Oct. 25, 1938. R. A. JONES 2,134,334

EXTERNAL COMBUSTION ENGINE

Filed July 21, 1934 4 Sheets-Sheet 1

Fig.1.

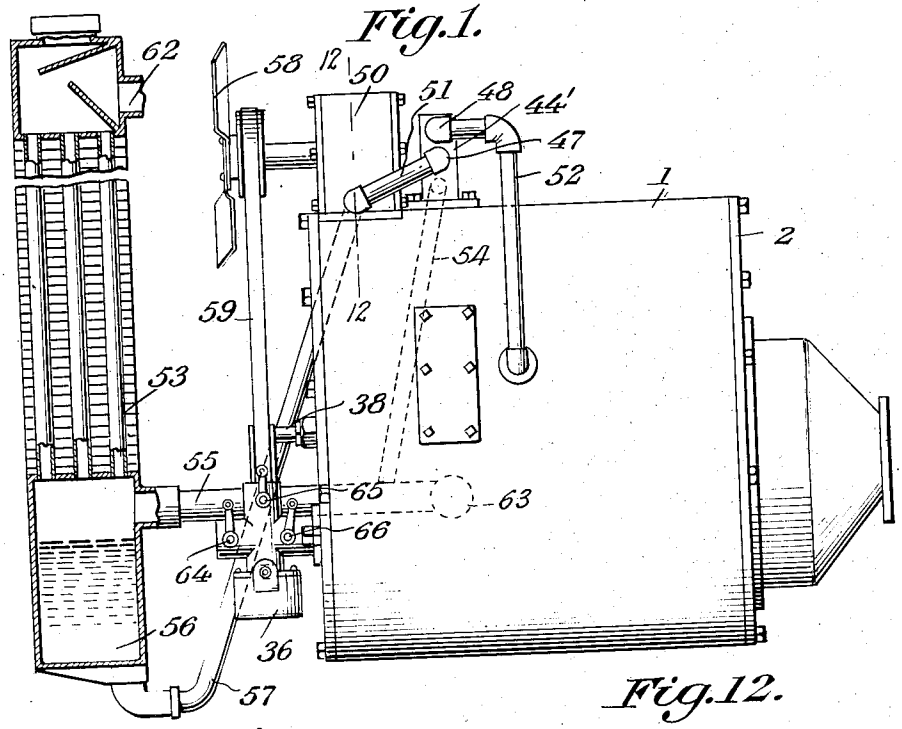
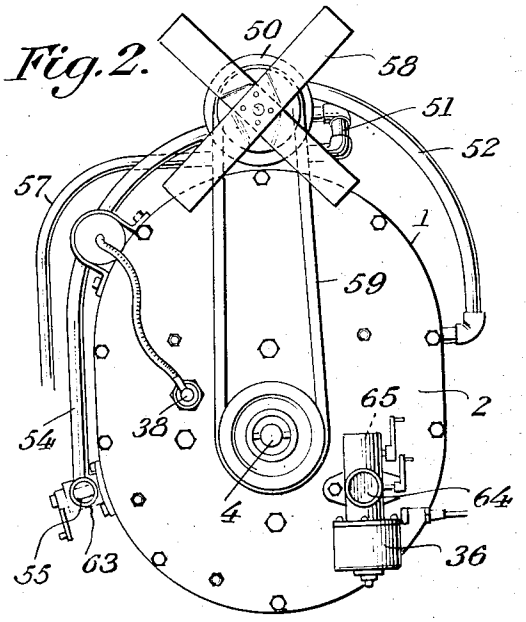


Fig.12.

Fig.2.



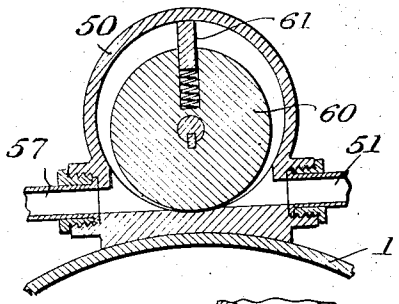
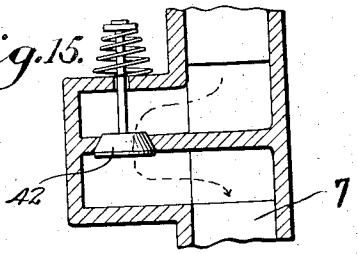


Fig.15.



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EXTERNAL COMBUSTION ENGINE

Filed July 21, 1934 4 Sheets-Sheet 2

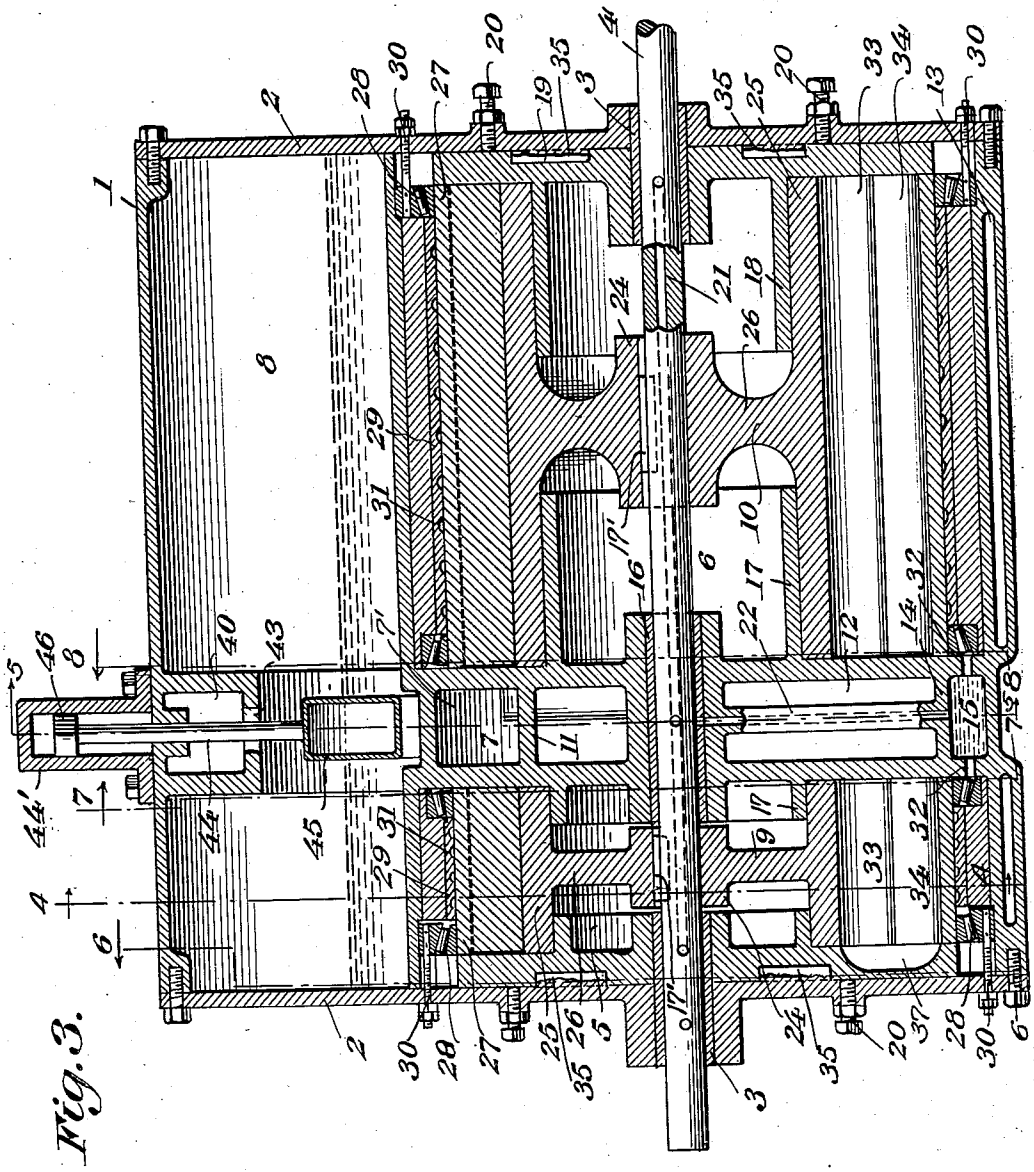


Fig. 3.

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EXTERNAL COMBUSTION ENGINE

Filed July 21, 1934 4 Sheets-Sheet 3

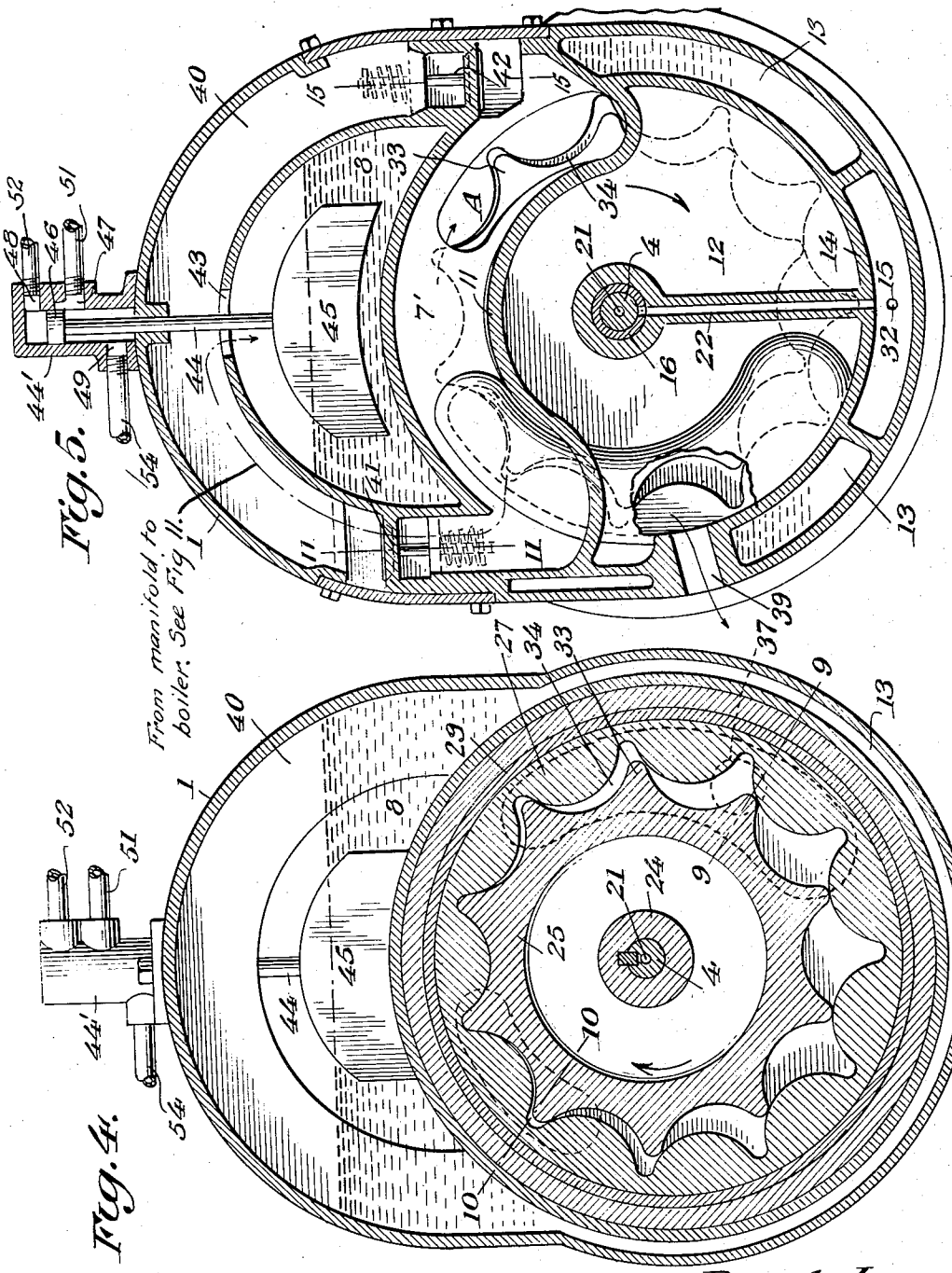


Fig. 5.

Fig. 4.

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EXTERNAL COMBUSTION ENGINE

Filed July 21, 1934 4 Sheets-Sheet 4

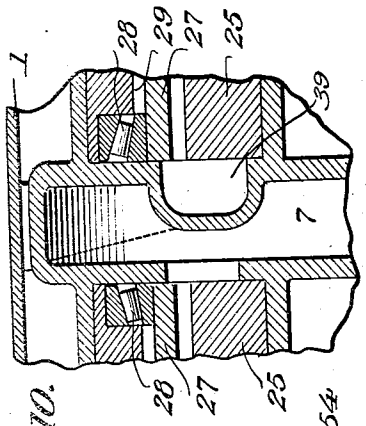


Fig. 10.

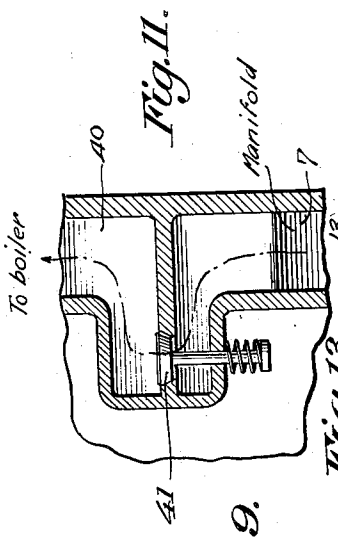


Fig. 11.

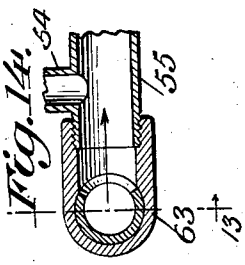


Fig. 14.

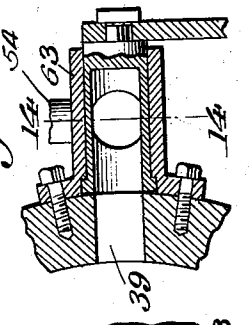


Fig. 13.

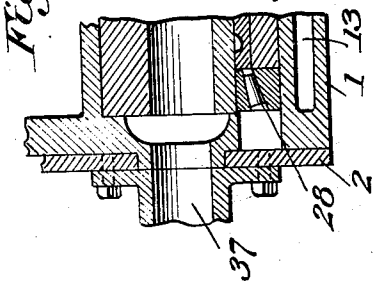


Fig. 9.

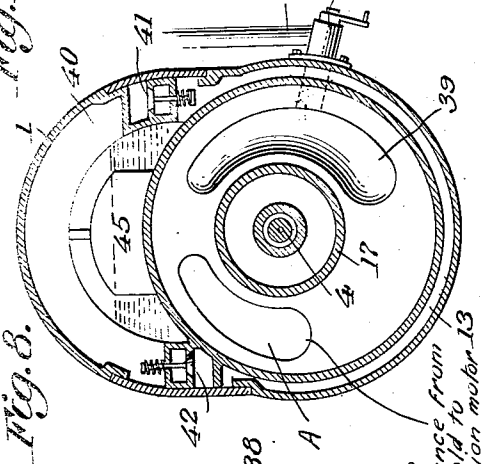


Fig. 8.

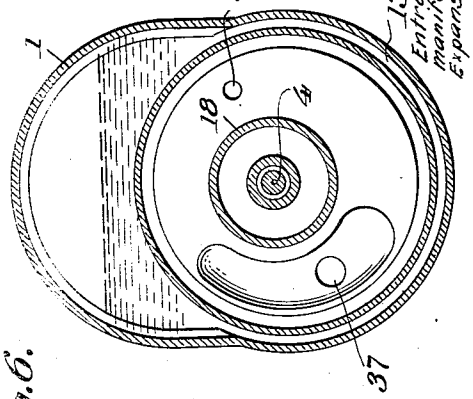


Fig. 6.

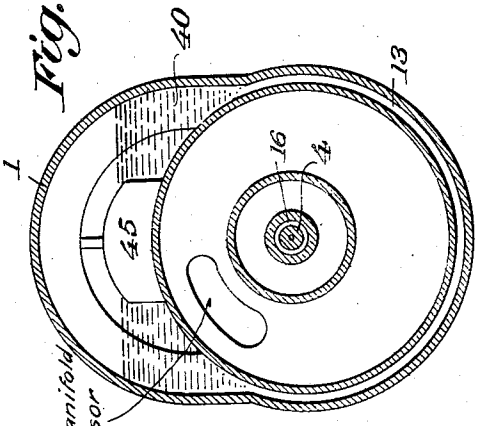


Fig. 7.

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2,134,334

UNITED STATES PATENT OFFICE

2,134,334

EXTERNAL COMBUSTION ENGINE

Ray A. Jones, Colmar, Ky.

Application July 21, 1934, Serial No. 736,422

4 Claims. (Cl. 60—45)

This invention relates to a rotary external combustion engine and has for the primary object the provision of means for augmenting the burning fuel prior to each power stroke of the engine by a second expansion medium which with the burning fuel act togther on the power developing medium of the engine to provide an increase in volume of the propelling force on each power stroke.

Another object of this invention is the provision of compressing and power developing units connected by a power take-off shaft wherein the power developing unit has a working area greater in size or ratio than that of the compressing unit both being of the rotor type equipped with means therebetween whereby the compressed and burning fuel may be delivered to the power developing unit from the compressing unit augmented by the second expansion medium, the latter being generated by heat obtained from the burning fuel and the operation of the engine.

With these and other objects in view this invention consists in certain novel features of construction, combination and arrangement of parts to be hereinafter more fully described and claimed.

For a complete understanding of my invention, reference is to be had to the following description and accompany drawings, in which—

Figure 1 is a side elevation, partly in section, illustrating a rotary external combustion engine constructed in accordance with my invention.

Figure 2 is an end elevation illustrating the engine with the condenser removed.

Figure 3 is a vertical sectional view illustrating the compressing and power developing units and means for the development of the secondary propulsion medium.

Figure 4 is a transverse sectional view illustrating the compressor and taken on the line 4—4 of Figure 3.

Figure 5 is a similar view illustrating the power developing unit and taken on the line 5—5 of Figure 3.

Figure 6 is a fragmentary sectional view illustrating the intake for the compressor and taken on the line 6—6 of Figure 3.

Figure 7 is a similar view showing the outlet manifold for the compressor and taken on the line 7—7 of Figure 3.

Figure 8 is a detail sectional view showing the exhaust for the power developing unit and taken on the line 8—8 of Figure 3.

Figure 9 is a fragmentary sectional view taken on the line 9—9 of Figure 4.

Figure 10 is a fragmentary sectional view taken on the line 10—10 of Figure 4.

Figure 11 is a detail sectional view taken on the line 11—11 of Figure 5.

Figure 12 is a detail sectional view illustrating a circulating pump for the water of the boiler and taken on the line 12—12 of Figure 1.

Figure 13 is a detail vertical sectional view showing an exhaust control valve and taken on the line 13—13 of Figure 14.

Figure 14 is a sectional view taken on the line 14—14 of Figure 13.

Figure 15 is a detail sectional view taken on the line 15—15 of Figure 5.

Referring in detail to the drawings, the numeral 1 indicates a main casing or housing having removable end walls 2 which are constructed to receive journals 3 for a power take-off shaft 4. The casing or housing 1 is divided by a series of partitions or walls to form chambers 5, 6, 7 and 8. The chamber 5 is for a compressor rotor 9, the chamber 6 for a power developing rotor 10 and the chamber 7 is designed to form manifolds between the chambers 5 and 6 as well as an exhaust manifold. The manifolds will be hereinafter described in detail. A wall 11 divides the chamber 7 into a compartment 12. The exterior walls of the casing or housing 1 are water jacketed, as shown at 13, also in communication with the chamber or boiler 8. The chamber 12 is further divided from the lower portion of the water jacket 13 by a partition 14 to form an oil or lubricant sump 15. The vertical walls of the chamber 7 are constructed to form a support for a bearing 16 cooperating with the bearings 3 in supporting the power take-off shaft 4. Said walls also are equipped with annular flanges 17 forming supports for the rotors which will be hereinafter more fully described. Similar flanges 18 for the rotors are formed on wear plates 19 engaging the end walls of the casing or housing 1 and said wear plates may be adjusted to take up wear through mediums 20. The rotors 9 and 10 are secured to the power take-off shaft 4 by keys 17'. The shaft 4 is drilled to provide an oil or lubricant conduit 21 communicative with the journals and also with the pipe 22 in the chamber 12 leading to the lubricant sump 15. The circulation of the lubricant can be accomplished in any well known manner.

The constructions of the rotors 9 and 10 are identical except that the rotor 10 is longer than the rotor 9 to provide the rotor 10 with an increased working area over the working area of the rotor 9. Each rotor consists of a hub 24 secured to the power take-off shaft and integrally connected to an annular inner member 25 by a web or spider 26. The annular member 25 overlies the flanges 17 and 18 and is surrounded by an outer rotatably mounted annular member 27. The annular member is rotatably supported by anti-friction bearings 28 carried by the housing or casing 1 and also by babbit bearings 29. The anti-friction bearings 28 are capable of adjustment for wear through mediums 30. The babbit

bearing 29 is equipped with a spiral groove 31 for feeding lubricant endwise of the annular member 27, the lubricant reaching the spiral grooves through ports 32 communicative with the lubricant sump 15. The lubricant also reaches the anti-friction bearings 28 from the spiral grooves 31. The inner annular member 25 is arranged eccentric to the outer annular member 27 and the opposing faces of said annular members 25 and 27 have formed thereon spaced intermeshing teeth 33 cooperating with one another to form a series of non-communicative pockets 34 which pockets increase and decrease as to size during the rotation of the rotor as will be apparent by reference to Figures 4 and 5.

It is preferable that the wear plates 19 be held against rotation with the rotors 9 and 10, this being accomplished by ribs 35 integral with the casing or housing 1 fitting in sockets formed in said wear plates.

The chamber 7 connects the compressor chamber 5 with the motor chamber 6 and is known as a transfer chamber. Fuel from a carbureter 36 is introduced to the compression rotor 9 by a port 37 so that as the pockets of the rotor 9 progress in the direction indicated by the arrow in Figure 4 said compartments will be filled with fuel and as the pockets progress towards the intake end of the chamber 7 they decrease in size to compress the fuel and communicative with said end of the last-named manifold is an ignition medium 38 for igniting the fuel. The burning and expanded fuel leaves the compressor and passes to the power developing rotor 10, the discharge end of the chamber 7 being indicated by A so that the expanded fuels may enter and act on the pockets 34 of the rotor 10 and where said pockets are of a restricted dimension. As the pockets progress in the direction of the arrow in Figure 5 by the rotor 10 they increase in area and empty into an exhaust manifold 39.

The water of the boiler which surrounds the rotor compartments or chambers and the mixing and combustion chamber 7 absorbs heat and converts the water into steam at the upper portion of the boiler and in communication with the boiler is a steam dome 40 of substantially arcuate shape communicative with both ends of the chamber 7. Check valves 41 and 42 are provided in the manifold 40 adjacent the communication of the latter with the manifold defined by the chamber 7 and said check valves work in opposite directions so that steam pressure may be admitted to the burning fuel where the latter enters the pockets of the rotor 10, the check valve 41 normally remaining seated to close the steam dome 40 to the chamber 7 where the latter communicates with the compressor rotor 9. The check valves are of the spring seated type and the manifold is so constructed or offset that by-passes are defined in which the check valves operate so as to position the springs thereof within the chamber 8 and within the water and not within the burning fuel. The steam dome 40 intermediate its end is in communication with the boiler by a port 43 and operating through the manifold 40 is a float stem 44 one end of which is disposed in the chamber 8 and the other end enters a valve casing 44'. A float 45 is carried by the stem and governs the level of the water in the boiler through the actuation of a valve 46 in the valve casing 44'. The valve 46 controls ports 47, 48 and 49. The port 47 is connected to a water pump 50 by a pipe 51 and the port 48 is connected to the boiler by a pipe 52 while the port 49 is connected to a condenser 53 which will be hereinafter described. The connection between the condenser 53 and the port 49 is by way of a pipe 54 connected to an exhaust pipe 55 of the condenser 53 and which is connected to the exhaust manifold 39 of the rotor 10. The pump 50 is connected to the sump 56 of the condenser 53 by a pipe 57, it being noted that the sump is located in the lower end of the condenser. The condenser is of the vertical tube type with the exhaust pipe 55 entering the condenser at the lower ends of the tubes and the latter being spaced to permit air to be drawn therethrough by a fan 58 carried by the shaft of the pump 50, the pump being driven from the power take-off shaft by an endless belt 59. The pump is of a conventional rotary type, as clearly shown in Figure 12, wherein the rotor 60 is eccentrically mounted in the pump housing and carries a spring-pressed abutment 61 having a wiping contact with the walls of the pump casing. The pump 50 circulates the water by drawing the water from the condenser to the valve housing 44' where it may either pass into the boiler should the supply of water need replenishing or by-pass back to the condenser, the valve 46 and its float 45 governing the water level in the boiler. The steam generated in the boiler passes to the steam dome 40 by way of valve 42 and augments the burning fuel where the latter enters the pockets of the rotor 10 thereby increasing the power of the engine over that derived simply from the expansion of the burning fuel. The steam pressure in the steam manifold 40 against the valve 42 has a tendency to open the said valve 42. Only heated vapors enter the manifold chamber 7 when the poppet valve 42 opens. The spent gases and steam exhaust from the rotor 10 into the condenser 53 by the exhaust pipe 55 and passes through the tubes of the condenser so that the liquid of the exhaust will return to the sump 56 while non-condensable gases escape to the atmosphere by way of the port 62. In this arrangement the non-condensable gases are lowered in temperature to approximate atmospheric temperature so that when contacting with the atmosphere the exhaust will be substantially noiseless.

The operation of this engine can be either of the ignition type or of the Diesel type. However, when in the latter type it will require, during the initial starting of the engine, the use of the sparking medium 38 to ignite the first charge reaching the manifold defined by the chamber 7 after starting the compressor in rotation. The starting of the engine can be accomplished by the conventional type of starter connected to the power take-off shaft 4 if desired.

A control valve 63 is provided between the exhaust pipe 55 and the exhaust manifold 39 and is manually controlled. The engine can be employed for many purposes and when used for motor vehicle propulsion it can be caused to act as a brake medium for the motor vehicle to retard the momentum of the latter, this being accomplished by closing the valve 63 causing a back pressure to be developed on the rotor 10, the compressing rotor 9 continuing its compressing operation as long as the power take-off shaft 4 is in rotation. Should the compressed fuel in the engine or the rotors 10 and 9 thereof exceed the steam pressure in the steam dome 40 the check valve 41 will open to equalize the steam and gaseous pressure, consequently permitting the pressure in the boiler to be increased during the slowing down of the momentum of the ve-

hicle. The carbureter is equipped with a choke valve **64**, an air regulating valve **65** and a throttle valve **66**.

Having described the invention, I claim:

1. A rotary external combustion engine including a casing having a power takeoff shaft journaled therethrough and which casing is divided by partitions into end chambers, a lubricant sump between said end chambers, a boiler above said chambers, a steam dome above the boiler and receiving steam therefrom, a transfer chamber below the steam dome and having its ends communicating with the end chambers, spring influenced and oppositely opening valves between the steam dome and transfer chamber and one of said valves acting to admit excessive pressure to the dome from said transfer chamber, a compressor rotor on the shaft in one of the end chambers, a power developing rotor on the shaft in the second end chamber, each of said rotors having peripheral teeth and surrounding ring members provided with inner peripheral teeth in engagement with those of the rotors and eccentrically engaging with the rotor teeth, means for directing a fuel charge into the chamber for the compressor rotor to be compressed by said rotor, means for exploding the compressed fuel charge prior to its entrance into the transfer chamber and onto the power developing rotor, means for introducing steam from the dome into the transfer chamber by the opening of the other of said valves whereby the steam and burning gases are intermingled, means for directing the spent gases from the chamber for the power developing rotor, and lubricant conducting means extending from the lubricant sump for supplying lubricant therefrom onto the shaft and onto the rotors.

2. A rotary external combustion engine including a casing having a power takeoff shaft journaled therethrough and the casing being divided by partitions into end chambers, a lubricant sump between said end chambers, a boiler above said chambers, a steam dome above the boiler and receiving steam therefrom, and a transfer chamber below the steam dome and having its ends communicating with said end chambers, spring influenced and oppositely opening valves between the steam dome and transfer chamber and one of said valves acting to admit excessive pressure to the dome from said transfer chamber, a compressor rotor on the shaft in one of the end chambers, a power developing rotor on the shaft and located in the second end chamber, each of said rotors having peripheral teeth and surrounding ring members having inner peripheral teeth in engagement with those of the rotors and eccentrically engaging with the rotor teeth, means for directing a fuel charge into the chamber for the compressor rotor to be compressed by said rotor, means for exploding the compressed fuel prior to its entrance into the transfer chamber and onto the power developing rotor, means for introducing steam into the transfer chamber by the opening of the other of said valves, means for directing the spent gases from the chamber for the power developing rotor, lubricant conducting means for supplying lubricant from the lubricant sump onto the shaft and onto the rotors, said power shaft having a bore spaced from the ends thereof and provided with ports opposite the bearings therefor, ring bearings for the interiorly toothed rings for the rotors and having spiral grooves for feeding lubricant endwise of the rotors, a pipe between the lubricant sump and the central bearing for the shaft and providing a conduit for lubricant into the hollow portion of the shaft, and passages communicating with the lubricant sump for supplying lubricant into the spiral grooves of said ring bearings.

3. A rotary external combustion engine including a casing having a power takeoff shaft journaled therethrough and which casing being divided by partitions into end chambers, a lubricant sump between said end chambers, a boiler above said chambers, a steam dome above the boiler and receiving steam therefrom, a transfer chamber below the steam dome and having its ends communicating with the end chambers, spring influenced and oppositely opening valves between the steam dome and the transfer chamber and one of said valves acting to admit excessive pressure to the dome from said transfer chamber, a compressor rotor on the shaft in one of the end chambers, a power developing rotor on the shaft in the second end chamber, each of said rotors having peripheral teeth and surrounding ring members having inner peripheral teeth in engagement with those of the rotors and eccentrically engaging with the rotor teeth, means for directing a fuel charge into the chamber for the compression rotor to be compressed by said rotor, means for exploding the compressed fuel prior to its entrance into the transfer chamber and onto the power developing rotor, means for introducing steam into the transfer chamber by the opening of the other of said valves, means for directing the spent gases from the chamber for the power developing rotor, lubricant conducting means for supplying lubricant from the lubricant sump onto the shaft and onto the rotors, means comprising a pump for introducing water in the boiler, a float in the boiler, and a valve carrying stem on the float for controlling the supply of water to the boiler.

4. A motor of the class described employing in its construction a rotary compressor unit and a power developing unit and a shaft connecting said units, a boiler in communication with said units and receiving its heat from the explosive charge from the compressor unit, a steam dome above and receiving steam from the boiler, a float valve controlled means for regulating the supply of water to the boiler, a transfer chamber below the boiler and the steam dome and having ports communicating with said units and passages, oppositely directed spring influenced valves between the steam dome and the ends of the transfer chamber, and one of said valves acting to admit excessive pressure to the dome from said transfer chamber, means directing an explosive fluid onto the compressor unit to be compressed thereby, an agent for exploding the fluid after the compression and immediately prior to its entrance into the transfer chamber, means for introducing steam into the transfer chamber by the opening of the other of said valves, said exploded fuel, in a burning condition, adapted to be mixed with steam entering the transfer chamber before passing therethrough onto the power developing unit, and means for exhausting the spent fuel after the same has expanded its force on the power developing unit.

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