Sept. 8, 1942. J. S. KOESTER 2,295,117

ROTARY ENGINE

Filed July 19, 1941 3 Sheets-Sheet 1

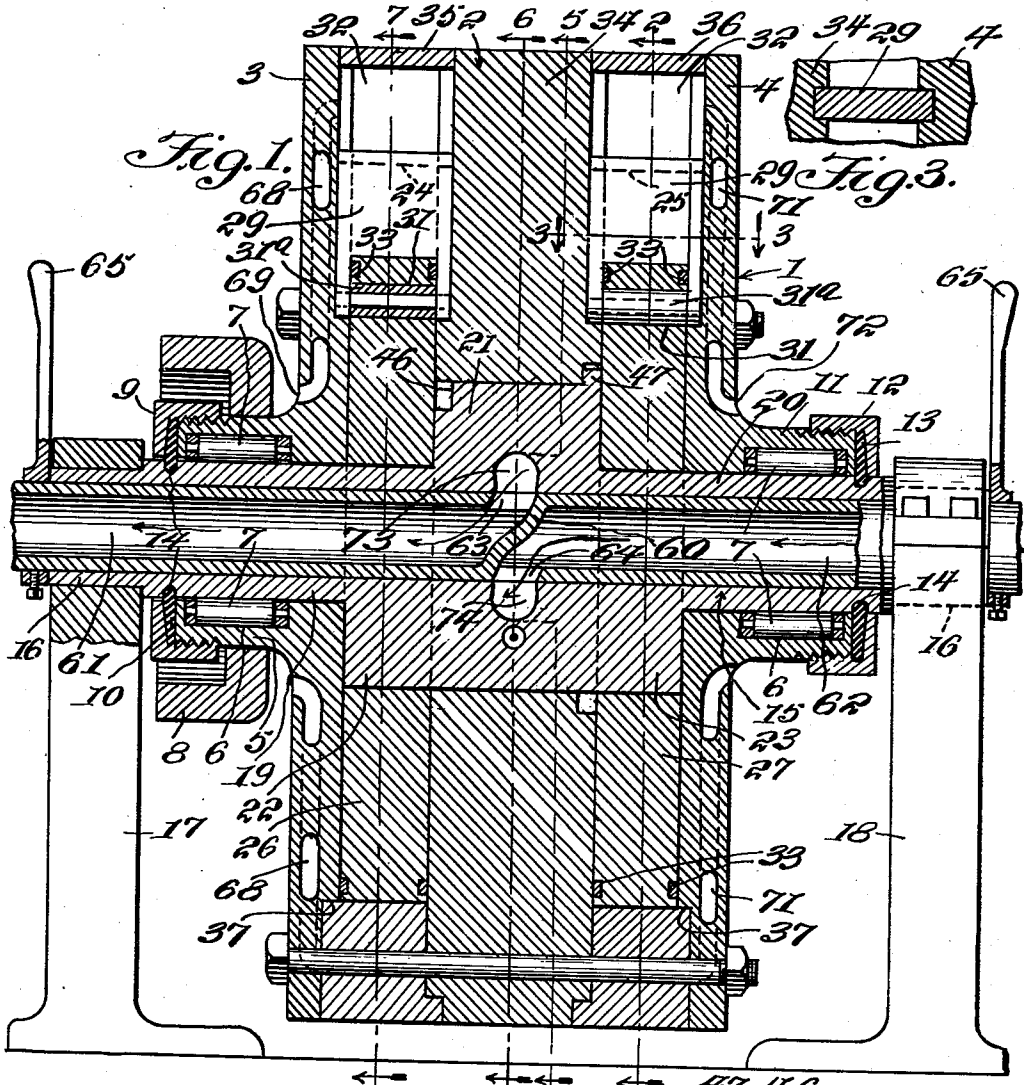


Fig. 1.

Fig. 3.

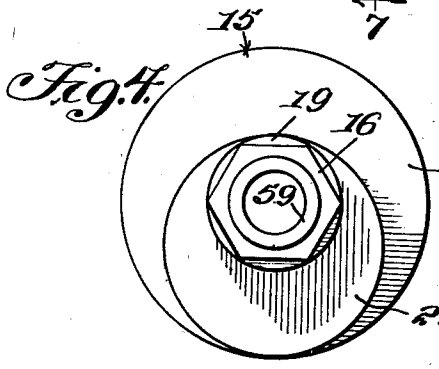


Fig. 4.

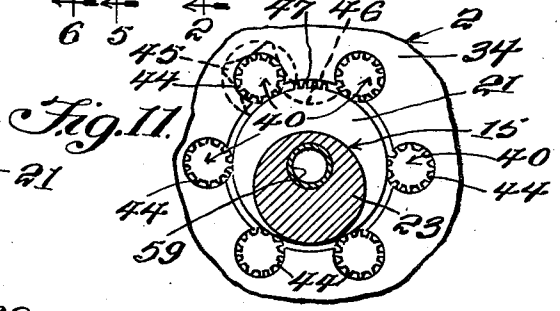


Fig. 11.

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Fig. 2.

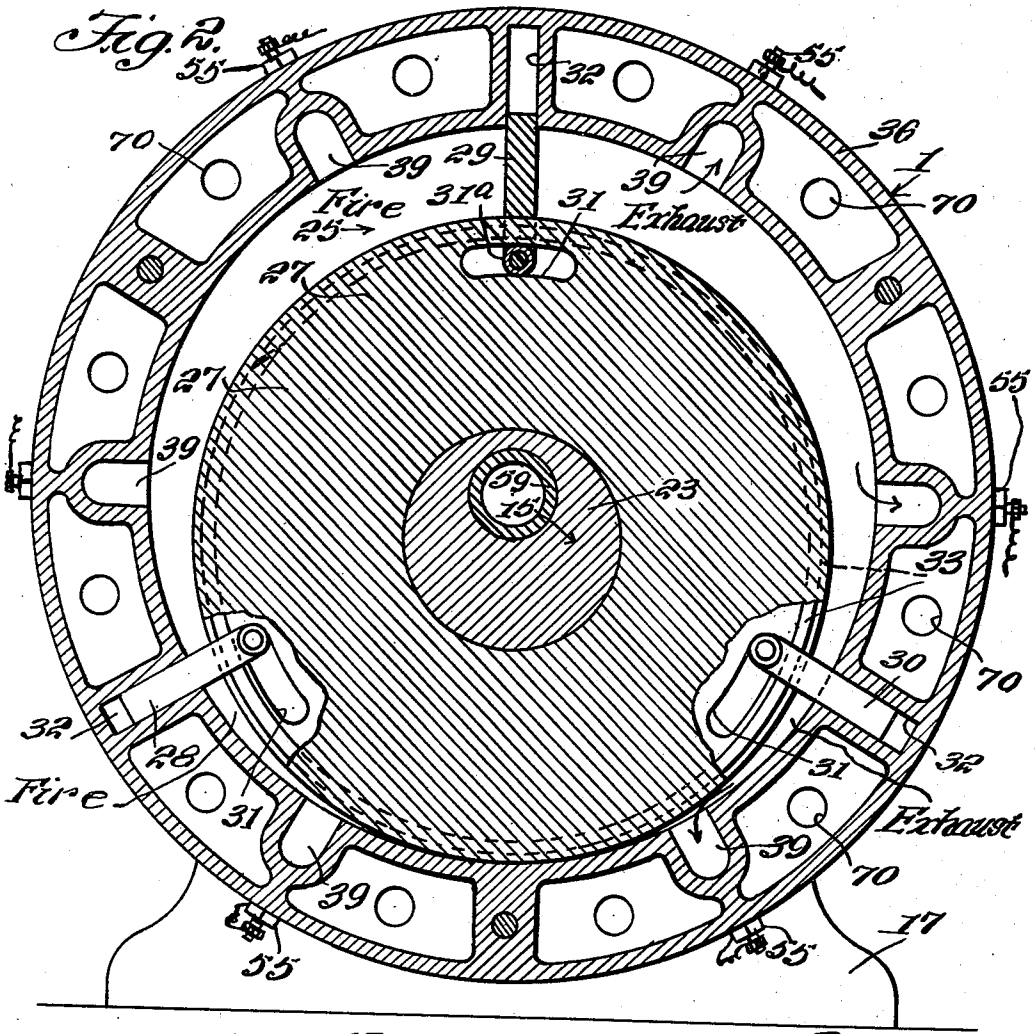


Fig. 13.

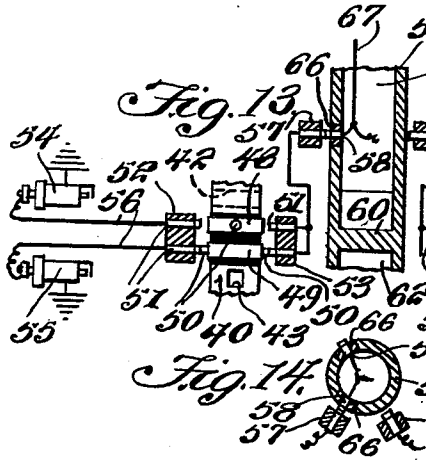
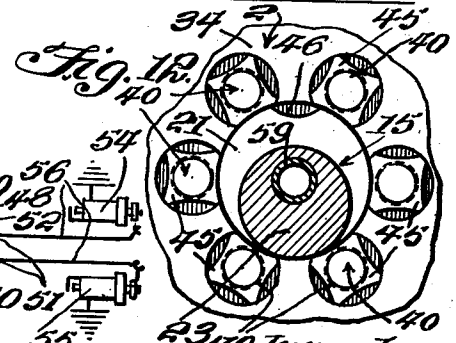


Fig. 14.

Fig. 12.

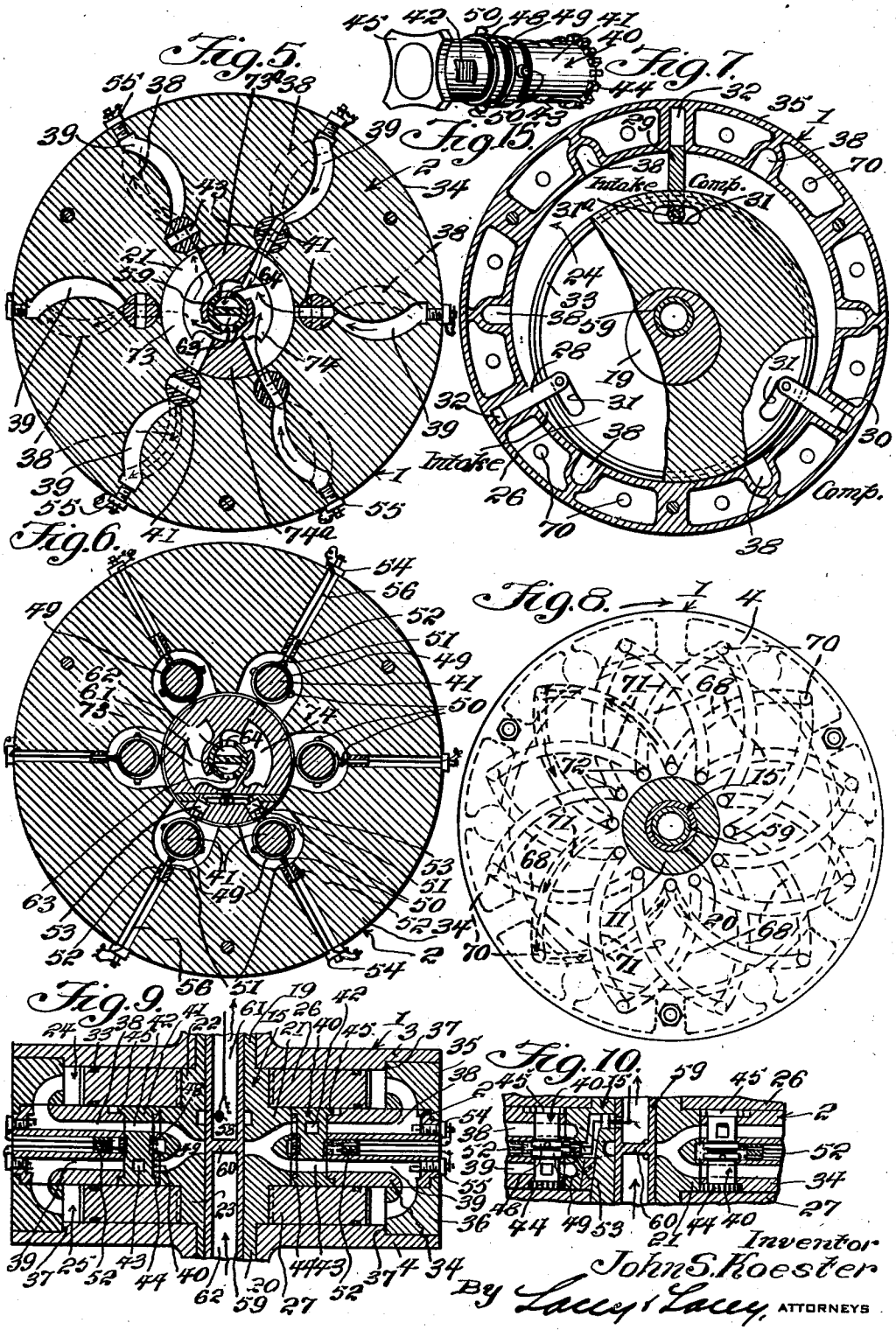


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UNITED STATES PATENT OFFICE

2,295,117

ROTARY ENGINE

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Application July 19, 1941, Serial No. 403,207

6 Claims. (Cl. 123—8)

This invention relates to engines and more particularly to an improved rotary engine.

One object of the invention is to provide a rotary engine which is so constructed that friction will be largely eliminated.

Another object of the invention is to provide an engine of this character which will be easily reversible and which will operate as well in one direction as in the other.

A further object of the invention is to provide a rotary engine which is relatively simple in construction and highly efficient in operation.

A further object of the invention is to provide a rotary engine which is capable of delivering a continuous flow of power with the result that the pounding common to reciprocating engines, which pounding results in wear, will be practically eliminated.

A further object of the invention is to provide a device of this character which employs valve and timing mechanism.

A still further object of the invention is to provide a rotary engine which is compact in size and which may, therefore, be readily installed in a small space.

Further objects of the invention, not specifically mentioned hereinbefore, will become apparent during the course of the following description.

In the drawings forming a part of my application:

Figure 1 is a vertical sectional view of my improved rotary engine with parts in elevation and broken away,

Figure 2 is a vertical sectional view on the line 2—2 of Figure 1 looking in the direction indicated by the arrows,

Figure 3 is a detail horizontal sectional view on the line 3—3 of Figure 1,

Figure 4 is a detail end view showing the stationary mounting shaft or spindle employed,

Figure 5 is a vertical sectional view on the line 5—5 of Figure 1 on a reduced scale,

Figure 6 is a vertical sectional view on the line 6—6 of Figure 1 on a reduced scale,

Figure 7 is a vertical sectional view on the line 7—7 of Figure 1 on a reduced scale,

Figure 8 is a diagrammatic view showing the cooling system employed,

Figure 9 is a transverse sectional view showing particularly the arrangement of the valves and firing chambers,

Figure 10 is a detail sectional view particularly showing the valves and timing mechanism,

Figure 11 is a detail elevation showing a portion of the valve operating structure as it would appear from corresponding ends of the valves,

Figure 12 is a detail elevation showing the valve operating mechanism from opposite corresponding ends of the valves,

Figure 13 is a schematic view showing the electrical system, and

Figure 14 is a detail vertical sectional view of the intake, exhaust and control pipe.

Referring now more particularly to the drawings wherein, as will be seen, similar reference numerals are employed to designate like parts throughout the views, the numeral 1 indicates the casing of my improved rotary engine. The casing 1 includes a body 2 and end plates 3 and 4. The end plate 3 is provided with a hub or axial boss 5 which is formed with a bearing recess 6 in which is mounted a roller bearing 7. Mounted integrally on the boss 5 is a pulley 8 which is adapted to have a belt trained thereabout for conducting power from the engine. The boss 5 is externally threaded at its end to receive a retainer cap 9 and clamped between the retainer cap and the outer end of the boss is a packing ring 10.

The end plate 4 is formed with a boss 11 which is similar to the boss 5 and which is externally threaded at its outer end to receive a cap 12 similar to the cap 9. The cap 12 clamps the packing 13 in place and this packing, as well as the packing 10, extends into grooves 14 which are formed in the opposite end portions of the stationary mounting shaft or spindle to be described hereinafter.

The mounting shaft is best seen in Figures 1 and 4 of the drawings and is indicated generally by the numeral 15. The mounting shaft 15 is formed near its opposite end with hexagonal end portions 16 which are mounted in the upper ends of standards 17 and 18, said standards mounting the engine in operative position above a floor or other surface. In this connection it should be understood that, if desired, splines may be employed in lieu of the hexagonal end portions 16 to retain the shaft 15 stationary in the standards 17 and 18. Inwardly of the end portions 16, the shaft is formed with axial or concentric portions 19 and 20 about which the bearings 7 on the bosses 5 and 11 of the end plates 3 and 4 rotate. Medially of the length of the shaft 15 is formed a concentric manifold portion 21, the purpose of which will be described in more detail hereinafter. Between the manifold portion 21 and the portions 19 and 20 are disposed eccentrics 22 and 23.

It will now be understood that the casing 1 is rotatably mounted on the stationary shaft 15 and that the manifold portion 21 and eccentrics 22 and 23 will be disposed within said casing between the end plates 3 and 4.

As best seen in Figures 2, 7 and 9 of the drawings, the body 2 of the casing is disposed medially between the end plates 3 and 4 and cooperates with said end plates and the eccentrics 22 and 23 to define crescent shaped chambers 24 and 25. Rotatably mounted on the eccentrics within the chambers 24 and 25 are rotors 26 and 27, said rotors being of a diameter somewhat less than the interior of the diameters of the chambers 24 and 25 and being operatively connected to rotate with the casing 1 by means of keys 28, 29 and 30. As best seen in Figure 7, the keys are slidably mounted in arcuate slots 31 in the rotors, by means of rollers 31a and in radial slots 32 in the body and end plates. The keys are, of course, necessarily each radially and circumferentially slidably connected between the rotors and the casing, by said rollers and slots, in view of the fact that the rotors are mounted on the eccentrics 22 and 23 and are of a smaller diameter than the interior diameter of the chambers 24 and 25. Said rotors 26 and 27 and the keys 28, 29 and 30 divide the chambers 24 and 25, respectively, into intake, compression and combustion compartments or chambers, as will be described in more detail hereinafter. In this connection it is desired to state that a separate set of keys will, of course, be provided for each of the rotors. It is also desired to call attention to the fact that the eccentrics 22 and 23 will be of such diameter and will be so disposed that the rotors will be mounted with corresponding points on their circumferences in contact with points on the inner surfaces defining the chambers 24 and 25.

In order to seal the rotors in the chambers, I provide annular rings 33 which are mounted in the opposite faces of each of said rotors near their circumferential edges.

As best seen in Figures 5, 6 and 9 of the drawings, the body 2 comprises a center element 34 and side elements 35 and 36, said side elements being confined between the end plates 3 and 4 and said center element by shoulders 37. Formed in the body 2 are pairs of radially extending arcuate combustion chambers 38 and 39, said chambers extending throughout the major portion of the radius of the body and having their inner ends communicating with the inner end of the manifold portion 21 of the shaft 15. At their opposite corresponding faces, each pair of combustion chambers 38 and 39 communicate with the chambers 24 and 25 at each side of said body. That is to say, the chambers 38 and 39 are curved at their outer ends and extend through the elements 35 and 36 in communication with said chambers 24 and 25. As shown in Figures 5 and 6, I have employed six pairs of the chambers 38 and 39. It should be understood that, if desired, a greater or less number of pairs of chambers may be employed. It is desirable, however, that the number of chambers be an odd number. As best seen in Figure 5, the chambers of each pair of chambers are curved in opposite directions. That is to say, the combustion chambers on one side of the body 2 are disposed with their arcuate portions extending in opposite directions. Inasmuch as the arcuate shape of the chambers assists to a small degree in the rotation of the casing and rotors, it has been found advantageous to provide them in the manner shown.

It is now desired to describe the valves employed for controlling flow of fuel through the pairs of combustion chambers 38 and 39. The valves are best seen in Figures 5, 6 and 9, 10 and 11 of the drawings. One of said valves is employed for each pair of combustion chambers 38 and 39 and extends through the body and through said openings. The valves are indicated generally at 40 and each has a body 41 which is formed with passages 42 and 43, said passages being disposed in the body perpendicularly to the axis thereof and communicate with the chambers 38 and 39. In this connection it is desired to call attention to the fact that the passages 42 and 43 are disposed on axes perpendicularly to each other so that, when the valve is moved for placing the opening 42 in alinement with the chamber 38, for permitting passage through said chamber, the opening 43 will be out of alinement with respect to the chamber 39, and flow through the chamber will be interrupted.

At corresponding ends each of the valves 40 is provided with a gear 44 and at their corresponding opposite ends the valves are each provided with Geneva wheels 45. As best seen in Figure 12, the manifold portion 21 of the shaft 15 is provided with an arcuate recess 46 at one point on its circumference. At its opposite end and in longitudinal alinement with the recess 46, the said manifold portion is formed with a plurality of teeth 47 which are adapted to mesh with the teeth of the gears 44. It will now be understood that, when the teeth 47 mesh with the teeth of one of the gears 44, said gear will be rotated one-quarter turn with the result that the valve body will be rotated for placing the passages 42 and 43 in their proper relative positions in the chambers 38 and 39. The Geneva wheel 45 on each of the valves will prevent said valves from rotating except the one-quarter turn rotation which takes place at each revolution of the casing about the shaft 15.

The valves 40 each carry timing bands 48 and 49, said bands each having pairs of contact points 50 thereon. The contact points are adapted for engagement with contact plungers 51 which are carried in insulating blocks 52 and 53 on the body 2 at each side of the valve. The plungers 51 in the block 52 are electrically connected to spark plugs 54 and 55 by conductors 56. As best seen in Figure 6, the spark plug 54 is mounted in the chamber 38 and the spark plug 55 is mounted in the chamber 39 of the pairs of manifold chambers. As shown, the plugs are mounted near the outer ends of the chambers, but it should be understood that said plugs may be mounted in any desired position. The plungers 51 in the block 53 are connected to a plunger 57 which is engageable with a contact 58 carried in the control, exhaust and intake pipe to be described hereinafter.

The control, exhaust and intake pipe is indicated generally at 59. Said pipe extends through the stationary shaft 15 axially thereof and is capable of rotation within said shaft. The pipe 59 includes a partition 60 which divides said pipe into a pair of passages 61 and 62. Ports 63 and 64 communicate between the manifold portion 21 and the passages 61 and 62, respectively. At its outer ends the pipe 59 is provided with handles 65 for manual engagement. Mounted in the pipe 59, as best seen in Figure 14, are the

contacts 58. The contacts are disposed radially on the pipe and are insulated therefrom by an insulating sleeve 66. As will be noted, the contacts 58 are disposed on the pipe in such a manner that said pipe need only be turned a one-quarter turn to bring either of said contacts into engagement with the plunger 57. The contacts 58 are connected by conductors 67 to a source of high tension electricity which is preferably disposed externally of the motor.

It is now desired to describe the cooling system employed. Said cooling system comprises an annular series of arcuate passages 68 which are formed in the end plate 3. The passages 68 have their corresponding inner ends communicating with the outer surface of the plate 3 through mouths 69. At their corresponding outer ends, the passages communicate with compartments 70 in the body 2 and with passages between the chambers of the pairs of combustion chambers 38 and 39. The end plate 4 is similarly formed with passages 71 which are arranged in an arcuate series and communicate with the outer surface of the end plate 4 through mouths 72. At their corresponding outer ends the passages 71 communicate with the chambers 70. It will thus be seen that, when the casing 1 is rotated in one direction, air will be caused to pass through the mouths 69 and through the passages 68 into the chambers 70. From the opposite sides of said chamber and from the openings in the body air will flow outwardly through the passages 71 and through the mouths 72. When the casing is caused to rotate in the opposite direction, air will flow through into the mouths 72 and through the passages 71 into the chamber 70 and into the passages defined between the manifold chambers 38 and 39. Air will flow from the casing through the passages 68 and the mouths 69.

It is now desired to describe in more detail the manifold portion 21 of the shaft 15. Said manifold portion is best seen in Figures 1 and 5 of the drawings, and by referring to these views it will be seen that pairs of manifold slots of substantially Y shape are provided. The slots are indicated at 73 and 74 and, as best seen in Figure 5, are of sector shape and, combined, extend throughout the major portion of the circumference of the portion 21. That is to say, the slots 73 and 74 are oppositely disposed and each extends throughout substantially one hundred and fifty degrees. The slots are separated by sector portions 73^a and 74^a, each of which extends substantially thirty degrees. As will be seen, the slots 73 and 74 are of such length that two adjacent pairs of manifold chambers will simultaneously communicate with the ports 63 and 64.

It is now desired to describe the operation of my improved rotary engine. Fuel is first introduced through the passage 61. Said fuel will pass through the port 63 and through both of the branches of the slot 73. It is assumed that the valve in the combustion chamber 39 is open. The opening 42 of the valve will, of course, be closed. Fuel will pass into the chamber 24 between the key 28 and the point of contact between the rotor 26 and the inner surface of said chamber 24. The casing and rotors are rotated about the stationary shaft, and this rotative movement will be designated as the cranking operation. During rotation of the rotor and casing, fuel will continue to enter the chambers until said chambers are covered by the unobstructed portion 73^a. After the rotors carrying said chambers move past the portion 73^a and into registration with the slot 73, the valve 40 in said chamber will be rotated a quarter turn for closing the opening 43. Further rotation of the rotors and casing will cause compression of the charge within the chamber 24 and said compression will continue to build up until the rotors move past the unobstructed portion 74^a. At this point the circuit to the plug will be closed and the charge will be caused to fire in the chamber defined by the key 28 and that portion of the chamber 24 which is disposed between said key and the point of contact of the rotor with the inner surface of the body. The explosion will exert itself against the key, the rotor and the body with the result that said rotor and body will be caused to rotate about the shaft 15. The explosive action will continue until the rotor and casing have again moved to overlying relation with the portion 73. The valve will again be opened by a one-quarter turn rotation and the charges will exhaust through the combustion chambers which communicate with the slots 73. This exhausting action will continue until the rotor and casing have moved until the first-mentioned combustion chambers are in overlying position with respect to the portion 74^a. After passing over the portion 74^a, the combustion chambers are ready to receive a new charge of fuel and thus for a new cycle of operation similar to that just described.

It should be understood that each of the pairs of the combustion chambers receive a charge of fuel and that each will fire in its proper sequence so that a continuous flow of power will be produced. In that connection it is desired to state that the valves 40 are so arranged that the firing in the chambers 38 and 39 will take place alternately. That is to say, when the firing and exhaust cycle is taking place in the chambers 39 at one side of the motor, the intake and compression part of the cycle will be taking place in the chambers on the opposite side of the motor.

Attention is particularly directed to the fact that the effort exerted by the explosion in the firing chamber will be exerted against the keys 28, and will continue to be exerted against the keys 29. The maximum explosive energy will be confined behind the key 28 but, as the rotor and casing rotate, energy will continue to be exerted against the key 29. The explosive energy operates against the rotors 26 and 27 and, as said rotors are eccentrically mounted, rotation will be imparted to them and to the casing.

It is particularly desired to emphasize that my improved engine will operate satisfactorily in either direction. In order to reverse the direction of rotation, it is only necessary to partially rotate the pipe 59. When this is done, the ports 63 and 64 will be reversed with the result that fuel will be lead through the pipe 62 and will exhaust through the pipe 61. At the same time, contact will be established through the contact 58 and through the plunger 57^a which is similar to the plunger 57, for energizing the plug in the chamber 38 which is in alinement with the intake port. The cycle of operation will be the same in either direction and the plugs in the chamber will fire alternately.

It is also desired to call attention to the fact that the cooling passages 68, being of arcuate formation and being radially disposed alternately on each side of the casing, will insure proper cooling of the motor when rotating in either direction.

The entire engine may be lubricated by a force

feed lubrication system of any conventional design. Also the motor may be cooled by liquid in lieu of air, if so desired.

It is also desired to state that my improved rotary engine, by eliminating the valves, may be used either as a compressor or as a steam engine.

Having thus described the invention, what is claimed as new is:

1. A rotary engine including a stationary shaft, a casing rotatably mounted on the shaft, said shaft having an eccentric, a rotor mounted in the casing on the eccentric, said rotor cooperating with the casing for defining a chamber, a combustion chamber in the casing and communicating with the first-mentioned chamber, a valve in the combustion chamber, said stationary shaft having a manifold portion adapted to communicate with the combustion chamber, a pipe shiftably mounted in the shaft and having a partition defining passages, a port communicating between one of the passages and said manifold portion, means on the shaft for shifting the valve, and means on said valve and on the casing and cooperating for firing a charge in the combustion chamber and said first-mentioned chamber, said firing charge causing rotation of the rotor and casing about the shaft.

2. In a rotary engine, a stationary shaft, a casing rotatably mounted on the stationary shaft, said shaft having an eccentric disposed within the casing, the casing having a chamber therein, a rotor rotatably mounted on the eccentric within the chamber, a pipe in the casing for receiving a charge of explosive fuel, the shaft having a passage for leading the charge to the chamber, the pipe having a side port and being rotatable in the shaft for moving its port into and out of registry with the passage of the shaft, and means on the casing energizable upon rotation of the casing and rotor about the shaft for firing the charge in the chamber, the force of the firing charge being exerted against the rotor for rotating said rotor and the casing about the eccentric.

3. In a rotary engine, a stationary shaft, a casing rotatable about the shaft and having a body and a pair of chambers, said shaft having a pair of eccentrics, one of said eccentrics being disposed in each of the chambers, rotors rotatably mounted on the eccentrics in the chambers, combustion chambers formed in the body and communicating with the first-mentioned chambers in spaced relation to each other circumferentially thereof, said shaft having a concentric manifold portion between the eccentrics adapted to communicate with the combustion chambers, a pipe in the shaft formed with passages leading from opposite ends thereof, the pipe being rotatable in the shaft to move inner ends of the passages into and out of communication with companion passages of the manifold portion, valves for the combustion chamber movable to open and closed positions, and means on the body and projecting into the combustion chambers for firing charges in the first-mentioned chamber for rotating the rotors and casing about the eccentrics, said charges in the chambers being fired alternately.

4. In a rotary engine, a stationary shaft, a pipe extending through the shaft and shiftable therein, said pipe having a partition defining a pair of passages and said passages each having a port, said shaft having a pair of eccentrics and a manifold portion adapted to communicate with the ports, a casing rotatably mounted on the shaft and having chambers receiving the eccentric, rotors rotatably mounted on the eccentrics in the chambers, said casing having combustion chambers communicating between said first-mentioned chambers and the manifold portion of the shaft, a valve rotatably mounted in the combustion chambers, and means mounted on the casing and projecting into the combustion chambers for firing a charge of explosive fuel in said combustion chambers and said first-mentioned chamber, said charge being received through certain of the passages, said manifold portion and said combustion chambers, the force of said charge being exerted on the rotors for rotating the rotors and casing as a unit about the shaft, the other of said passages in the pipe receiving exhaust gases from the chambers after firing of the charges, said valve being rotatable for causing alternate firing of the charges in the chambers at each end of the body.

5. In a rotary engine, a stationary shaft having an eccentric, a casing rotatably mounted on the shaft and having a chamber receiving the eccentric, a rotor about the eccentric within the chamber formed with combustion chambers, means in the shaft and on the casing for leading a charge of explosive fuel to the combustion chamber, valves for inner ends of the combustion chamber movable to open and closed positions means for exploding the charge in the chamber for causing simultaneous rotative movement of the rotor and casing, and passages formed in the casing at each end thereof for receiving a flow of air upon rotation of the casing for cooling the engine.

6. In a rotary engine, a stationary shaft having an eccentric, a pipe shiftably mounted in the shaft and having a partition defining passages, said shaft having a manifold portion, said passages having ports adapted to communicate with the manifold portion, a casing rotatably mounted on the shaft, said casing having a chamber, a rotor rotatably mounted in the chamber on the eccentric, a combustion chamber communicating between the manifold portion and said first-mentioned chamber, a valve carried by the casing and extending through the combustion chamber for controlling flow of fuel through said combustion chamber, means on the manifold portion of the shaft and engageable with the valve upon rotation of the casing for opening and closing said valve for permitting intake, compression, firing and exhaust of the charge of fuel, means on the casing and extending into the combustion chamber and energizable for firing the charge, and means on the valve for controlling current flow to said last-mentioned means, the firing of the fuel charge exerting pressure between the wall of the casing and the rotor for rotating the rotor and casing as a unit about the shaft.

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