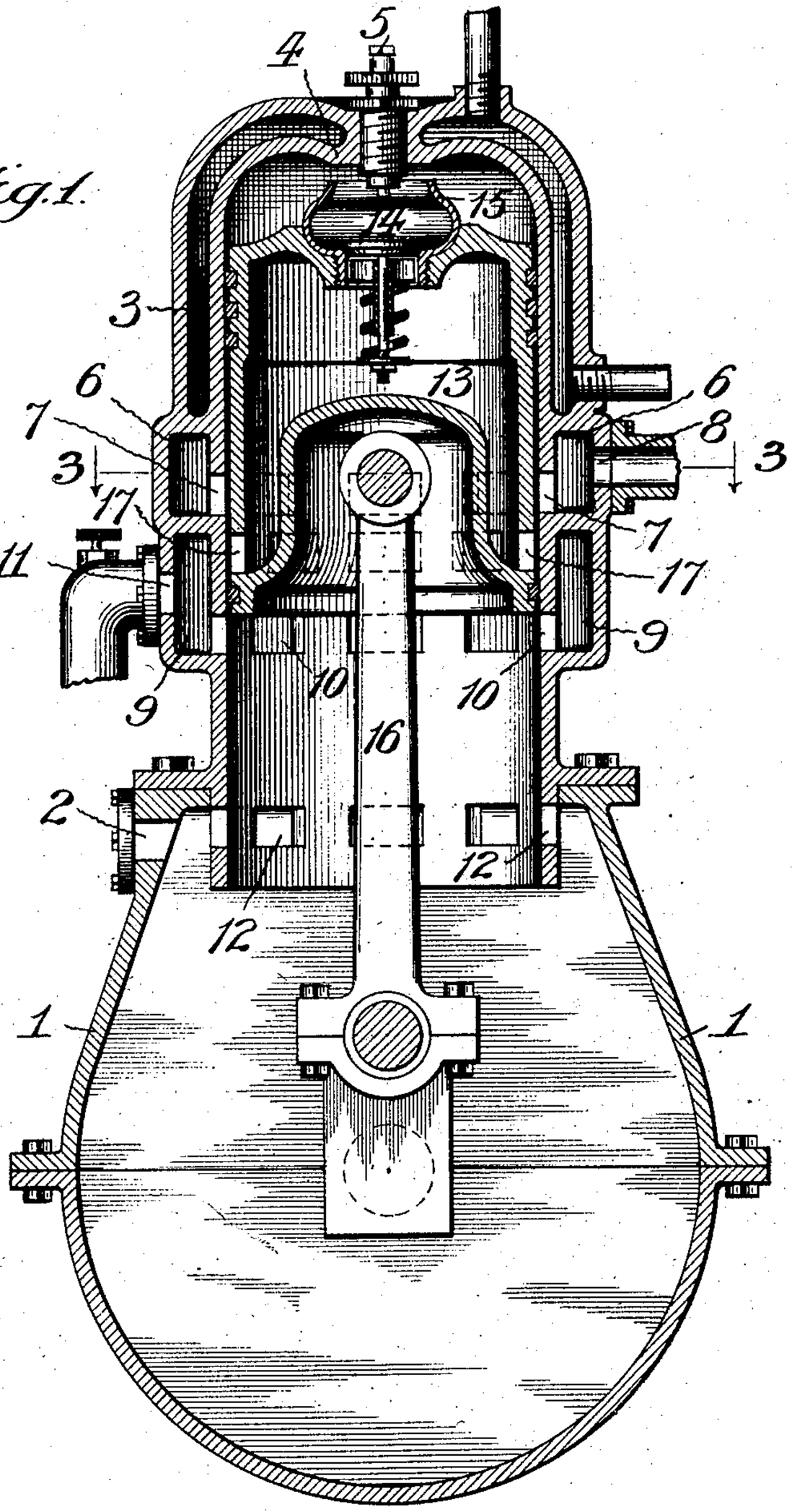
APPLICATION FILED FEB. 28, 1907.

931,319.

Patented Aug. 17, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

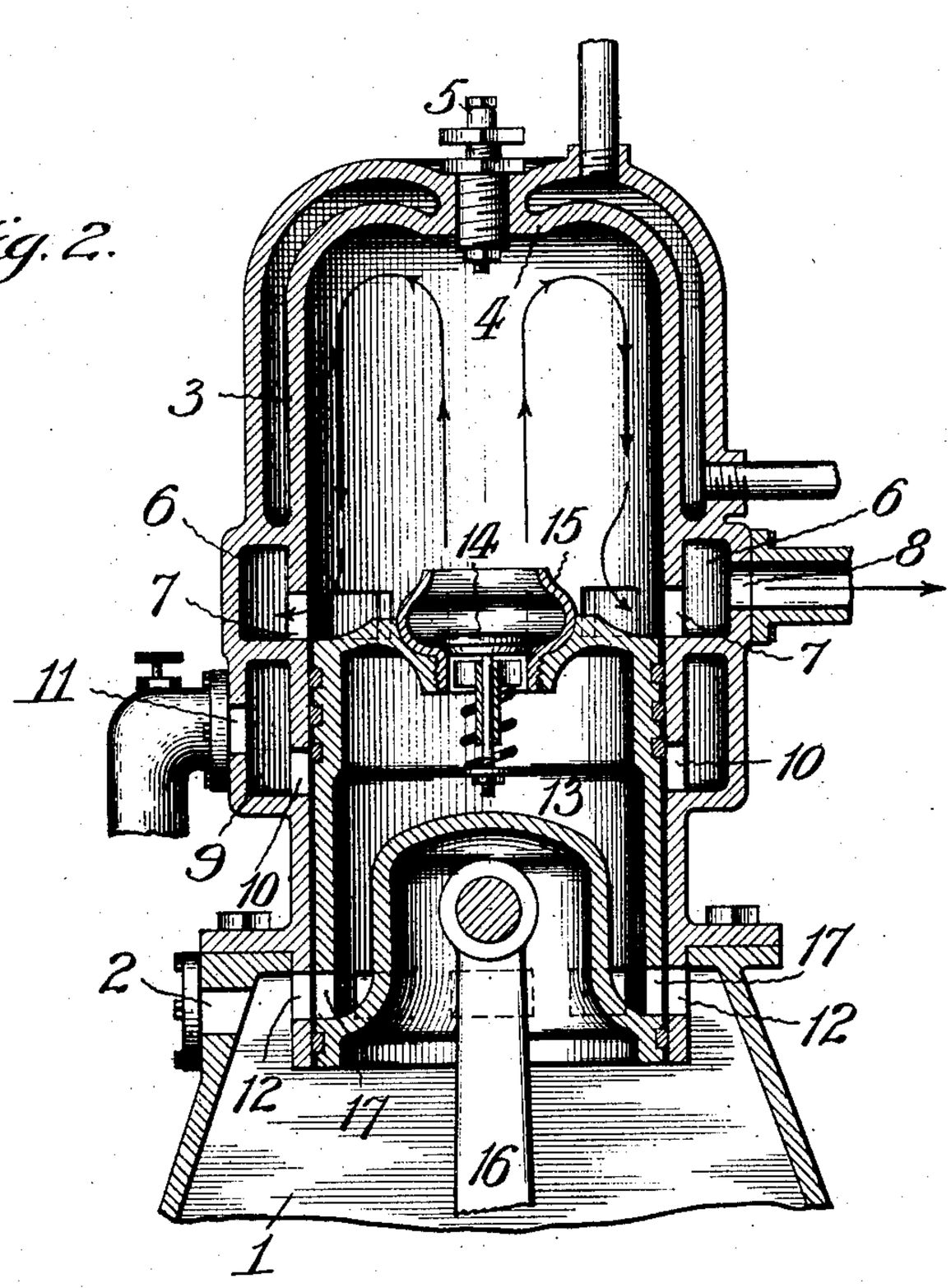
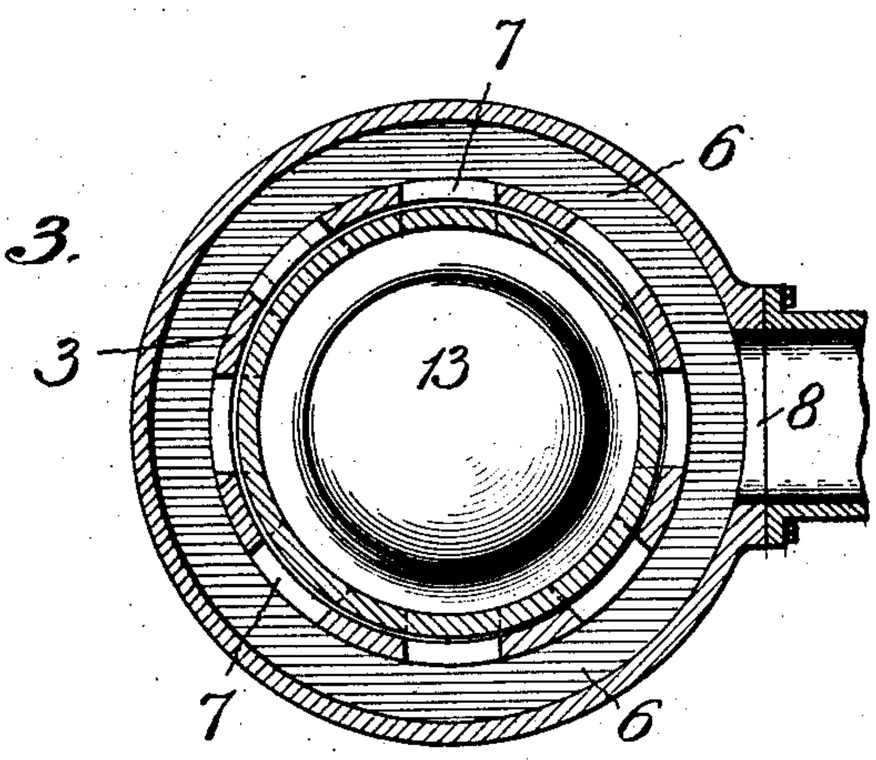


Fig. 3.



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UNITED STATES PATENT OFFICE.

ALVARO S. KROTZ, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

No. 931,319. Specification of Letters Patent. Patented Aug. 17, 1909.

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To all whom it may concern:

Be it known that I, ALVARO S. KROTZ, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to gas engines of the two-cycle type, and has for its object to provide a simple and efficient structural arrangement and formation of parts adapted to afford a very free outlet for the exploded gases from the engine, with a consequent free and effective operation of the engine, and in which the incoming charge of explosive gases is adapted to very effectively expel the previously exploded gases from the engine cylinder, and with which the inlet and outlet ducts of the explosion chamber are adapted to open simultaneously, or approximately so, without danger of "back firing" due to the ignition of the new charge by the old charge still under partial compression, all as will hereinafter more fully appear.

In the accompanying drawings:—Figure 1 is a vertical section of a gas engine embodying the present invention, and showing the piston at the end of its up stroke. Fig. 2 is a similar view, with a piston at the end of its down stroke. Fig. 3 is a horizontal section on line 3—3, Fig. 1.

Similar numerals of reference indicate like parts in the different views.

Referring to the drawings, 1 represents the closed crank chamber of the engine of any usual construction adapted to bearings for the main shaft, cylinder and other parts of the engine, and which in some applications of the present invention will have a passage 2, for connection with the carbureter or other source of gaseous fuel supply, as common in gas engines of the two-cycle type. It is however preferable to arrange said inlet in the manner hereinafter described and for reasons hereinafter stated.

3, is the engine cylinder which may be of the air cooled or water cooled type, and which in the present improvement has the head or top portion of its explosion chamber made of the hemispherical or dome form shown, and provided with a central reëntrant or downturned apertured portion or eye 4, in which is arranged the usual spark plug 5 of the engine; and as so constructed is adapted to coact with the other parts of the engine in the attainment of functions hereinafter more fully described.

6, is an annular exhaust chamber surrounding the engine cylinder at a point immediately adjacent to the top of the engine piston when the same is at the end of its down stroke. Said exhaust chamber has communication with the interior of the engine cylinder, by a series of ports or passages 7 as shown, to afford an extended and free communication; and in addition said chamber is provided with an escape port 8 communicating in any usual manner with the atmosphere.

9, is an annular supply chamber surrounding the engine cylinder at a point immediately beneath the annular exhaust chamber 6 aforesaid. Such supply chamber has communication with the interior of the cylinder by a series of ports or passages 10, as shown, to afford an extended and free communication between such chamber and the interior of the engine cylinder. In addition said supply chamber is provided with an inlet passage 11 adapted for connection with a carbureter or other usual source of gaseous fuel supply.

12, are a series of lateral ports or passages formed in the wall of the engine cylinder near the lower end of the same, and which are adapted to register the closed crank chamber of the engine with the chamber of the hollow piston hereinafter described; the said lower end of the cylinder depending into the crank casing as shown for such purpose.

13, is the engine piston of an elongated and hollow form to provide a chamber of some capacity within the piston. The upper end of said piston is provided with a central port controlled by a downwardly closing and spring held check valve 14, the seat of which is preferably formed in a bushing 15, screwed into said port as shown; such bushing is formed with an upwardly extending annular rim, which narrows toward its upper end, and is adapted to protect the valve from accident, as well as to constitute a nozzle for directing the incoming gases in a central column into the explosion chamber of the engine, as hereinafter more fully described. The lower end of the engine piston is closed and has an inward cupped form as shown,

to afford a compact pivotal connection for the upper end of the engine pitman 16, to the said piston.

17, are a series of lateral ports formed in the wall of the piston 13, near its lower end and forming an extended inlet to the chamber of said piston, and adapted to intermittently register with the series of ports or passages 12, in the lower end of the engine cylinder in the operation of the engine and form a communication between the crank case chamber and that of the piston.

Assuming the piston is on a down stroke, the operation of the engine is as follows: As the piston moves downward a compression of the gaseous contents of the crank casing is effected, as usual in gas engines of the two-cycle type, with this difference, that in the present construction the inlet valve is not exposed to such pressure until the piston has practically reached the end of its downstroke, in which position the exhaust is open, and the ports 17, of the piston are in communication with the chamber of the crank casing to permit the compressed gases therein to pass through the chamber of said piston and past the inlet valve 14, of the explosion chamber in a retarded manner, due to frictional resistance to the passing gases, and the inertia of the valve aided by the resiliency of its closing spring. Accordingly the exploded gases in the explosion chamber will have time to exhaust down to practically atmospheric pressure before the incoming charge of explosive gases enters the said explosion chamber, the result being that there will be no liability to back firing, as it is a well established fact that the exploded charge in an engine explosion chamber when reduced to practically atmospheric pressure, will not ignite an incoming charge of explosive gases to cause back firing through the parts containing the gaseous fuel supply of the engine. With the present construction the fresh charge of explosive gases enters the explosion chamber centrally as a round column, and passes to the top of said chamber where they are deflected outwardly and downwardly along the walls of said chamber to very effectively expel the remainder of the exploded charge through the extended annular ports 7, provided by the present construction. With the engine piston moving upward, the charge of explosive gases within the explosion chamber is compressed, and as the piston practically reaches the end of its upstroke its lower end uncovers the inlet ports or passages 10, and permits a fresh supply of gaseous fuel to enter the chamber of the crank casing. Incidentally therewith the sparking mechanism will energize the spark plug 5 to cause an ignition of the gases in the explosion chamber to set up a fresh cycle of the operations just described.

Additional advantages of the present improved construction are as follows:—The flow of fresh gaseous fuel supply through the piston and engine cylinder in manner before described is adapted to aid materially in cooling said parts, while the extent and arrangement of the exhaust ports insure the free and quick action so very necessary in gas engines of the two-cycle type. The exhaust and inlet ports of the explosion chamber are adapted to open at a practically simultaneous period, with safety, to admit the new charge of explosive gases early and thereby give full or maximum power on the low speed of the engine. With an increase of engine speed the passage of the gaseous fuel through the hollow piston into the explosion chamber is more and more retarded in relation to the opening of the exhaust; such retardation is due to the increased inertia of the inlet valve, the closing stress of its spring, and the progressively increased pressure on its upper area. As a consequence the inlet of the explosive charge into the explosion chamber will vary automatically with the speed of the engine, and prevent in a very effective manner any liability to back firing. With the absence of such feature of automatic control, two-cycle engines as heretofore constructed have had their inlet and exhaust ports so arranged that the exhaust port opens at a predetermined period in advance of the inlet port, in order to prevent such back firing.

Having thus fully described my said invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a two-cycle engine, the combination of a closed crank casing, an engine cylinder connected thereto, a chambered piston arranged in said cylinder, and an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

2. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and having its lower end depending into the crank casing and formed with a lateral port, a chambered piston arranged in said cylinder, and an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, the piston having a lateral passage adapted to register with the aforesaid lateral port in the lower end of the cylinder when the piston is in its lower position and establish communication between

the chamber in the piston and the crank chamber, substantially as set forth.

3. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston, and controlling a port between the chamber of the piston and the combustion chamber of the engine, and a spring tending to hold said valve in a closed position, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

4. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and having its lower end depending into the crank casing and formed with a lateral port, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, a spring tending to hold said valve in a closed position, the piston having a lateral passage adapted to register with the aforesaid lateral port in the lower end of the cylinder when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

5. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of outlet ports and an annular exhaust chamber, a chambered piston arranged in said cylinder, and an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

6. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of outlet ports and an annular exhaust chamber, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, a spring tending to hold said valve in a closed position, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

7. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of inlet ports and an annular supply chamber, a chambered piston arranged in said cylinder, and an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

8. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of inlet ports and an annular supply chamber, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, a spring tending to hold said valve in a closed position, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

9. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of outlet ports and an annular exhaust chamber and with a series of inlet ports and an annular supply chamber, a chambered piston arranged in said cylinder, and an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

10. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and formed with a series of outlet ports and an annular exhaust chamber and with a series of inlet ports and an annular supply chamber, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, a spring tending to hold said valve in a closed position, the piston having a lateral passage adapted to register with the chamber of the crank cas-

ing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

11. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and having a dome shaped upper end and a depending central portion, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, and a bushing forming a seat for said valve and provided with an upwardly extending annular rim which narrows toward its upper end, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

12. In a two-cycle gas engine, the combination of a closed crank casing, an engine cylinder connected thereto and having a dome shaped upper end and a depending central portion, a chambered piston arranged in said cylinder, an inlet valve arranged in the upper end of said piston and controlling a port between the chamber of the piston and the combustion chamber of the engine, a bushing forming a seat for said valve and provided with an upwardly extending annular rim which narrows toward its upper end, and a spring tending to hold said valve in its closed position, the piston having a lateral passage adapted to register with the chamber of the crank casing when the piston is in its lower position and establish communication between the chamber in the piston and the crank chamber, substantially as set forth.

Signed at Chicago, Illinois, this 20th day of February, 1907.

ALVARO S. KROTZ.

Witnesses:
ROBERT BURNS,
HENRY MOE.