W. S. THOMPSON.

VALVE FOR ROTARY GAS ENGINES.

APPLICATION FILED JUNE 1, 1911.

1,038,462. Patented Sept. 10, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

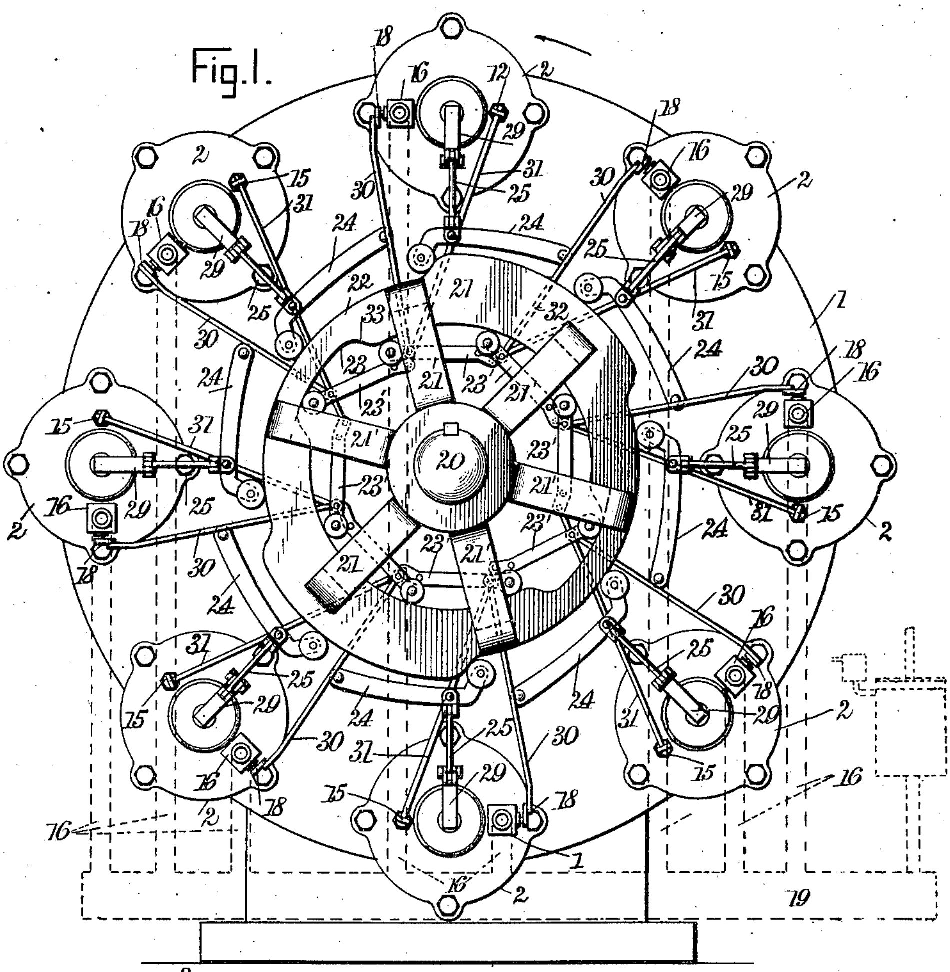
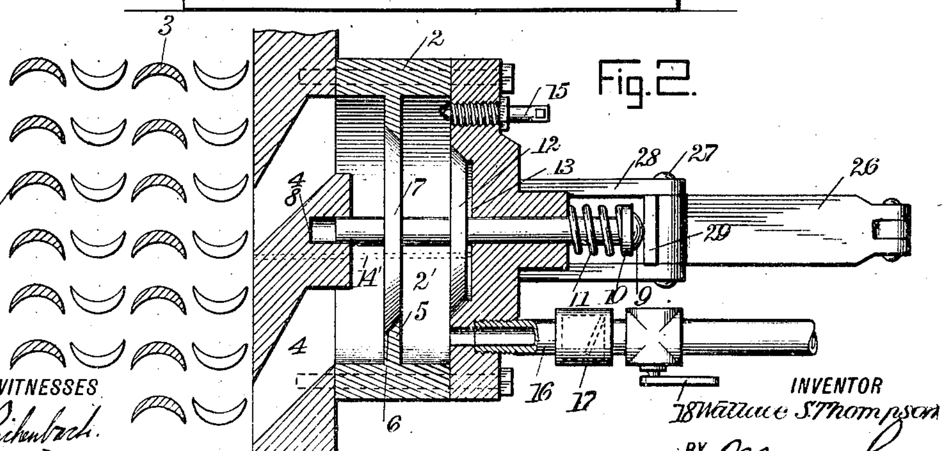


Fig. 2.



WITNESSES

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Fig. 3.

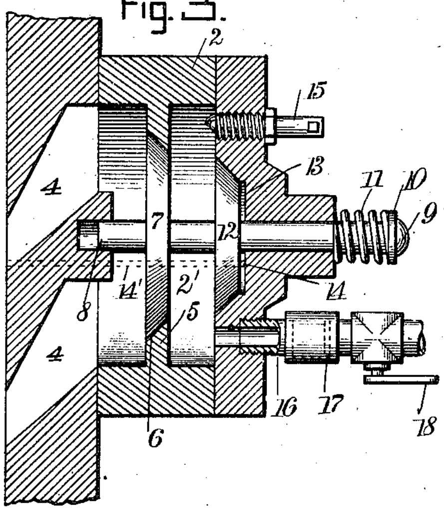


Fig. 4.

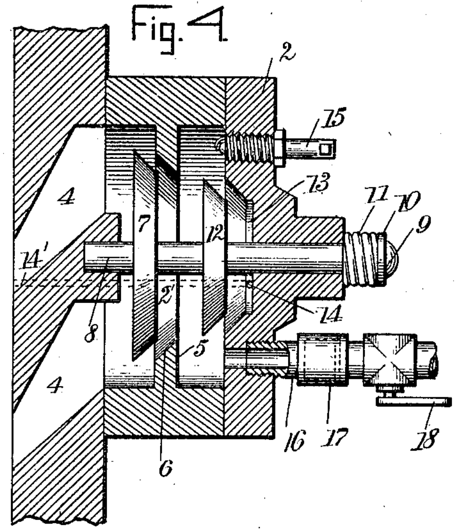


Fig. 5.

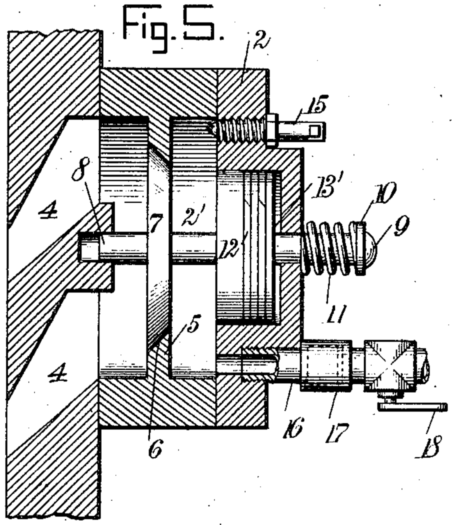
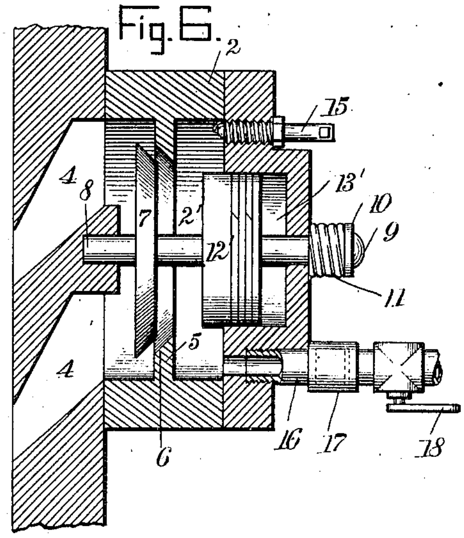


Fig. 6.



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UNITED STATES PATENT OFFICE.

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VALVE FOR ROTARY GAS-ENGINES.

1,038,462. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed June 1, 1911. Serial No. 630,675.

To all whom it may concern:

Be it known that I, WALLACE S. THOMPSON, a citizen of the United States, and a resident of Smyrna, in the county of Cobb and State of Georgia, have invented a new and Improved Valve for Rotary Gas-Engines, of which the following is a full, clear, and exact description.

My invention relates to a valve construction for rotary gas engines designed to facilitate the storing of the combustible mixture under pressure in the firing chamber before ignition, and the release of the same therefrom after ignition, to apply the power of the burning gases to produce rotary motion of the moving parts. To this end I make use of a suitable ignition chamber and a valve which normally closes said chamber when the combustible mixture is forced thereinto; and suitable mechanism automatically operated to open said valve as soon as the combustible mixture is fired, to allow the burning gases to flow out of the said chamber and do useful work.

Reference is to be had to the accompanying drawings forming a part of this specification, in which the same characters of reference indicate the same parts in all the views.

Figure 1 is a side elevation of a rotary gas engine, preferably of the turbine type, showing the casings forming the firing chambers, and the levers for actuating the valves in said casings; Fig. 2 is a longitudinal section through one of said chambers and part of the main casing adjacent thereto, showing the blades of the turbine wheel inside of the casing; Fig. 3 is a longitudinal section similar to that shown on Fig. 2, showing the controlling valve in closed position; Fig. 4 is a similar section, showing the valve in open position; and Figs. 5 and 6 are sections similar to Figs. 3 and 4, respectively, showing a modified form of valve construction.

On the drawings, 1 indicates the outer casing of a rotary combustion motor having mounted on one side thereof a number of cylindrical casings 2, closed at their outer ends, these casings being hollow inside to form combustion chambers 2′. The fuel supplied to these combustion chambers after being ignited flows out therefrom and acts against the turbine blades 3 of the motor after passing through one or more nozzles 4, passing through the side of the main casing 1 to which the valve casing 2 is secured. Each of the valve casings 2 has a transverse partition 5 inside of the same, in which is formed a central opening, the edge of which constitutes a suitable seat 6 for a controlling valve 7. This controlling valve 7 is fixed upon a reciprocating stem 8 mounted in a bearing in the side of the main casing between the nozzles 4, and passes out through the closed end of the casing 2. On the outer end of each of said stems is a head 9, which retains on the stem 8 a washer 10; and between this washer 10 and the closed end of the casing 2 is a spring 11, which is under compression to keep the valve 7 in closed position.

The stem 8 also carries between the valve 7 and the closed end of the casing 2 a disk or head 12 of somewhat smaller area than the disk or head. This valve 7 seats in a recess 13 formed on the inside of the closed end of the casing 2, the edge of the same being shaped to afford a snug fit to the edge of the head or disk 12. This recess is of course of greater depth than the thickness of the head or disk 12, and communicates through a port 14 with the inside of the casing 1, so that any gas which may be trapped in the recess 13 may pass out to be ignited with the body of the gases acting upon the turbine blades 3; a passage 14′ in the body of each valve casing 2, leading into the main casing 1.

Each of the valve casings 2 is provided with an ignition plug 15 of the make-and-break type, mounted in the end thereof to one side of the valve 12. Mixture is supplied to each of the chambers 2′ by a pipe 16 communicating with a port in the closed end of the casing, and this pipe 16 has a casing 17 which contains an automatically-operating check-valve to prevent the back flow of gases therethrough; and a supply valve 18, which is automatically operated by a moving part of the rotary motor to be opened at the proper time to allow combustible mixture to flow under pressure through the pipe 16 into the chamber 2′. Each of the pipes 16, as shown on Fig. 1, communicates with a header 19, from which leads a pipe, to a supply pump which forces the fuel through the pipe 16 to each of the combustion chambers 2′ in turn. The combustible mixture may be formed in any suitable way, and is raised by the pump to any suitable pressure, say ninety pounds per square inch, before being stored into the firing chambers 2′. An ordinary air pump having a carbureter attachment may be employed.

In the modification shown in Figs. 5 and 6, the parts are the same as those illustrated in Figs. 3 and 4, only the disk 12′ is cylindrical instead of frusto-conical, and the recess 13′ is truly bored out to form a dash-pot to receive the plunger valve 12′. No passage 14′ in this case is needed.

The valves 7, 12 and 18 and the igniter 15 are actuated by means of a suitable cam ring 21, having an external cam edge 22 and an internal cam edge 23, this cam ring being secured by radial arms 21′ to the main shaft 20 of the motor. Mounted on the casing 1, inside the inner circumference of the cam 21, is a number of levers 23′, there being one of these levers for each casing 2; and mounted on the side of the casing 1, to be actuated by the outer cam edge 22 of the ring 21, is an equal number of levers 24. Each of the levers 23 and 24 has rollers on one end to bear against the cam surfaces by which they are actuated, and each of the outer levers 24 is connected to a push-rod 25, which actuates a bell-crank 26, these bell-crank levers being mounted on the closed ends of the casings 2 to operate the valve 7 and the disk 12, or 12′, as the case may be. They are pivoted to bolts 27 mounted in lugs 28 at points nearer to the shaft 20 than the valve stems 8, and have arms 29 which engage the heads 9 on the outer ends of the valve stems, to actuate the same.

Each of the inner set of levers 23′ is connected at one end to a rod 30, which operates the valve 18, and at its other end to a rod 31, which operates the igniter 15, the levers being pivoted between the points of connection thereof to these two rods 30 and 31. The cam projections 32 on the outer edge of the cam ring 21 are two in number, so as to cause ignition to take place in two diametrically opposite ignition chambers at the same time; and the cam indentations 33 on the inner surface of the cam ring are also two in number and arranged about ninety degrees distant from the projections 32.

In operation, suppose the turbine be rotating in the direction of the arrow shown in Fig. 1, ignition will then take place in the upper and lower casings 2. The cam indentations 33 will be engaging the roller on the lever 23′, which actuates the supply valve for the next casing 2 at the left, so as to permit explosive mixture to flow into this casing at this time. The opposite end of this lever will be thrown toward the center of the shaft 20, pulling outward on the lever 31, which actuates the igniter 15. At the same time, the cam projection 32 will be lifting the lever 24, forcing the push-rod 25 upward to actuate the bell-crank 26, and open the valve 7 and disk 12. The valves are normally not opened until after the igniter 15 has been actuated to start the combustion, so that when the burning mixture flows out through the nozzles 4, its pressure will have been greatly increased when the force of the burning gases is exerted against the turbines 3.

On account of the area of the valve 7 being greater than the disk 12, no damage can result, even should the bell-cranks not be actuated at the proper moment to open communication from the ignition chamber to the nozzles 4, because, as soon as the pressure of the burning gases reaches a certain point, the excess pressure on the inner face of the valve 7 over the total pressure on the opposed face of the disk 12 will be great enough to overcome the spring 11, so as to force the valve and disk open independently of the actuating mechanism controlled by the cam 21. As the rotation of the turbine continues, carrying the cam ring 21 with it, the valves in each two diametrically opposite casings 2 will be actuated in turn, so that the force of the burning gases will be exerted always on opposite sides of the turbine blades to give the greatest amount of turning effect.

As stated above, the cam indentations 33 being in advance of the cam projections 32, the supply valves 18 of the casings 2, in which the combustion is next to take place, are always actuated just about the time that the valve 7 and disk 12 are opened, and the igniter 15 operated in the two casings in which the combustion is under way. Suitable spring means will of course be provided to keep the roller ends of the arms 23′ and 24 in constant contact with the inner and outer edges of the cam ring 21.

I may of course use any suitable form of governor attachment to control the supply valves 18, and I may also use a governing arrangement to produce ignition first in one pair of the combustion chambers 2′, then in two pairs, and then in three pairs, until all of these combustion chambers are in operation, according to the load on the engine. By connecting a governor to the inlet valve 18, not only the quantity of the mixture supplied to each of the chambers 2 will be regulated, but the pressure also, for the pump supplies the mixture at constant pressure, and if a smaller volume of this gas be supplied to the chamber 2, the capacity of which is constant, the pressure thereof would fall off in consequence.

The compression pump which supplies mixture can be driven direct from the engine or from some outside source. I prefer to employ a small storage tank or reservoir, connecting the same between the pump and the motor, and if need be, the header 19 can be made to have sufficient capacity for this purpose.

It will be observed that the pressure of the compressed mixture inside of the chambers 2′ is exerted oppositely on the valve 7 and disk 12, or 12′, as the case may be. This produces a balanced valve construction, and on account of the greater pressure on the inner face of the valve 7, this valve always tends to open, and is held shut by the spring 11. Consequently, but little power is required to operate the bell-crank levers 26 to overcome the spring 11 and release the mixture after the same has been ignited.

Referring to Figs. 3 and 4, it will be noted that the moment the excess pressure on the inner face of the valve 7 causes the valve to open, the burning gases will rush through the nozzles 4, and the pressure will instantly become uniform on both faces of the valve 7 and the head or disk 12. Under such conditions the spring 11 would cause the valve 7 to return to its seat, but the operating levers 9 prevent this by holding the valve 7 open as long as is necessary to allow the gases of combustion to pass out of the chamber 2′. The same mode of operation practically controls the operation of the modification shown in Figs. 5 and 6. When the valve 7 opens in this form, the pressure on both faces thereof is equalized, and the disk 12′ can be forced back into the bore 13′, the pressure of the gases cooperating with the spring 11 to tend to move the parts in this way. The operating levers, however, prevent the valve from closing until at the required moment.

It will be observed from the above description that by means of my improved valve the principle of compression can be advantageously applied to a gas turbine. In most turbines of the internal combustion type, gas and air are simply pumped into a combustion chamber, where it is ignited and from which it flows in a steady stream through a nozzle or nozzles against the turbine wheel, this nozzle being opened at all times making compression in the chamber before firing impossible.

By means of my invention the mixture can be given almost any desired degree of compression within practicable limits in the combustion chamber, and instantly released after the same is ignited, to flow into the main chamber and set the motor in rotation. The motor runs very smoothly, with little vibration, even if of the impulse type, and the gases expand almost down to atmospheric pressure before passing out through the exhaust.

The igniters 15 may be of any suitable make-and-break type; the ones shown on the drawings are intended as diagrammatic illustrations of igniters in which a movable electrode reciprocates back and forth into and out of contact with a fixed electrode, the movable electrode being operated for this purpose by means of a cam formed on the ends of the reciprocating rods 31.

I wish it to be understood that I may make such changes in the shape, size and arrangement of parts as fairly fall within the scope and nature of my invention.

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

1. In a rotary gas engine, the combination of a main casing having a passage through its wall, a casing carried by said main casing and inclosing a combustion chamber, a valve controlling communication between said combustion chamber through said passage to the inside of said main casing, a disk rigidly connected to the first-named valve and of smaller area than the same, said disk seating against the inner wall of the combustion chamber for the purpose of partly balancing the outward pressure on the valve, means for supplying combustible mixture to said combustion chamber, and means for actuating the valve to open communication between the combustion chamber and the interior of the main casing after the mixture is ignited.

2. In a rotary gas engine, the combination of a main casing having a passage in its wall, a casing mounted on said main casing and adapted to communicate with same through said passages, said second-named casing inclosing a combustion chamber, a valve mounted within said second-named casing to control communication between said combustion chamber and the inside of the main casing through said passage, a stem on which said valve is mounted, said stem passing through the wall of the casing inclosing the combustion chamber, a recess concentric with said stem formed on the inner face of said wall, a disk mounted rigidly upon said stem and seating against the edge of said recess, said disk being of smaller diameter than the inner face of the valve, means for supplying combustible mixture under pressure to said combustion chamber, said mixture under pressure acting in opposite directions on the opposed faces of said valve and disk, and means engaging the outer end of said valve stem to actuate the same after the combustible mixture has been fired to open communication between the combustion chamber and the main casing to allow the burning gases to flow into said main casing.

3. In a rotary gas engine, the combination of a main casing having a passage in its wall, a casing mounted on said main casing and adapted to communicate with same through said passage, said second-

named casing inclosing a combustion chamber, a valve mounted within said second-named casing to control communication between said combustion chamber and the inside of the main casing through said passage, a stem on which said valve is mounted, said stem passing through the wall of the casing inclosing the combustion chamber, a recess concentric with said stem formed on the inner face of said wall, a disk mounted rigidly upon said stem and seating against the edge of said recess, said disk being of smaller diameter than the inner face of the valve means for supplying combustible mixture under pressure to said combustion chamber, said mixture under pressure acting in opposite directions on the opposed faces of said valve and disk, a head on the outer end of said valve stem, a spring between said head and the outside of the second casing to hold said valve and disk to their seats, and means engaging the outer end of said valve stem to actuate the same after the combustible mixture has been fired to open communication between the combustion chamber and the main casing to allow the burning gases to flow into said main casing.

4. In a rotary gas engine, the combination of a main casing having a passage through its wall, a casing inclosing a combustion chamber mounted upon said main casing and adapted to communicate with the inside of the main casing through said passage, a valve mounted upon a reciprocating stem controlling said communication, said stem passing outward through the wall of said combustion chamber, a disk mounted upon said stem and having a seat in a recess formed on the inner surface of said combustion chamber, said disk being of smaller area than said valve, a passage adapted to establish communication with said recess beyond said disk and the interior of the main casing, means for supplying combustible mixture to said combustion chamber under pressure, said combustible mixture acting oppositely on the faces of the valve and disk, and means actuated by the engine to engage the outer end of said valve stem to move said valve and disk to open position.

5. In a rotary gas engine, the combination of a valve casing inclosing a combustion chamber, a main casing upon which said valve casing is mounted, a passage in the wall of said main casing adapted to communicate with the interior of the valve casing, a valve in said valve casing for controlling said communication, a cylindrical disk rigidly mounted to move in unison with the valve, a recess formed inside of the valve casing to receive said cylindrical disk, means for supplying combustible mixture to said combustion chamber, and means connected to said valves and extending through the wall of the valve casing to be operated by the engine to move said valves to open position.

6. In a rotary gas engine, the combination of a main casing, a casing inclosing a combustion chamber carried by said main casing, said main casing having a passage in its wall adapted to communicate with the combustion chamber, a valve in said combustion chamber to control said communication, a stem to operate said valve extending through the wall of said combustion chamber, a disk of smaller area than said valve, mounted on said stem and seating against the edge of a recess formed on the inside of the combustion chamber, an igniter mounted in the wall of said combustion chamber and having its electrodes located inside of said combustion chamber, means for supplying combustible mixture under pressure to said combustion chamber, means for actuating said igniter to ignite said mixture, and means engaging the valve stem to move said valve and disk to open position to permit the mixture after ignition to flow into the main casing to operate the motor.

7. In a rotary gas engine, the combination of a main casing, having passages formed in its wall, a plurality of valve casings carried by said main casing, each of said valve casings inclosing a combustion chamber, said combustion chambers being adapted to communicate with the inside of the main casing through said passages, said valve casings being oppositely mounted on said main casing, a balanced valve in each of said valve casings, a stem on which said balanced valve is mounted, said stem extending through the wall of each of said valve casings and being engaged by a spring at its outer end to hold said valve in closed position, a conduit for supplying combustible mixture to the interior of each of said valve casings, valve means controlling said conduit, an igniter mounted in the wall of each of said valve casings, a plurality of links and levers to actuate the igniters, the valves in the supply conduit and the stems of the balanced valves, and cam means carried by the engine to operate the links and levers, whereby, after the mixture in each valve casing has been ignited, the balanced valve will be opened to permit the burning gases to flow therefrom into the interior of the main casing.

8. In a rotary gas engine, the combination of a main casing, having passages formed in its wall, a plurality of valve casings carried by said main casing, each of said valve casings inclosing a combustion chamber, said combustion chambers being adapted to communicate with the inside of the main casing

through said passages, said valve casings being oppositely mounted on said main casing, a balanced valve in said valve casing, a stem on which each balanced valve is mounted, said stem extending through the wall of each of its valve casings and being engaged by a spring at its outer end to hold said valve in closed position, a conduit for supplying combustible mixture to the interior of each of said valve casings, valve means controlling said conduit, an igniter mounted in the wall of each of said valve casings, a plurality of links and levers to actuate the igniters, the valves in the supply conduit and the stems of the balanced valves, the mechanisms for operating the balanced valves being connected to an outer set of levers and the links for operating the valves in the supply conduits and the igniters being connected to a set of levers disposed inside of the first set on the side of the main casing, and a cam ring having means on its inner and outer edges for engaging said levers to operate the supply valves to admit combustible mixture, and subsequently to operate the igniters to fire the same, and last to open the balanced valves to permit the burning gases to pass out of the combustion chambers into the main casing.

9. In a rotary gas engine, the combination of a main casing, a plurality of valve casings, each containing a combustion chamber, carried by said main casing, there being passages in the wall of said main casing adapted to communicate with said combustion chambers, a plurality of supply pipes, one being connected to each of said combustion chambers to supply combustible mixture thereto under pressure, and a header of suitable capacity, to which said supply pipes are connected.

10. In a gas engine, the combination of a main casing, a casing carried thereby and inclosing a combustion chamber communicating with the interior of the main casing, a valve controlling communication between the combustion chamber and the main casing, a disk rigidly connected to the valve and of smaller area than the same, said disk seating against the inner wall of the combustion chamber for the purpose of partly balancing the outward pressure on the valve when the explosive mixture in said combustion chamber is ignited, and means for supplying a combustible mixture to said combustion chamber.

11. In a gas engine, the combination of a main casing, a pair of valve casings mounted thereon and communicating with the interior of the main casing, means in said valve casings for controlling said communication, combustible mixture supply means and ignition means communicating with said valve casings, means for simultaneously opening the combustible mixture supply means of one casing and operating the ignition means of the other casing, and means for subsequently operating the controlling means of said other valve casing.

12. In a gas engine, the combination of a main casing, a pair of valve casings carried thereby and communicating with the interior of the main casing, means for controlling such communication mounted in each of said valve casings, means for operating the controlling means from the exterior of the valve casings, combustible mixture supply means and ignition means communicating with the interior of each of said valve casings, a lever pivoted intermediate its length and connected at one end to the inlet of the combustible mixture supply means of one casing and at its other end to the ignition means of the other casing, means for operating said lever to open the supply means of one casing and to operate the ignition means of the other casing simultaneously, and means carried by said last-named means for subsequently operating the controlling means of the other valve casing.

13. In an internal combustion engine, the combination of a casing forming a combustion chamber, means for supplying combustible mixture thereto, means for igniting said mixture, a valve for controlling the exit of said ignited mixture from said chamber, and a disk rigidly connected to said valve and of smaller area than the same and engaged by the inner wall of the combustion chamber for the purpose of partly balancing the outward pressure of the valve when the combustible mixture in the chamber is ignited.

14. In an internal combustion engine, the combination of a main casing, a casing forming a combustion chamber communicating with the main casing, a valve controlling said communication, said valve having an inclined edge seating against a correspondingly-formed seat in a wall of said combustion chamber, and a disk rigidly connected to the valve and of smaller area than the same, said disk likewise having an inclined edge seating against a correspondingly-formed seat in the wall of the combustion chamber opposite the first-named wall.

15. In an internal combustion engine, the combination of a casing forming a combustion chamber, means for supplying combustible mixture to said chamber, means for igniting said mixture, a valve controlling the exit of said ignited mixture from said chamber, and a disk rigid with said valve and of smaller area than the same, and seating against the inner wall of said combustion chamber, said chamber having a duct formed therein to permit the pressure of

said mixture after leaving said combustion chamber to be applied to the unexposed face of said disk.

16. In an internal combustion engine, the combination of a casing forming a combustion chamber, means for supplying combustible mixture to said chamber, means for igniting said mixture, a valve having an inclined edge engaging a correspondingly-formed seat in a wall of said combustion chamber, and a disk rigid with said valve and having a flaring inclined edge engaging a correspondingly-shaped seat formed in the wall of the combustion chamber opposite the first-named wall, said casing having a duct therein to permit the pressure of the combustible mixture after leaving the said chamber to be applied to the unexposed face of said disk.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WALLACE S. THOMPSON.

Witnesses:

J. W. JACKSON,

J. R. LESTER.