March 4, 1924. 1,485,591

F. A. BULLINGTON

ROTARY ENGINE

Filed Oct. 20, 1919 2 Sheets-Sheet 1

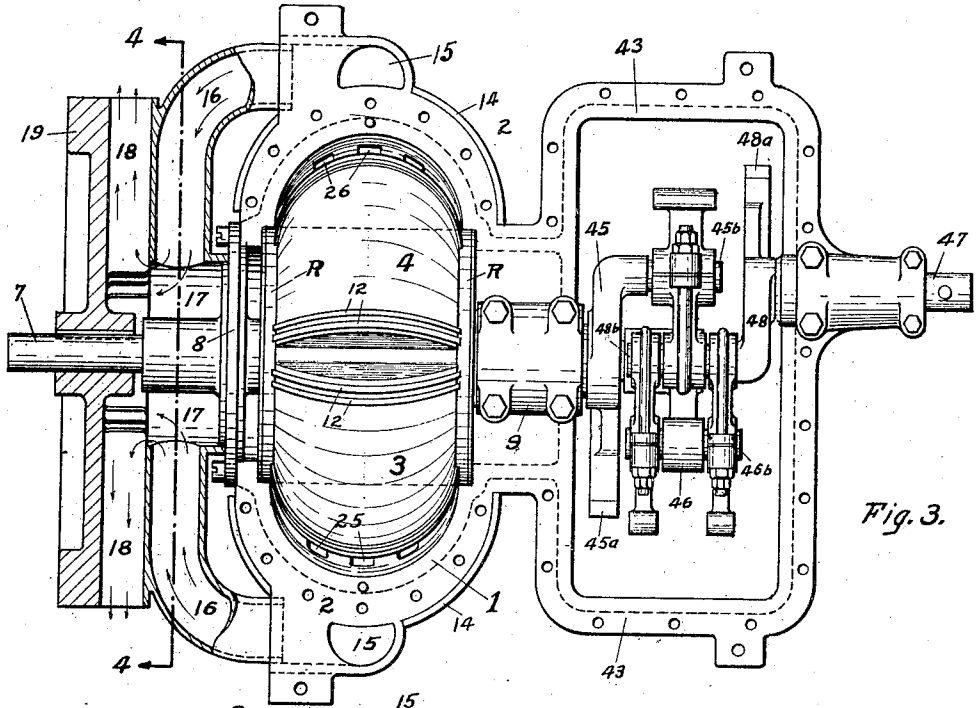


Fig. 3.

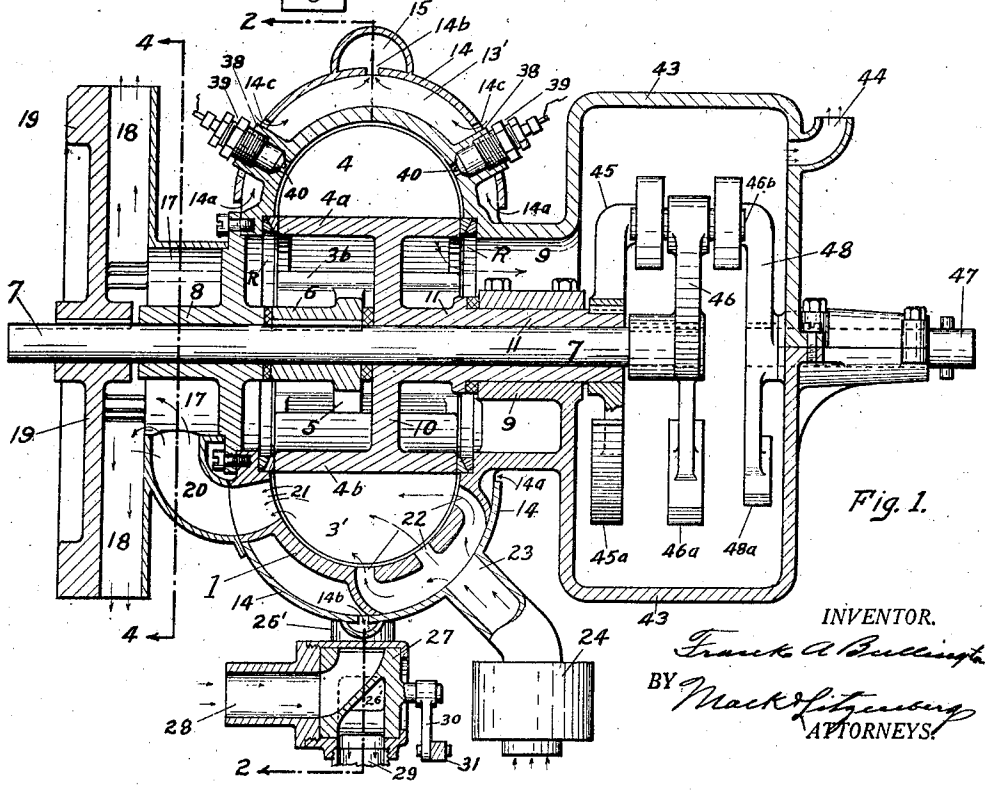


Fig. 1.

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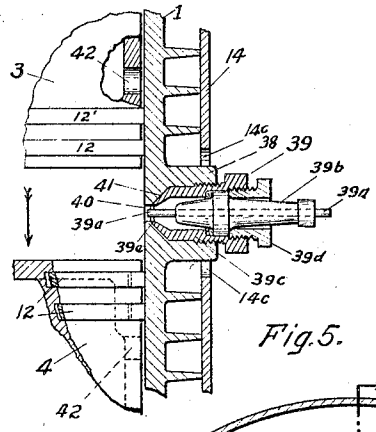


Fig.5.

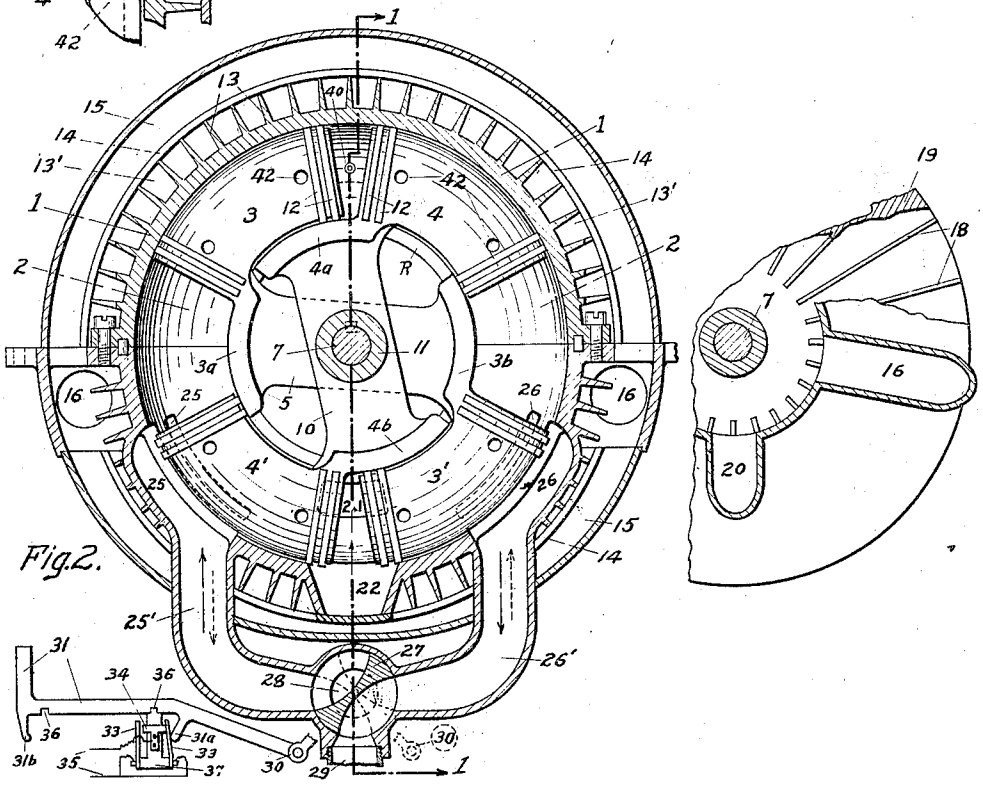


Fig.2.

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Patented Mar. 4, 1924. 1,485,591

UNITED STATES PATENT OFFICE.

FRANK A. BULLINGTON, OF PORTLAND, OREGON, ASSIGNOR TO BULLINGTON MOTORS, OF KANSAS CITY, MISSOURI, A COMMON-LAW TRUST CONSISTING OF SOLOMON STODDARD, ERNEST E. HOWARD, AND FRANK A. BULLINGTON.

ROTARY ENGINE.

Application filed October 20, 1919. Serial No. 332,859.

To all whom it may concern:

Be it known that I, FRANK A. BULLINGTON, a citizen of the United States, residing in the city of Portland, county of Multnomah and State of Oregon, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to rotary engines of the character referred to in my pending applications, Serial Numbers 240,443 and 278,880 and Case 332,858 simultaneously herewith.

The salient objects of this invention will be apparent from the following description, taken in connection with the accompanying sheets of drawings illustrating one embodiment of my invention, and in which,—

Figure 1 is a vertical longitudinal sectional view of my improved engine;

Figure 2 is a vertical sectional view transversely of the axis thereof, taken on line 2—2 of Fig. 1;

Figure 3 is a top plan view thereof, with the upper half of the casing removed and with parts shown in section;

Figure 4 is a fragmentary sectional view taken on line 4—4 of Figs. 1 and 3;

Figure 5 is a fragmentary sectional view of piston casing and two pistons, showing improved spark plug.

Referring now more in detail to the drawings, my invention as here illustrated, comprises a piston casing 1, of substantially oval shape in cross section and of circular form in side elevation. Within the piston casing 1 is a piston chamber 2, of semi-circular form in cross section, with pistons 3 and 3′ and 4 and 4′ rotatable therein, the pistons 3 and 3′ being connected to the outer ends of piston arm 5, having a hub portion 6, keyed to a main shaft 7, rotatably mounted in bearing supports 8 and 9 at the opposite sides of the piston casing 1. The pistons 4 and 4′ are connected to the outer ends of the piston arm 10, having a hub sleeve 11, turning upon and turning with the main shaft 7. Said pistons are of semi-circular form in cross section, and have straight inner sides and are provided at their opposite ends with two sets of piston rings 12 and 12′. The piston rings of each set are spaced apart, as clearly indicated in Fig. 2. Said pistons also have the piston lips 3^a, 3^b and 4^a and 4^b. The piston lip of one piston underlies the adjacent piston and forms an inner wall for the chamber formed between the piston bodies. Circumferentially positioned sealing rings R are located in the opposite sides of the casing and bear against the opposite sides or edges of said pistons and piston lips.

Said piston casing 1 is provided with exterior ribs or members 13, extending longitudinally of the axis of the casing and spaced circumferentially thereof. Said ribs are covered or enclosed by a member or outer wall 14, whereby to form circulating passageways 13′ between said ribs and within said enclosing member 14, as indicated in Figs. 1 and 2. Said enclosing member 14 is provided with inlets at 14^a, at opposite sides, and with an outlet 14^b circumferentially thereof. The outlet 14^b communicates with a circumferentially disposed conduit member 15, shown in cross section in Fig. 1, and in circumferential section in Fig. 2. Said conduit 15 is connected at opposite sides with pipes 16, 16, which are connected at their other ends with a chamber 17, open to a fan 18, connected with a balance wheel 19, mounted on the outer end of the main shaft 7, whereby the action of said fan and balance wheel operates to cause a circulation of air through chambers 13′ and the conduit 15 for the purpose of cooling the piston casing 1. Also connected with the suction chamber 17 is a conduit member 20, connected with an auxiliary exhaust port 21, in the piston casing 1, shown in Figs. 1 and 2. Said casing 1 is provided at its opposite side with intake members 22, to which air is supplied through a pipe 23, connected with an air cleaning means 24. Thus clean air can be forced transversely through the piston chamber, across the path of the pistons at this point, for the purpose of removing all of the burnt gases from the piston chamber. Formed in the piston casing 1 are two main ports 25 and 26, Figs. 2 and 3, which are connected by means of pipes or conduits 25′ and 26′, provided at their connected ends with a valve mechanism 27, adapted to connect said conduits 25′ and 26′, respectively, with the intake supply 28 and with the exhaust outlet 29.

By turning said valve to the position indicated in dotted lines, the connection of said conduits 25′ and 26′ with the intake and exhaust means is reversed, thus providing simple and practical means for controlling the direction of rotation of the engine.

Said valve 27 is operated by means of a lever 30, connected with a control lever 31, adapted in its movements to operate a circuit controlling device comprising two spring members 32 and 33, adapted to be moved alternately into and out of contact with a block or member 34, with which are connected circuit wires 35, of the spark mechanism. Projecting fingers 31ª and 31ᵇ on the lever 31 operate to accomplish the alternate movements of the spring members 32 and 33. Said lever 31 is also provided near the fingers 31ª and 31ᵇ with holding notches 36, adapted to hook over a holding member 37.

The piston casing 1 is provided at its upper side with extension portions 38, 38, forming sockets to receive spark plugs 39, 39. Said sockets communicate with the interior of the piston casing through small ports 40, 40, Figs. 1 and 5. Said extension portions 38 project through relatively large openings 14ᶜ through the outer wall member 14, whereby air inlet space is provided around said spark plug extensions for the entrance of air for the purpose of cooling said spark plugs.

Referring now more particularly to the larger view in Fig. 5, said spark plugs each comprise a terminal 39ª, carried in an insulation member 39ᵇ, secured in the body 39ᶜ by means of a bushing 39ᵈ. Said body 39ᶜ is provided with an opening 39ᵉ which, when the spark plug is in position in the extension portion 38, registers with and forms a continuation of the small port 40 through which the terminal 39ª projects, as indicated. The casing wall around the port 40 forms the grounded terminal and the spark is, therefore, formed in said small opening or port 40. Sealing means 41 is provided between the body 39ᶜ and the interior of the extension 38. By further reference to Fig. 5, it will be seen that two pistons, 3 and 4, in spaced relation are successively passing the spark port 40, in the direction indicated by the arrow. The piston bodies are slightly smaller than the piston casing and the only sealing means therebetween is the piston rings 12 and 12′, which bear yieldingly against the wall of the casing. As the advancing piston crossed the port 40, the gas mixture between the pistons, being under pressure, entered the spark plug through the port 40 and surrounded the inner end of the terminal 39ª. The parts are shown in position for a spark and explosion to take place. After the explosion takes place the spark plug cavity is filled with burnt gases at high pressure, which operates on the advancing piston ring, on piston 3, to depress said ring sufficiently to allow the gas in the chamber formed between said pistons 3 and 4 to escape past the first or advancing piston ring 12. Said gas however, is still confined by piston ring 12′. After piston ring 12 passes the port 40, it reseats against the casing wall as piston ring 12′ registers with the port 40, and is depressed by the high pressure from within the spark plug. As piston ring 12′ moves past said port 40, an exhaust port 42, in the piston body 3, comes into register with said port 40, whereby the gas from said spark plug is allowed to escape into the interior of the piston body, from which said gases pass to the crank casing 43, as indicated by the arrow shown through the sealing ring R in Fig. 1. From the crank casing said gases escape through the outlet port 44.

I will now describe the operation of the engine as here illustrated. Referring especially to Fig. 2, the chamber between pistons 3 and 4 is shown at the spark plug port 40, ready for an explosion. The pistons as here shown are turning in a clockwise direction. The chamber between pistons 4 and 3′ is in a position whereby to commence exhaust action through the exhaust ports 26. The chamber between pistons 3′ and 4′ is in a position to receive the auxiliary scavenging action of a forced draft of air caused by the fan 18 through said chamber and across the piston casing for completely cleaning the chamber before another intake action commences. The chamber between pistons 4′ and 3 is in a position whereby the intake of a further charge of explosive mixture is about completed. These functions will, of course, be readily understood from the showing. It will be understood that the pistons, while moving in the same direction continuously, have a variable movement which results in increasing and diminishing the sizes of the respective chambers formed between adjacent pistons. For example, as pistons 3′ and 4 advance from the position indicated, where exhaust is commencing, said pistons are moved together until they reach the positions occupied by pistons 3′ and 4′, where the chamber formed therebetween is at its smallest size. As the following end of the advancing piston 3′ reaches the beginning of the auxiliary exhaust port 21, the advancing end of piston 4 has fully crossed the main exhaust ports 26, and the completion of the exhaust action through the auxiliary exhaust port 21 takes place, followed immediately by the scavenging action through the elements 23, 24, 21 and 20, Fig. 1. The scavenging action continues through the finishing of the exhaust action and the beginning of the intake action, and this results in providing a supply

of fresh air to the chamber at the beginning of the intake stroke prior to the intake action through the intake ports 25.

Referring now to the connecting and operating crank arms and links which connect and operate the shaft 7 and the sleeve 11 and their pistons, the connections are such that the crank arm 45, connected with the sleeve 11, the crank arm 46, connected with the shaft 7, and the crank arm 48, connected with the eccentric shaft 47, are caused to revolve about their respective axes and to make possible a variable speed of rotation of one set of pistons with relation to the other. By means of the balance wheel 19 on shaft 7, a uniform rotation is established in shaft 7 and the pistons connected thereto. In order to provide a balanced mechanism, the connecting links are provided with the counter balance weights, whereby their balance on their respective pins 45^b and 46^b is secured. The counter balance weights at the ends of the crank arms 45 and 46 balances the combined weight of their respective links and crank pins, while the counter balance weight 48^a, which is smaller, on crank arm 48, balances the crank pin 48^b thereof.

Thus I have provided a rotary engine having an effective air cooling system, with an auxiliary exhaust or scavenging action, with an improved fan action for operating said cooling system and scavenging action, and with an improved balanced driving mechanism, whereby greater efficiency can be had. I am aware that many changes can be made in the mechanisms here shown and described without departing from the spirit of my invention, and I do not, therefore, limit my invention to the showing made, except as I may be limited by the hereto appended claims.

I claim:

1. In a rotary engine, a casing, spaced ribs on the casing, an outlet jacket surrounding the ribs, co-operating with them to form passage ways between the ribs, pistons in the casing, the casing having ports at opposite sides for passing air transversely across the path of the pistons and a single suction means for creating air circulation through the casing between said pistons as they pass said ports, said single suction means being effective in creating air circulation through the passage ways between the ribs.

2. In a rotary engine, a piston casing, pistons rotatable therein, the casing having ports at opposite sides for passing air transversely across the path of said pistons, and power driven suction means for creating air circulation through said casing between said pistons as they pass said ports.

3. In a rotary engine, a casing, pistons mounted to rotate therein and form chambers therebetween, an air cooling system exteriorly of said casing, ports through said casing for the passage of air transversely across the path of said pistons and through the chambers formed therebetween, and power driven air circulating suction means connected with said air cooling system and said ports which creates air circulation therethrough.

4. In a rotary engine, a casing, spaced arcuate ribs on the casing, an outer jacket surrounding the ribs and cooperating with them to form passageways between the ribs, the passageways having air inlets near the axial center of the casing and outlets at the periphery of the jacket, and means for passing air through the passageways, the jacket having a circumferential air passageway about the outlets of the first-named passageways and communicating with each of said first-named passageways.

5. In a rotary engine, having pistons, semi-circular in cross section, a casing inclosing them, of semi-circular form at the piston inclosing portion, spaced arcuate, reinforcing and cooling ribs on the casing in radial, longitudinal planes, an outer jacket surrounding the ribs and co-operating with them to form passage ways between the ribs, the passage ways having air inlet openings near the axial center of the casing and an outlet opening intermediate the ends of the passage ways so that air will pass from opposite ends of the jacket toward the middle portion to outlet and means for passing air through the passage ways.

6. In a rotary engine, having pistons, semi-circular in cross section, a casing inclosing them of semi-circular form at the piston inclosing portion, spaced arcuate, reinforcing and cooling ribs on the casing in radial, longitudinal planes, an outer jacket surrounding the ribs and co-operating with them to form passage ways between the ribs, the passage ways having air inlet openings near the axial center of the casing and an outlet opening intermediate the ends of the passage ways so that air will pass from opposite ends of the jacket toward the middle portion to outlet, an outlet conduit communicating with all the passage ways intermediate their ends and a suction air circulating means, in co-operative relation with the outlet conduit.

Signed at Portland, Multnomah County, Oregon, this 24th day of September, 1919.

FRANK A. BULLINGTON.

Witnesses:

I. M. GRIFFEN,

WILLIAM R. LITZENBERG.