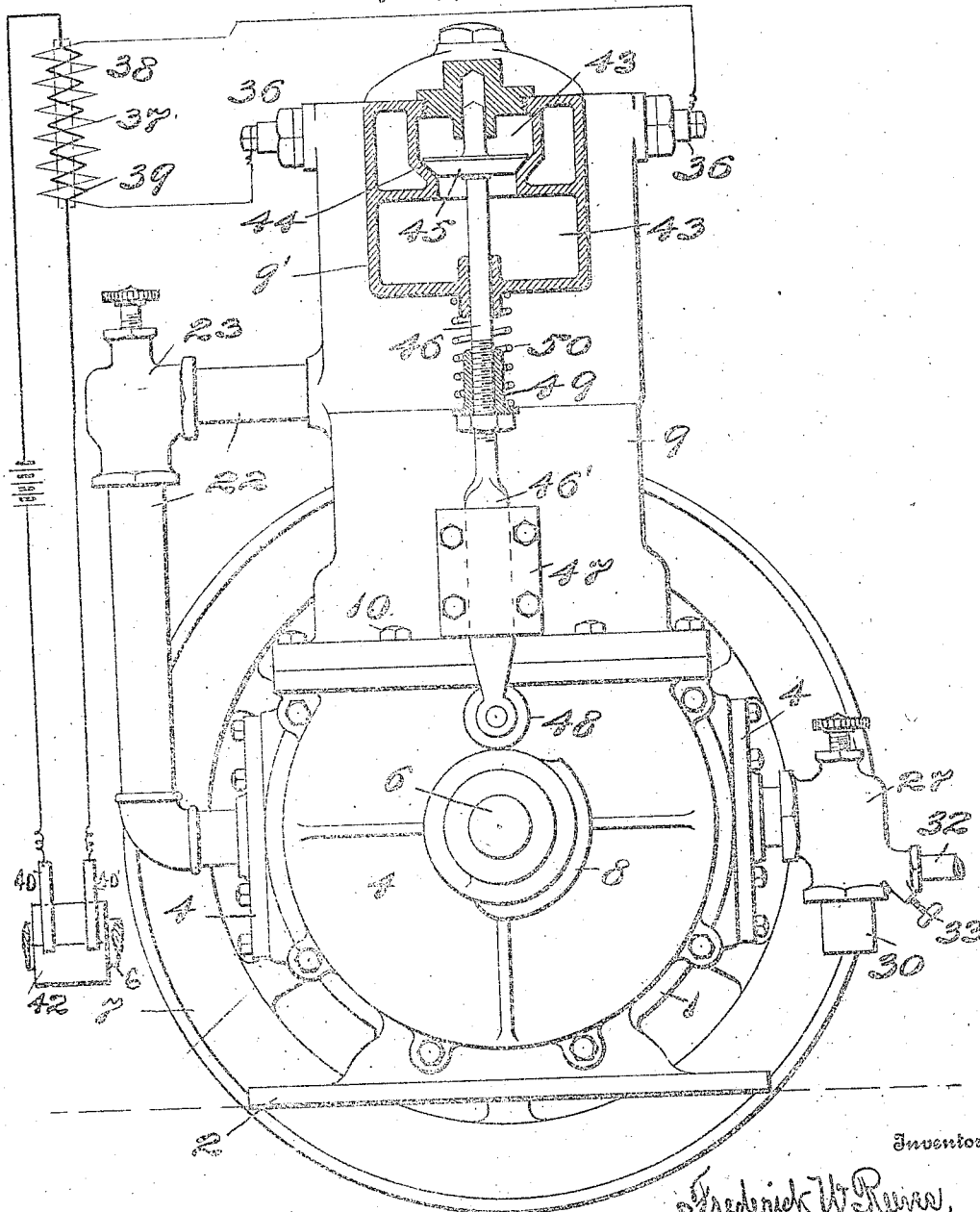


F. W. REEVES.
GAS ENGINE.
APPLICATION FILED FEB. 29, 1909.

Patented Sept. 7, 1909.
4 SHEETS—SHEET 1.

933,109.

FIG. 1.



Inventor

Frederick W. Reeves,

Richard S. Harrison,

Attorney

Witnesses

W. B. Simpson,
H. S. Harrison,

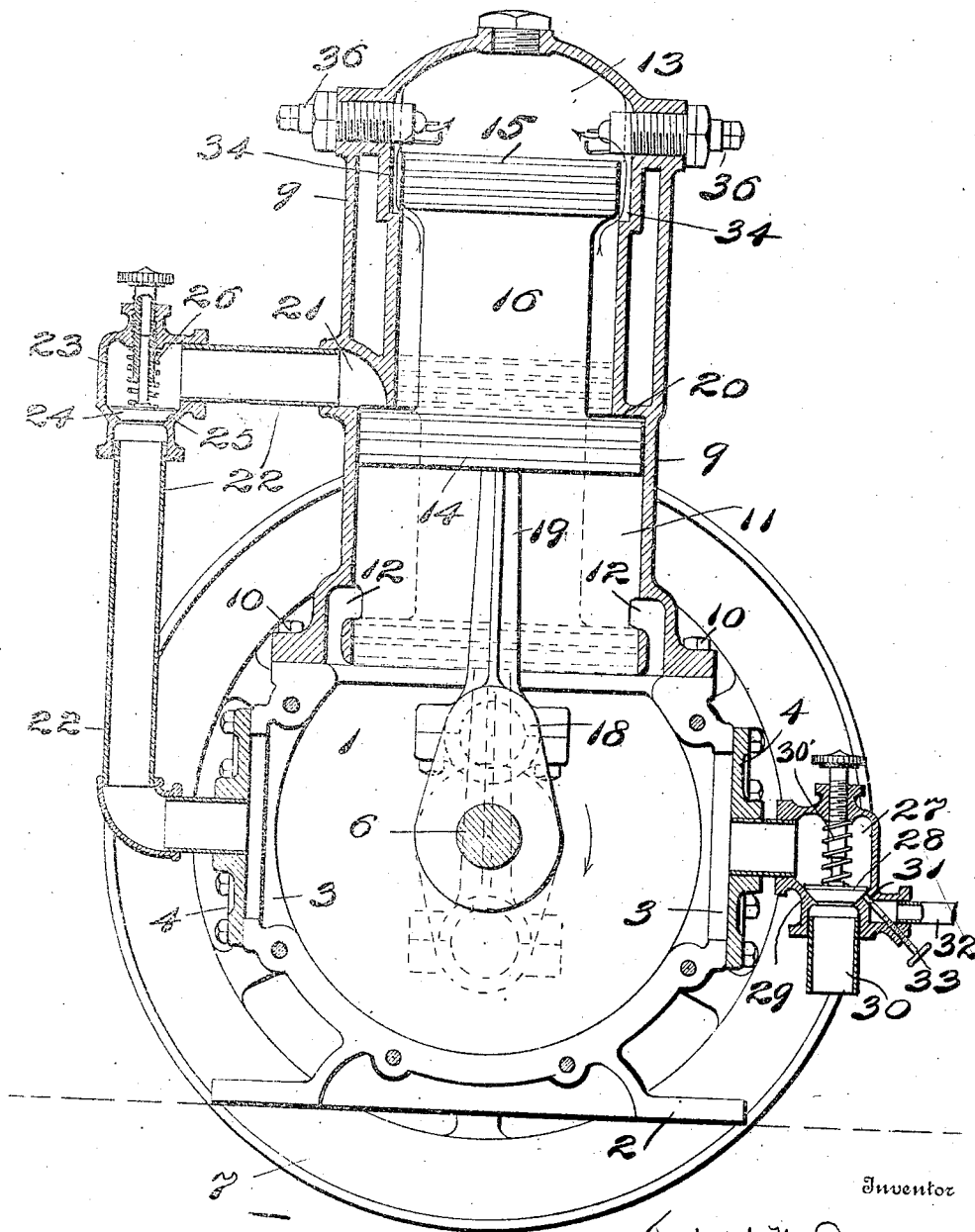
By

983,109.

F. W. REEVES.
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FIG. II.



Inventor

Witnesses
W. B. Stoops.
W. H. Harrison,

Frederick W. Reeves,
By Richard S. Harrison,

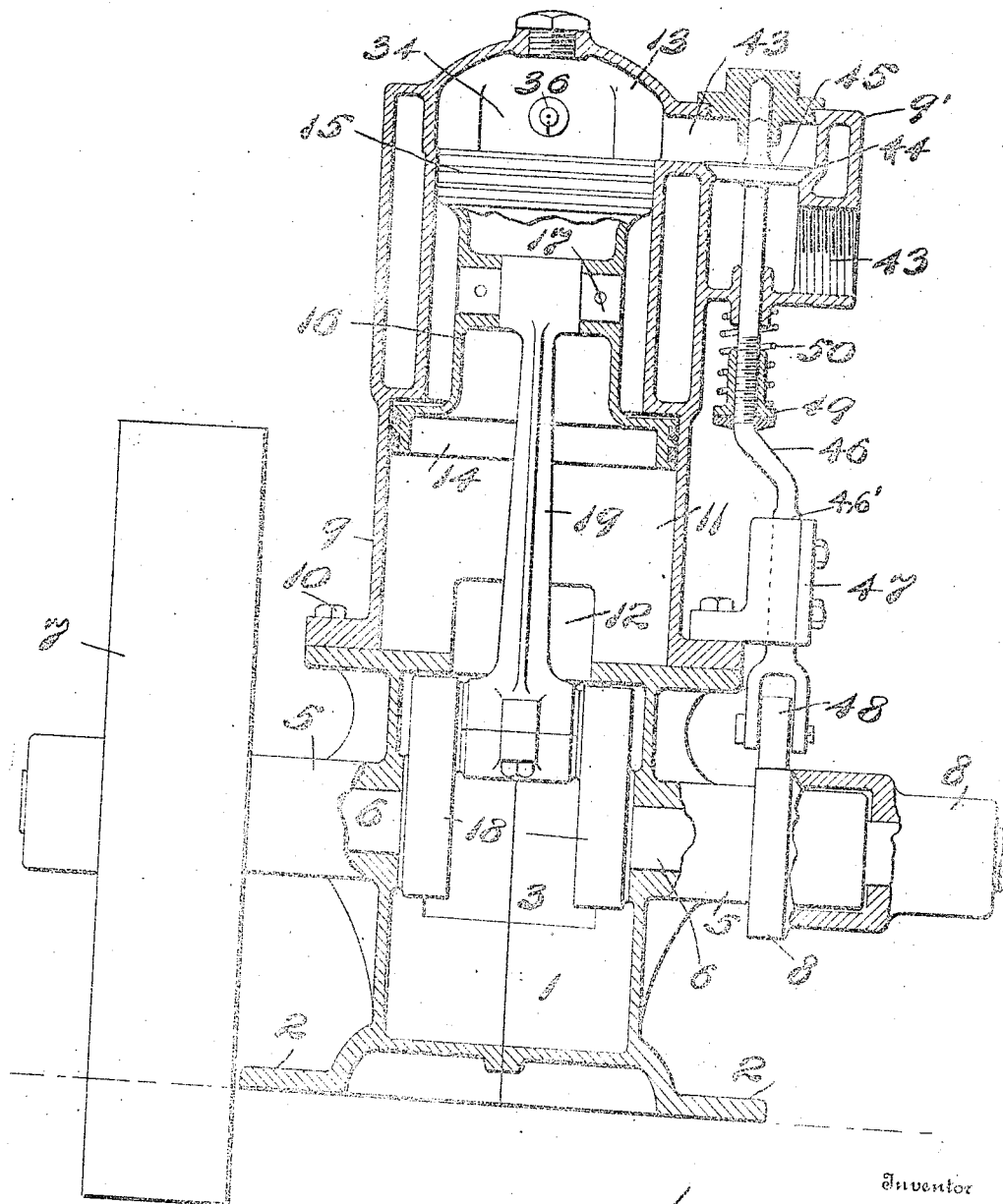
Attorney

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F. W. REEVES.
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4 SHEETS—SHEET 3.

FIG. III.



Witnesses
W. B. Stroops—
W. H. Harrison

Inventor
Frederick W. Reeves,
By Richard S. Harrison

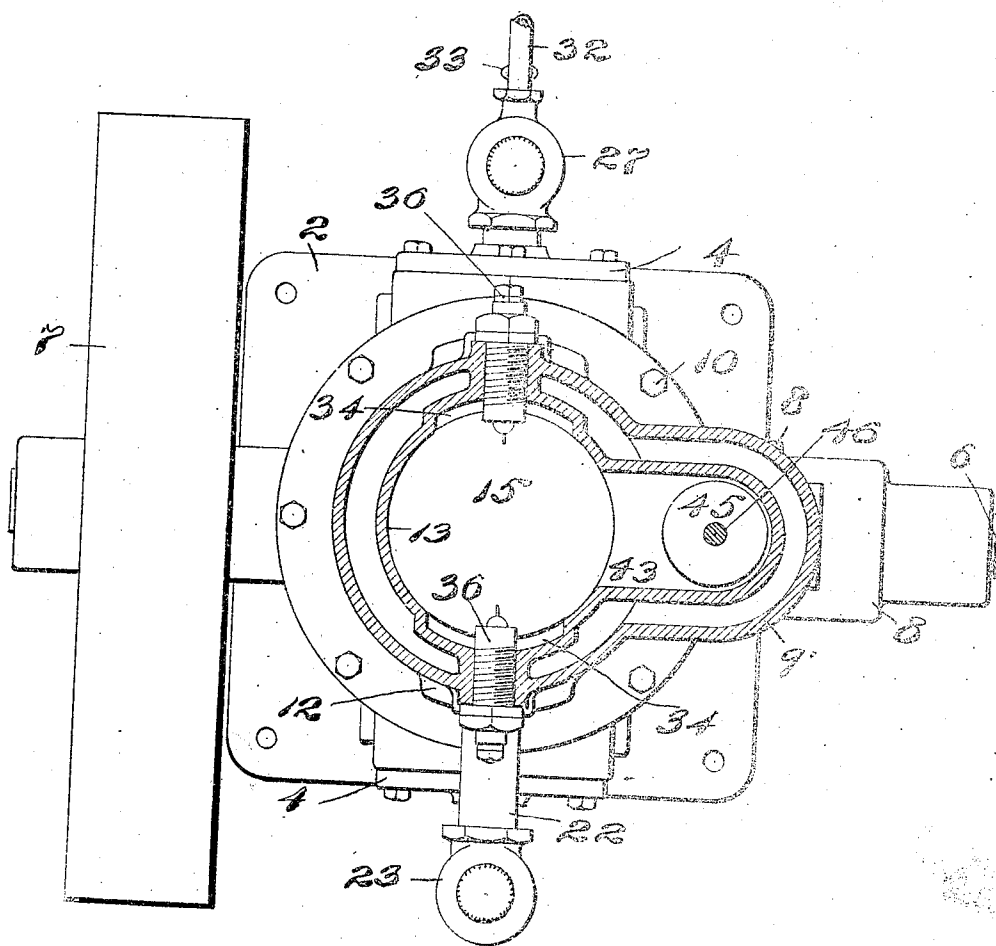
Attorney

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F. W. REEVES.
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4 SHEETS—SHEET 4.

FIG. IV.



Witnesses

W. B. Stokes
W. H. Harrison

Inventor

Fredrick W. Reeves

By Richard D. Harrison

Attorney

UNITED STATES PATENT OFFICE.

FREDERICK W. REEVES, OF PITTSBURG, PENNSYLVANIA.

GAS-ENGINE.

933,109.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed February 29, 1908. Serial No. 418,479.

To all whom it may concern:

Be it known that I, FREDERICK W. REEVES, a citizen of the United States, residing at Pittsburg, N. S., in the county of Allegheny and State of Pennsylvania, 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 of the two cycle type.

The invention has for its object the provision of an engine capable of producing greater power in proportion to cylinder area and fuel consumption than heretofore, adapted to give complete combustion under compression every second stroke of the piston, followed by a more perfect exhaust of the burned gases than heretofore, as well as completely eliminate back-firing, and maintain as perfect operation as possible at variable speeds and under variable loads and provide for simplicity of construction, operation, etc.

In the accompanying drawings, which form a part of this specification, I have illustrated my invention in various ways, wherein,

Figure I, is a side elevation of my improved engine, partly in section. Fig. II, is a similar view with a more complete disclosure in section. Fig. III, is also a side elevation, at right angles to the aforesaid views, the greater portion of which is shown in section. Fig. IV, is a plan view partly in section, like detail parts of said views being designated by like numerals of reference.

The invention comprises in structure, a vertically disposed and divided crank case or primary compression extension chamber 1, integral with the bed-plate 2, and provided at its opposite sides with openings 3 which are closed by heads 4, the sides of said casing or chamber having bearings 5 formed thereon to receive the crank shaft 6, said crank shaft carrying a fly-wheel 7 at one end and a valve actuating cam 8 at the other. Mounted upon said crank case, or primary chamber extension, is a cylinder 9 which is secured thereto by bolts 10, the interior of said cylinder being divided into two chambers, namely, the chamber 11 which is the primary compression chamber proper, provided with oppositely disposed auxiliary by-passes 12 at its base, and the combustion chamber 13 of lesser diameter than the pri-

mary chamber, said chambers having operatively arranged therein a piston provided with a large head 14 at its lower end to fit the primary chamber and a lesser head 15 at its upper end to fit the combustion chamber, the intermediate portion 16, between the heads, being further reduced in diameter to form, with the surrounding chamber walls, a secondary compression and transfer chamber thereabout, said piston being closed at its upper end and connected by a wrist-pin 17, carried thereby, to the crank 18 of the aforesaid crank shaft, through the medium of the connecting rod 19.

At the shouldered portion 20, in the walls of the secondary compression chamber, is formed a port 21, which communicates with the primary compression chamber by means of a suitable passage way or by-pass 22, having a valve chamber 23 included therein and containing a valve 24 normally held upon its seat 25, by a spiral spring 26, said primary compression chamber extension or crank case, communicating at its opposite side with an air and gas mixing chamber 27 having a valve 28 therein which is normally held upon its seat 29, over the air inlet pipe 30, by a spiral spring 30' and at the same time closing the inlet 31 of the fuel supply line 32, the volume of fuel gas passing through the inlet being controlled by a needle valve 33.

Within the combustion chamber, at diametrically opposite points, are formed vertically disposed groove-like ports or by-passes 34, which extend to a point slightly below the upper head of the piston, when said piston is in its extreme upper position, said chamber being further provided with transversely disposed openings formed in its walls, at the top of said ports, into which are fitted spark plugs 36, the inner terminals thereof being attached to the ends of the secondary coil 37 of any suitable spark coil 38, preferably of the non-vibrating form, the primary coil 39 having connected in its circuit brushes 40 and 40' to engage a suitable make-and-break device 42 arranged upon and adapted to be rotated by the crank shaft.

Integral with the aforesaid cylinder 9 is an extension 9' containing an exhaust chamber 43 and attending outlet leading from the combustion chamber to the atmosphere, said chamber having a valve seat 44 therein, upon which is normally seated a valve 45 mounted upon a stem 46, which stem has a flattened

portion 46' passing down through a guide bearing 47 attached to the cylinder, and carries a roller 48 at its extremity which engages the aforesaid cam 8, said valve stem 5 having thereon an adjustable sleeve 49 which engages a helical spring 50 under tension to hold and retain the valve to its seat.

In operation, if it be assumed that the piston is upon its extreme upward stroke, as shown, then the said piston upon its downward stroke causes rapid enlargement of the secondary compression chamber between its heads, which tends to create a vacuum in said chamber, at the same time the downward movement of the piston causes compression of the combustible mixture contained in the primary chamber and attending crank-case, which coaction of suction and pressure causes the charge under compression to escape up through the by-pass or transfer passage 22, raising the valve 24, and passes into the aforesaid secondary compression chamber about the piston, and when the lower head of the piston passes the auxiliary by-passes 12, the combustible mixture will also pass therethrough into the secondary compression chamber relieving the pressure on the valve 24, thus causing the said valve to resume its seat owing to the tension of the spring and pressure of the combustible mixture acting upon the upper side thereof, preparatory to the piston starting upon its upward stroke. Upon the upward stroke of the piston, the auxiliary by-passes 12 become closed as the head 14 of the piston moves thereover, the charge in the compression chamber becomes further compressed and upon said piston reaching its extreme upper movement, or immediately before doing so, the charge in the secondary compression chamber escapes into the now decreasing space of the combustion chamber, by way of the ports 34, as indicated by the arrows at Fig. II. Now as the piston begins its next downward movement, the head 15 thereof, closes the said ports 34, and immediately following this closure of the said ports, the circuit in the primary coil is broken, followed by a spark between the plug terminals of each of the oppositely disposed spark plugs and consequent combustion of the mixture under compression in the said chamber, the resultant force of which acts upon and drives the piston downward. Immediately before the piston reaches its extreme lower movement, the high portion of the cam 8 will engage the roller on the valve stem, causing said roller to ride thereupon and lift the valve 45 from its seat in the exhaust passage, and upon the piston moving upward a suction will be created in the crank case, causing a new charge of combustible mixture to be drawn therein through the valve chamber 27, followed by the operation previously set forth, and before the head 15 of

the piston uncovers the ports 34, the high portion of the cam will have passed from beneath the roller upon the valve stem, thus permitting the exhaust valve to close preparatory to or immediately before the next charge is received in the combustion chamber, said exhaust valve being assisted to its seat by the action of the spring 50.

In an engine constructed and operated, as set forth, more perfect exhaust of the residual burned gases is attained owing to the exhaust port being controlled by means other than the piston, as is the case in most instances, and the length of time which the same remains open, and in addition thereto the new charge not being admitted to the combustion chamber until immediately before the piston reaches its extreme upward position, commingling of the new charge with any residual spent gases, usually residing therein, is prevented, thus giving better combustion and consequent increase in power, which result is furthered by bringing the charge into the combustion chamber from opposite points to meet in the center, thereby causing the charge to move more rapidly and be more effectually diffused in the center of the chamber than otherwise. Furthermore, by placing spark plugs, one opposite the other in the combustion chamber, with like terminals of each grounded through the cylinder, and connecting the other like terminals to the ends of the secondary coil to form plural gaps or breaks in the circuit, together with the use of brushes connected direct in the primary circuit without grounding through the iron structure, it has been found that much better results are attained than otherwise.

By reducing the diameter of the piston between its heads, so as to form, with the surrounding chamber walls, a secondary compression and transfer chamber the engine is greatly simplified in structure, is more compact, etc.

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

1. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former, and a piston operating in the respective chambers the intermediate portion of which is of less diameter than its smaller head, adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, said combustion chamber being provided with ports adapted to communicate with said secondary compression chamber to transfer the charge to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the said combustion chamber, said primary and secondary chambers having

means of communication therebetween to permit the charge to pass from the former to the latter.

2. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former, and a piston operating in the respective chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber; said combustion chamber being provided with ports adapted to be opened by the piston to transfer the charge from the secondary compression chamber to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the said combustion chamber, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

3. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former and provided with an exhaust outlet, a piston operating in the respective chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber; a valve-controlling the exhaust outlet, means to actuate said valve, and plural igniting means in said combustion chamber, said combustion chamber being provided with ports adapted to be opened by the piston to transfer the charge from the secondary compression chamber to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the said combustion chamber; and said valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber; said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

4. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former and provided with an exhaust outlet, a piston operating in the respective chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber; a valve controlling the exhaust outlet, and independent means to actuate the said valve in opposite directions, said com-

bustion chamber being provided with ports in its walls adapted to be opened by the piston to transfer the charge from the secondary compression chamber to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the said combustion chamber, and said valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

5. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, a crank case connected to and forming an extension to the primary compression chamber, said combustion chamber being of less diameter than the primary compression chamber and provided with an exhaust chamber having a valve therein, a piston operating in the said combustion and primary chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, and means to actuate the exhaust valve, said secondary compression chamber having a valve controlled passage between the same and the primary compression chamber, said combustion chamber being provided with ports in its walls adapted to be opened by the piston to transfer the charge from the secondary compression chamber to said combustion chamber immediately before the piston reaches its extreme limit of stroke toward the combustion chamber, and said exhaust valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber.

6. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, a crank case connected to and forming an extension to the said primary compression chamber, said combustion chamber being of lesser diameter than the primary compression chamber and provided with an exhaust outlet, a piston operating in the said combustion and primary chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls to form a secondary compression chamber and convey the charge therein to the combustion chamber; a valve in said exhaust outlet, and means to operate said valve, said secondary compression chamber having a valve controlled passage between the same and the primary compression

chamber and being further provided with auxiliary ports controlled by the piston and adapted to communicate with the said secondary compression chamber for transferring the charge from the primary chamber thereto, said combustion chamber being provided with ports adapted to be opened by the piston to transfer the charge from the secondary compression chamber thereto immediately before the piston reaches its extreme limit of stroke toward the combustion chamber, and said valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber.

7. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former and provided with independent transfer and exhaust ports, a piston operating in the respective chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, a valve in the exhaust port, and means to operate said valve, the charge in said secondary compression chamber adapted to remain therein, preparatory to being transferred to the combustion chamber, until the piston has almost reached its extreme limit of stroke toward said combustion chamber, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

8. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former, and a piston operating in the respective chambers the intermediate portion of which is adapted, with the adjacent chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, said combustion chamber having means located in the path of and adapted to be opened by the piston to transfer the charge therein to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the same, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

9. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former, a piston operating in the respective chambers the intermediate portion of which is adapted, with the adjacent chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, and plural means

of igniting the charge arranged in said combustion chamber, said combustion chamber being provided with ports located in the path of and adapted to be opened by the piston to transfer the charge in the secondary compression chamber thereto immediately before the piston reaches its extreme limit of stroke toward the same, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

10. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former and provided with a valve controlled exhaust port, a piston operating in the respective chambers the intermediate portion of which is adapted, with the adjacent chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, and plural means of igniting the charge arranged in said combustion chamber, said combustion chamber being further provided with charge receiving ports located in the path of and adapted to be opened by the piston to transfer the charge in the secondary compression chamber thereto immediately before the piston reaches its extreme limit of stroke toward the same, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

11. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, a crank case connected to and forming an extension to the primary compression chamber, said combustion chamber being of lesser diameter than the primary compression chamber and provided with an exhaust outlet having a valve therein, a piston operating in the said combustion and compression chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, means to actuate the valve, and plural igniting means arranged in said combustion chamber, said combustion chamber being further provided with charge receiving ports arranged in the path of and adapted to be opened by the piston to transfer the charge from the secondary compression chamber to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the combustion chamber, and said valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber, said primary and secondary chambers having means of communication there-

between to permit the charge to pass from the former to the latter.

12. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, a crank case connected to and forming an extension to the said primary compression chamber, said combustion chamber being of lesser diameter than the primary compression chamber and provided with an exhaust outlet, a piston operating in the said combustion and compression chambers the intermediate portion of which is reduced in diameter and adapted, with the surrounding walls of the chambers, to form a secondary compression chamber and convey the charge therein to the combustion chamber, a valve in said exhaust outlet, means to operate the same, and plural igniting means arranged in said combustion chamber, said secondary compression chamber having a valve controlled passage between the same and the primary compression chamber and being further provided with auxiliary ports controlled by the piston and adapted to communicate with said secondary compression chamber for transferring the charge from the primary chamber thereto, said combustion chamber being provided with ports in the path of and adapted to be opened by the piston to transfer the charge in the secondary compression chamber thereto immediately before the piston reaches its extreme limit of stroke toward the same, and

said exhaust valve adapted to open the exhaust outlet immediately before the piston reaches its extreme limit of stroke in the opposite direction and remain open until immediately before the transfer of the charge to the combustion chamber.

13. In a gas engine, a cylinder forming a primary compression chamber and a combustion chamber, the latter of lesser diameter than the former and provided with plural igniting means therein, and a piston operating in the respective chambers the intermediate portion of which is adapted, with the chamber walls, to form a secondary compression chamber and convey the charge therein to the combustion chamber, said combustion chamber being provided with ports adapted to communicate with said secondary compression chamber to transfer the charge to the combustion chamber immediately before the piston reaches its extreme limit of stroke toward the said combustion chamber, said primary and secondary chambers having means of communication therebetween to permit the charge to pass from the former to the latter.

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

FREDERICK W. REEVES

Witnesses:

R. S. HARRISON,
D. B. OAKS.