W. F. STERN.

ROTARY GAS ENGINE.

APPLICATION FILED APR. 29, 1911.

1,077,314.

Patented Nov. 4, 1913.

2 SHEETS—SHEET 1.

FIG 1

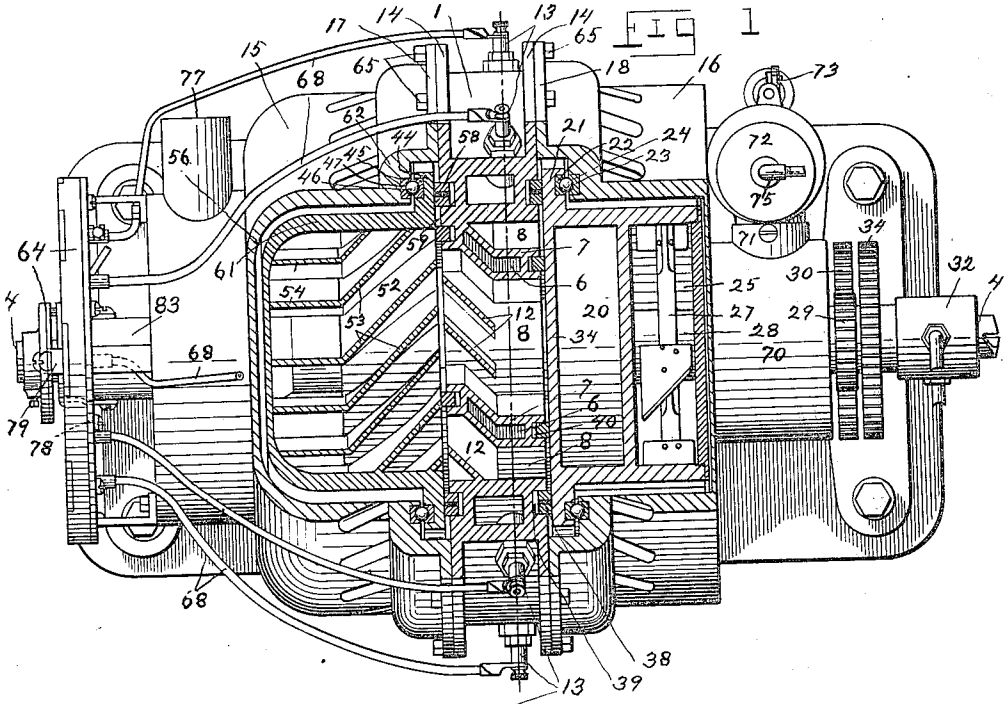
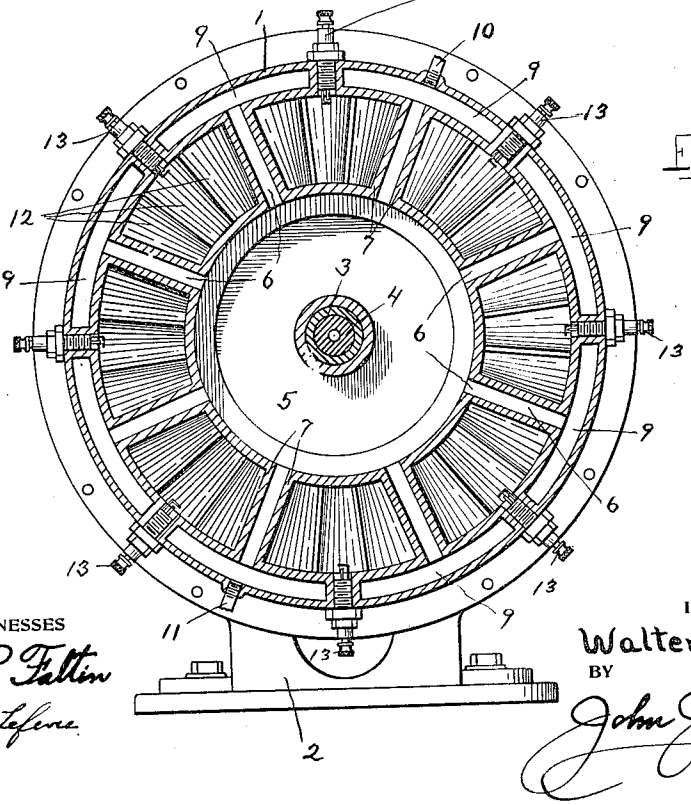


FIG 2



WITNESSES

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FIG 3

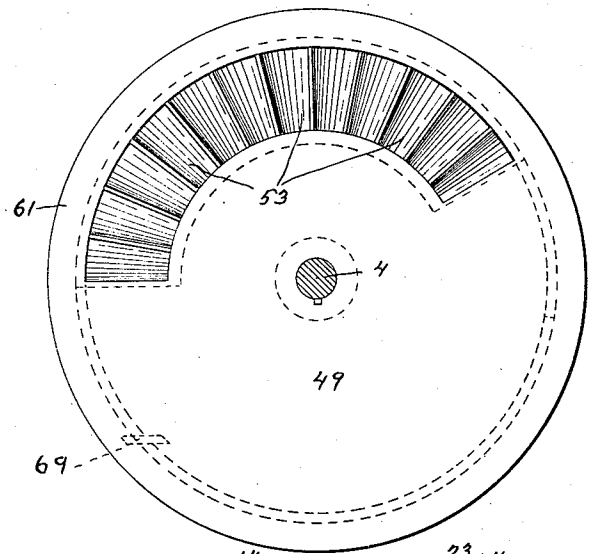
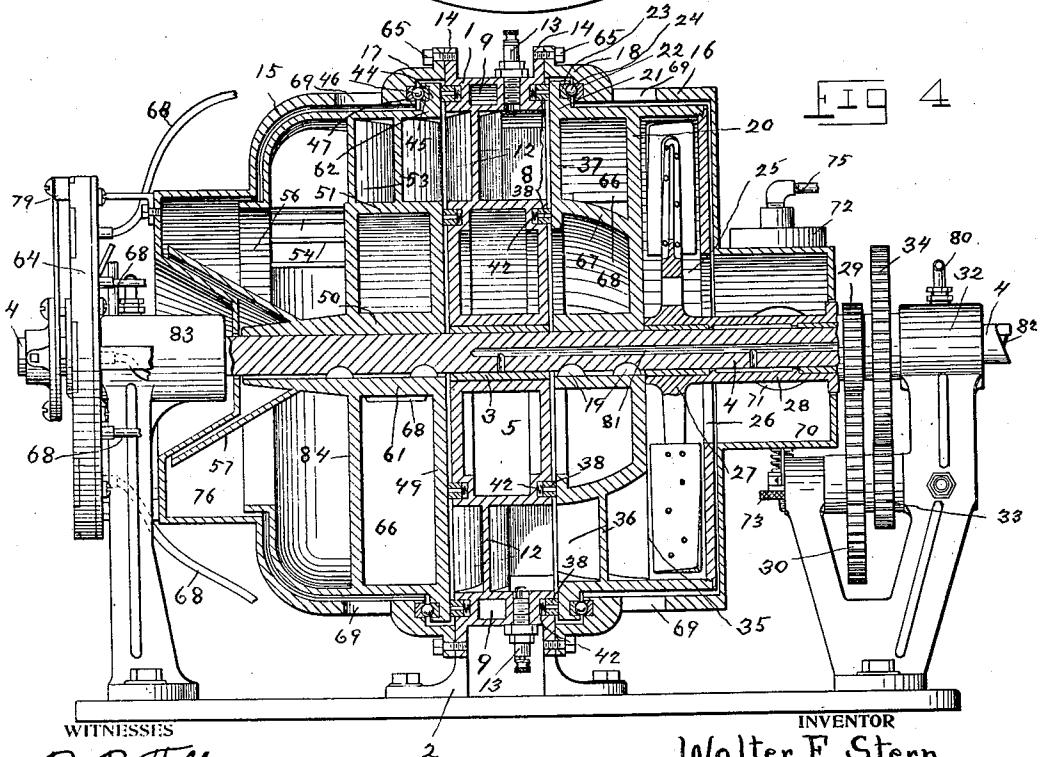


FIG 4



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UNITED STATES PATENT OFFICE.

WALTER F. STERN, OF GAP, PENNSYLVANIA, ASSIGNOR TO STERN MANUFACTURING COMPANY, A FIRM COMPOSED OF WALTER F. STERN, JOHN A. SHANK, AND SAMUEL J. SHANK, ALL OF LANCASTER, PENNSYLVANIA.

ROTARY GAS-ENGINE.

1,077,314. Specification of Letters Patent. Patented Nov. 4, 1913.

Application filed April 29, 1911. Serial No. 624,208.

To all whom it may concern:

Be it known that I, WALTER F. STERN, a citizen of the United States, residing at Gap, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to a gas engine of that type known as rotary or turbine engines, in which a circular rotating bladed member or rotor is secured to the main driving shaft which it rotates by the impulses received from successive charges of gas which are compressed by a similar circular rotating member secured to and driven by the same driving shaft, said circular members being secured upon said shaft in proper relation to each other and upon either side of a stationary circular member containing a series of explosion chambers, arranged in such a manner that the gas as compressed by one revolving member enters consecutively the explosion chambers, where at the proper instant, it is exploded against the bladed portion of the other revolving member.

The object of the invention is to provide means for utilizing all the energy of the ignited and expanded gas, to save fuel, to use to clean the chambers at each firing.

Another object of the invention is to provide an engine of this class that shall be smooth running, having a constant torsion, generate a maximum amount of power for a given quantity of fuel, be simple of action, light and durable, and especially adaptable for use in connection with automobiles, marine purposes and flying machines.

Still another object of the invention is to construct an engine of this type comprising only three moving parts and having no valves or cams.

With these and other objects in view, my invention consists in certain construction and combination of parts as will hereinafter be fully described and claimed in the annexed specification, and illustrated in the accompanying drawings, which form a part of this application, and in which like figures of reference refer to corresponding parts in all of the views; but it is fully understood that while I have here described my invention as shown, that I do not confine myself to the exact design, as slight changes may be made in the construction and arrangement of the several parts without departing from the spirit of the invention.

The subject of the present invention and of this application is to cover broadly the construction and design of my engine, and particularly the construction and arrangement of the explosion chamber member, and the impulse driving member or rotor; the detailed construction and operation of my novel form of compression mechanism, and by my novel form of mechanism for controlling and timing the explosions, and fuel feed form the subject of companion applications Serial No. 624,209, filed April 29, 1911, and Serial No. 623,245, filed April 29, 1911, respectively, as these devices may be employed with other styles of rotors, and therefore constitute separate inventions.

Referring to the drawings:—Figure 1, is a top plan view of an engine embodying my design, shown partly in section to expose the working parts. Fig. 2, is a cross-section through the center of the explosion chamber. Fig. 3, is a detail end view of the impulse driving member or rotor. Fig. 4, is a longitudinal vertical sectional view, taken through the center.

The construction shown in the drawings comprises a stationary circular ring-shaped double walled member 1, provided with a standard or base 2, or other suitable attaching or mounting means, and is formed with a central axial bearing 3, within which is rotatably mounted the driving shaft 4, which also has its ends supported in the bearing brackets 33, and 32; said central bearing or hub 3, is surrounded by a circular water-chamber 5, which communicates by the ducts 6, which are formed in the walls 7, (which separate the explosion chambers 8, from each other) with a surrounding outer water-jacket 9, which is provided with an inlet pipe 10, and an outlet pipe 11, connected to a suitable water supply to give a continuous circulation for the purpose of cooling the explosion chambers. The explosion chambers 8, are here shown as eight in number, but any desired number may be employed; and the dividing walls 7, extend straight or parallel to the shaft 4, from the intake side of the member 1, for

about one-half of the thickness of said member 1, and then extend at an angle of about forty-five degrees toward the outlet side of said member 1; and said chambers 8, upon their outlet sides, are each provided with the deflectors 12, for guiding the exploded charge, and each of said chambers 8, is also provided with a suitable spark-plug 13, for exploding the charge and which is connected by the wires 68, to a commutator 64, which forms the subject of a separate application, Serial Number 624,209 filed April 29, 1911. Said member 1, is also formed with the encircling peripheral flanges 14, upon both faces thereof, to which are secured by the bolts 65, the casing members 15, and 16, by their flanges 17, and 18.

Within the casing 16, and rigidly secured upon the shaft 4, by the keys 19, and adjacent to the intake side of the member 1, is mounted the rotating compression member 20, which is formed on its periphery with the flange 21, which is provided with a ball race 22, coacting with a ball race 23, formed in the flange 18, of the casing 16, and provided with the balls 24, forming a frictionless bearing for said member 20, to revolve upon within said casing 16. Said compression member 20, is provided with a compartment 25, having a central intake opening 26, in the end thereof, and surrounding the shaft 4; and within said compartment 25, is mounted a radial bladed combined suction and forcing fan 27, which is secured upon a sleeve 28, which is rotatably mounted on the shaft 4; and which extends out through the end of the casing 16, and which is adapted to be rotated by a pinion 29, secured on the end thereof; said pinion 29, being driven by a gear 30, which is rotatably mounted on a shaft 31, secured in the bearing bracket 32; said gear 30, being integral with a pinion 33, which is, in turn, driven by a gear 34, which is keyed to the shaft 4, and adjacent to the pinion 29; said train of gears as here shown being of such ratio, that the suction fan 27, will make four revolutions to one revolution of the compression member 20, and this ratio may be varied as desired. The compression member or ring 20, has a fan-shaped opening 35, extending from side to side of said member 20, and for about one-third of its circumference; and this opening 35, is provided with stationary dividing shutters 36, set at an angle of about forty-five degrees, for the purpose of breaking up and mixing the charge of gas as it is forced through the opening 35, by the fan 27, the remaining portion of the compression member 20, having the side wall 37, which affords a temporary side for the explosion chambers 8, during the period of explosion, as will hereinafter be more fully explained.

Between the explosion member 1, and the retaining compression member 20, is placed a gasket or packing ring 38, which is set into the grooves 39, and 40, and the connecting radial grooves 41, formed in the walls 7, in the face of the member 1; said gasket 38 being retained in a gas-tight contact with the face of the compression member 20, by a series of compression springs 42, placed behind the same in the grooves 39, 40, and 41; and the lubrication of the wearing surface of said gasket 38, is effected by a series of graphite or other suitable plugs 43, placed in the surface of said gasket 38. The impulse receiving member or driving rotor 61, is also keyed upon the shaft 4, upon the other or outlet side of the member 1, and is formed with a similar bearing flange 44, ball race 45, and balls 46, running in a corresponding race 47, formed in the flange 62, of the casing 16. Said driving rotor 61, is formed with the end wall 49, and the inner wall 84, which are connected together by the hub 50, and the wall 51; said rotor 61, being also formed with a fan-shaped opening 52, extending through the same, near the periphery thereof, and extending for about one-third of its circumference; said opening 52, being provided with a series of curved blades 53, which are set at an angle and extend downward by the side of the outer wall 49, and which are designed to receive the impact of the exploding gas from the explosion chambers 8, and thus be rotated thereby; said exploded gas being then expelled by the curved ends 54, of said blades 53, into the chamber 55, and then out of the exhaust port 56, formed in the casing 16; a cone-shaped deflector 57, being employed to keep the gas from the bearings of the shaft 4, the wall 48, serving as a temporary side for the explosion chambers during the period of compression, and being timed to move out of the way of the force of the explosion at the instant of the ignition of the charge, so that the full force of the exploding charge will be against the blades 53, which have taken the place of said wall 48. Between the adjacent surfaces of the member 1, and the rotor 61, is also placed a gasket 58, similar to the gasket 38, and retained in a like manner in the groove 59, and under compression of the springs 60.

The cooling of the compression member 20, and the rotor 61, is effected in the following manner:—Between the inner and the outer walls of said members is formed a compartment 66, which extends entirely around said members, except where closed off from the opening 35, by the wall 67; the outer walls of these compartments which are also the periphery walls of the members 20, and 61, are provided with one or more openings 88, through which air will circulate from the space between said members 20, and 61, and their respective casings 15, and

16; said casings 15, and 16, being formed with a series of openings 69, for the admission of said air. The end of the casing 16, is provided with an intake chamber 70, opening into the compartment 25, in the member 20; and is formed with an intake port 71, to which is connected a carbureter 72, provided with an adjusting means 73, and a controlling means 74, and fed by a feed pipe 75, from the fuel tank (not shown). The casing 15, is formed with an outlet chamber 76, formed with an exhaust port 77, to which may be attached a muffler, if desired, and to the outer end of said casing 15, is secured the stationary member 64, of a commutator, which coacts with a timing movable member 78, and a contact arm 79, which is secured to and rotated by the shaft 4, but a detailed description of said commutator or cylinder cut out device is not deemed necessary, as this forms the subject of a separate application.

Any suitable method for the lubrication of the shafts may be employed, and I have here shown the outer ends of the shaft 4, as being directly lubricated from a drip pipe 80, leading from an oil receptacle or mechanical feeder; while the central bearing 3, and the sleeve bearing 28, are supplied by an oil duct 81, in the shaft 4.

The operation of the device is as follows:—An electric ignition current having been applied and the shaft 4, rotated by the use of a hand crank applied to the ratchet end 82, to give the revolving parts sufficient momentum to start their operation. The fan wheel 27, being geared to revolve at four times the speed of the rotor 61, and compression member 20, (all rotating in the same direction) the proper mixture of gas and air as regulated by the carbureter is admitted through the intake port 70, into the chamber 25, and is exhausted from the chamber 25, by the fan 27, and thence is forced by the same fan into the opening 35, in the compression ring; the blades 36, in said opening of the ring 20, forcing the mixture into the explosion chambers 8, in the stationary member 1, and compressing the charge into said chambers 8, which are closed by the wall 48, of the rotor 61. The rotor 61, and the compression member 20, being set with their open bladed spaces in proper relation to each other; as they are revolved, the charge is compressed in each consecutive explosion chamber 8, the wall 48, of the rotor 61, forming a side to the explosion chamber 8, during compression, and as soon as compression is completed, the wall 48, of the compression member 20, closes the other side of said explosion chamber 8, and at the instant of ignition, the bladed space 52, of the rotor 61, reaches the explosion chamber 8, and receives the impact of the exploded charges, which passes through the blades 53, and out of the exhaust 56; this operation being repeated for each of the explosion chambers, each charge being ignited in turn, unless cut out by the timing means, in which case, the charge is released through the exhaust without ignition.

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

1. In a rotary gas engine of the class described, a stationary member formed with a series of explosion chambers arranged in a circle, a driving shaft rotatably mounted in said stationary member in axial relation thereto, a rotating compression member secured upon said shaft adjacent to one side of said stationary member, an impulse receiving rotor secured upon said shaft adjacent to the other side of said stationary member, casings secured to both sides of said stationary member and inclosing both of said rotating members, means for drawing in and compressing the charge, said impulse receiving rotor formed with a side wall providing a temporary wall on the exhaust side of said explosion chambers during the period of compression, and said compression member formed with a side wall providing a temporary wall on the intake side of the explosion chambers during the period of ignition.

2. In a rotary explosive engine of the class described, comprising a stationary member formed with a series of explosion chambers, each being provided with ignition means, a driving shaft rotatably mounted in said stationary member, a rotating compression device mounted on and driven by said shaft and adapted to compress the charge in said explosion chambers, a fan rotatably mounted on said shaft and driven at a greater speed than the speed of said shaft and adapted to deliver the explosive mixture to said compression device, a rotor mounted on said shaft and adapted to receive the impact of the ignited charges from the explosion chambers and be driven thereby and to drive said shaft, means for cooling said explosion chamber by a circulation of water, and means for cooling said compression device and said rotor by an air current actuated thereby.

3. In a rotary explosive engine of the class described, comprising a stationary circular member, formed with a series of explosion chambers open on both sides, each of said explosion chambers provided with a series of stationary blades, a fuel charge compressing member rotatably mounted upon one side of said stationary member and adapted to compress the fuel into said chambers, an impact wheel rotatably mounted upon the other side of said stationary member, said impact wheel formed with an opening through the side thereof, stationary blades

mounted in said opening at right angles to the blades of said explosion chambers and adapted to receive the impact of the exploding charges for the purpose of rotating said impact wheel, said impact wheel providing a temporary wall for said explosion chambers during the period of compression, said compression member providing a temporary wall for said explosion chambers during the period of ignition.

4. In a rotary gas engine of the class described, having a stationary member formed with a series of explosion chambers, double walls formed with water ducts and separating said chambers, a central axial bearing, a main driving shaft rotatably mounted in said bearing, said member formed with a central water chamber and an outer water chamber communicating with each other by said ducts, stationary blades secured in said explosion chambers and adapted to guide the exploded charge, each of said chambers also provided with ignition means for exploding the charge, casings secured upon both sides of said stationary member, one of said casings formed with an intake chamber, having a carbureter attached thereto, the other casing formed with an exhaust port, a bladed suction and forcing fan mounted in one of said casings adjacent to the intake chamber and adapted to draw the gas from the carbureter, a compression member mounted on the driving shaft and rotated thereby, within said casing between said bladed fan and said stationary member and adapted to receive the gas from the fan and compress the same within the explosion chambers, means for providing a temporary wall for said explosion chambers during the period of compression, means for receiving the impact of the exploding charges and rotating the driving shaft thereby, and means for making a gas-tight connection between said compression member and said stationary member, and between said stationary member and the shaft driving means.

5. A compression means for rotary gas engines comprising in combination with a stationary member formed with a series of explosion chambers, each provided with ignition means, and a driving shaft rotatably mounted in axial relation to said stationary member, a compression member secured upon said shaft adjacent to said stationary member, and adapted to be rotated by said shaft, said compression member formed with spaced side walls joined together by a hub and a rim, and having an opening extending through the sides thereof, blades secured within said opening and set at an angle, a suction and forcing fan mounted adjacent thereto and adapted to deliver gas to said bladed opening in said compression member whereby it is compressed into the explosion chambers, means for providing a temporary side wall for said explosion chambers during the period of compression, and means for providing a temporary side wall for said explosion chamber during the period of ignition.

6. A compression device for rotary gas engines comprising in combination with a stationary member having a series of explosion chambers formed therein communicating with a rotating shaft driving member, and a casing secured to said stationary member and provided with a carbureter, a rotating compression and suction fan mounted upon the driving shaft, within said casing and adapted to draw the gas from said carbureter, a double walled compression ring mounted within said casing upon and driven by said shaft and formed with a fan-shaped opening in the walls thereof, compression blades secured in said fan-shaped opening adapted to receive the gas from the fan and compress the same into the explosion chambers, and means for providing a temporary side wall for said explosion chambers during the period of ignition.

7. A fuel compressing device for rotary gas engines comprising in combination with an explosion chamber and a driving rotor to receive the impulses from the charge exploded in said chambers, a rotatable compression wheel mounted adjacent to said explosion chambers and formed with a transverse opening in the body thereof, fixed blades mounted in said opening and adapted to force and compress the charge of fuel in said explosion chambers, means carried by said compression wheel for producing a temporary side for said explosion chambers during the period of ignition, and means for supplying fuel to said compression wheel.

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

WALTER F. STERN.

Witnesses:
WM. J. COULTER,
JOHN J. THOMPSON.