S. R. THORNTON.

INTERNAL COMBUSTION ENGINE.

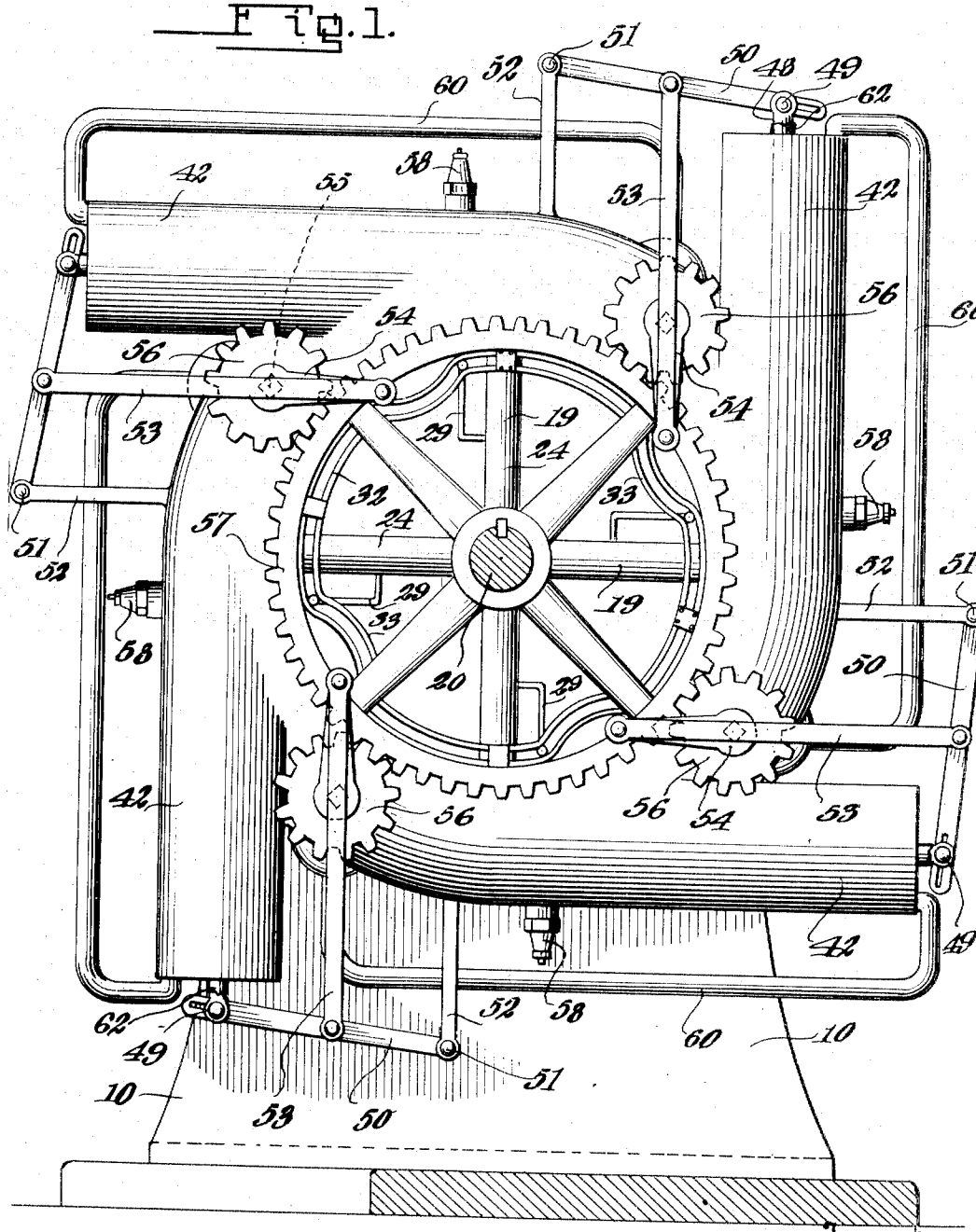
APPLICATION FILED JUNE 11, 1919.

1,385,161.

Patented July 19, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



Inventor

Stuart R. Thornton

By Lancaster and Allwine

his Attorneys

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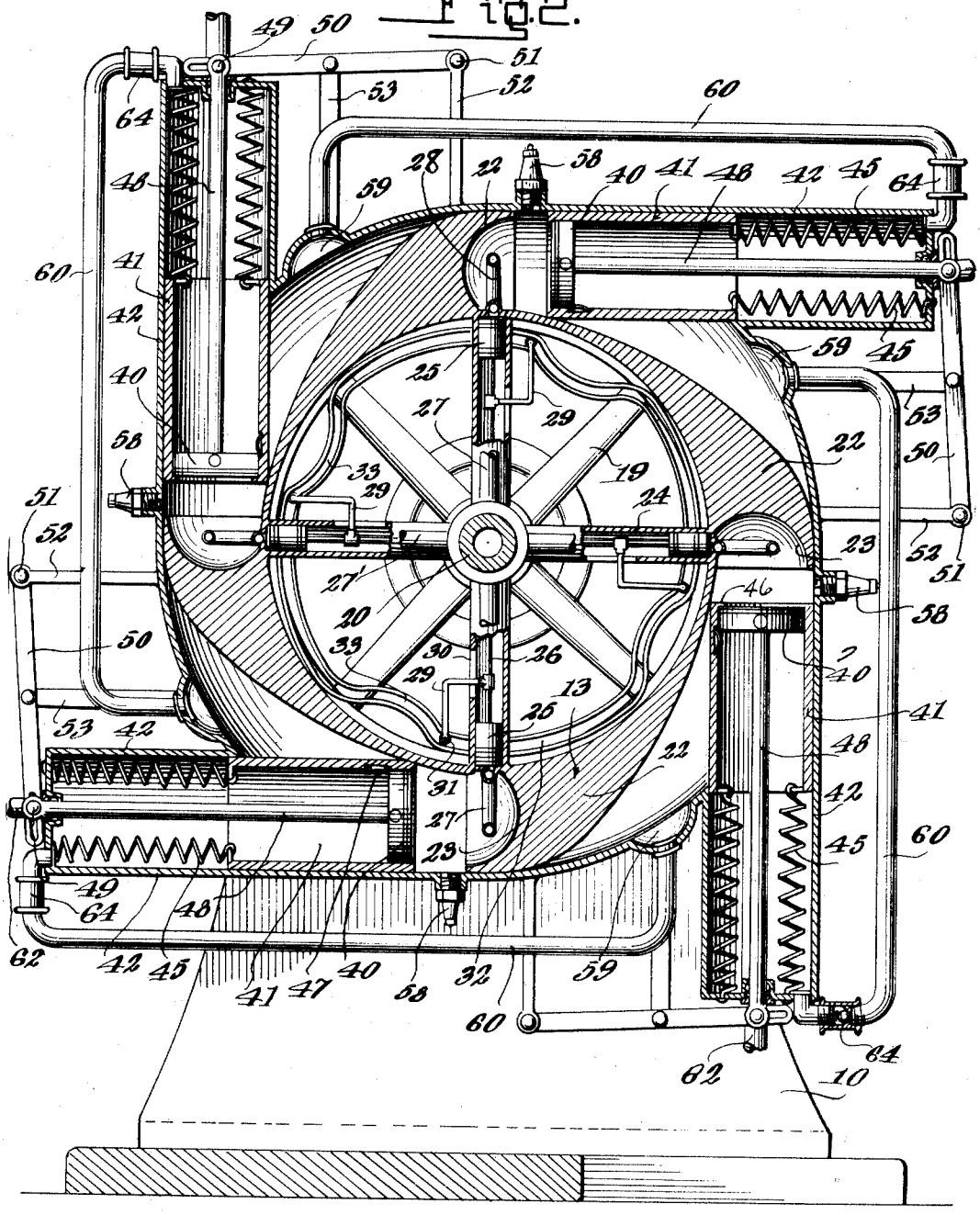
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

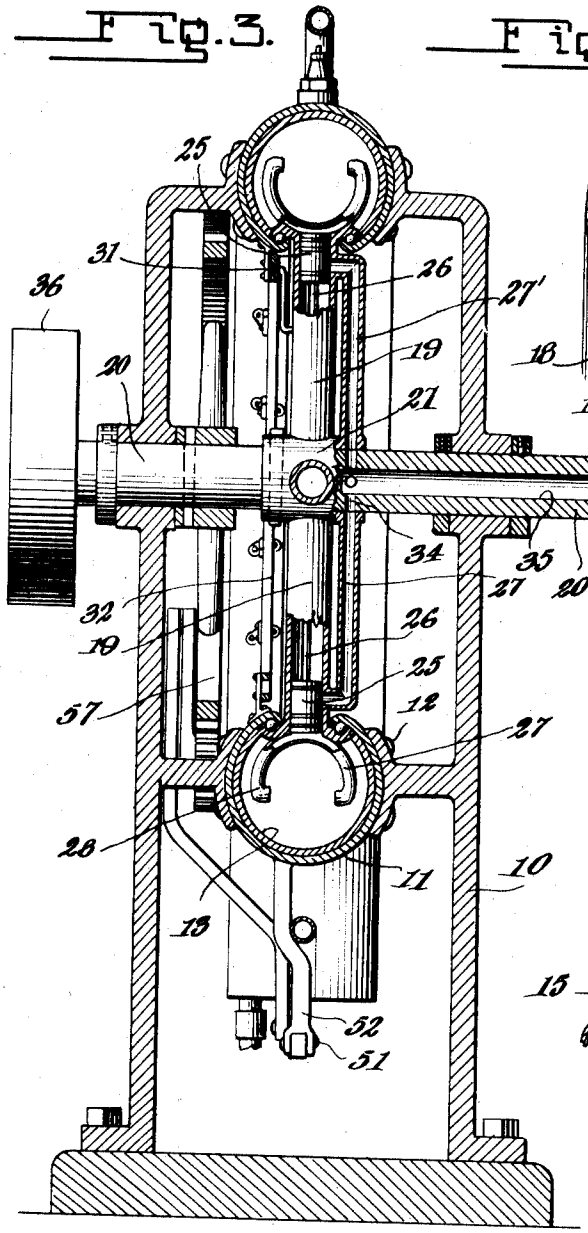


Fig. 4.

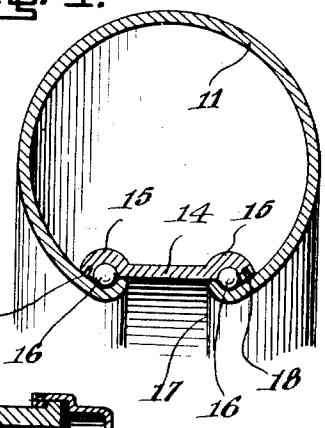
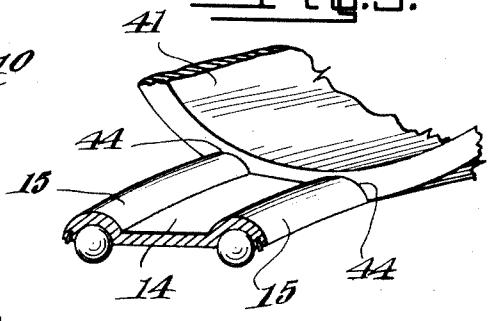


Fig. 5.



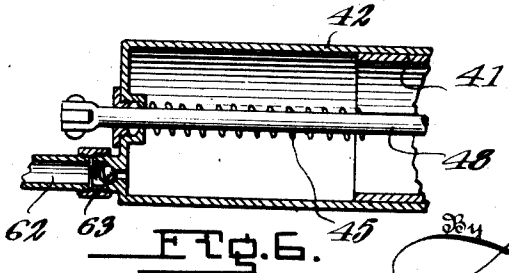


Fig. 6.

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UNITED STATES PATENT OFFICE.

STUART R. THORNTON, OF BERKELEY, CALIFORNIA.

INTERNAL-COMBUSTION ENGINE.

1,385,161. Specification of Letters Patent. Patented July 19, 1921.

Application filed June 11, 1919. Serial No. 303,325.

To all whom it may concern:

Be it known that I, STUART R. THORNTON, a citizen of the United States, residing at Berkeley, in the county of Alameda and State of California, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines of the rotary type, and an object of the invention is to provide, in a rotary engine, a rotor connected directly with the main power transmitting shaft which rotor carries a plurality of circumferentially spaced abutment members concentric of the axis thereof, and presenting abrupt radial ends provided with cup-shaped recesses adapted to form explosion chambers for the engine in which the fuel is exploded under compression, for imparting energy to the rotor.

A further object of the invention is to provide a plurality of tangentially extending extensions upon the stator of the rotary motor, in which extensions are slidably mounted cylinders, in which cylinders are slidably mounted compressing and suction creating pistons to scavenge the compression and explosion chambers of the engine during operation thereof and which cylinders co-act with cam surfaces formed upon the abutment members of the rotor to provide tight joints for the explosion chamber during the exploding of a charge of fuel therein.

Another object of the invention is to provide a novel construction for controlling the inlet of fuel into the respective explosion chambers, which comprises a plurality of fuel feeding tubes extending radially from and receiving their charge from the main power shaft of the engine and which open out into radially extending cylinders having pistons slidably mounted therein which are moved during the rotation of the rotor by means of a cam cap to automatically open and close the port entering into the cylinders, at the proper time to permit the combustible fuel to flow thereinto which fuel is in turn forced from the said cylinders into the explosion chamber of the engine by the outward movement of the said valve piston, where it is compressed by the inward movement of the pistons which extend tangentially from the stator.

Other objects of the invention will appear from the following detailed description taken in connection with the accompanying drawings forming a part of this specification and in which drawings:

Figure 1 is a side elevation of the improved rotary engine.

Fig. 2 is a vertical section through the engine.

Fig. 3 is a vertical cross-section through the engine.

Fig. 4 is an enlarged detailed section through the cylinder portion of the engine illustrating the connection between the rotor and stator.

Fig. 5 is a detailed perspective illustrating the engagement between the rotor and the tangentially extending cylinders or sleeves, and

Fig. 6 is a section through the tangentially extending portions of the casing or stator of the engine, taken at right angles to the section therethrough illustrated in Fig. 2.

Referring more particularly to the drawings, wherein like characters indicate like and corresponding parts throughout the several views, 10 indicates the supporting structure of the rotary internal combustion engine to which the stator 11 is rigidly connected as shown at 12. The stator 11 comprises a circular cylinder, which is also circular in cross section as shown in Fig. 4 of the drawings, and the rotor 13 rotates within the cylinder of the stator 11. The rotor 13 comprises an annular ring 14, the edges of which are shaped to form ball races 15 which receive therein bearing balls 16. The circular cylinder of the stator 11 has its innermost portion cut away as shown at 17 in Fig. 4 of the drawings, and the edges along this cut away portion are rolled inwardly to form ball races for co-action with the ball races 15. Suitable piston rings 18 are carried by the edges of the rotor 14 to provide fluid-tight connection between the rotor and the stator. This annular cut out portion 17 is formed to accommodate the spokes 19 which support the rotor 13, and which are connected to the power shaft 20 of the engine through the medium of a hub structure 21.

The rotor ring 14 has a plurality of enlargements 22 formed thereon, terminating in abrupt shoulders radial of the axis of the rotor, which shoulders are provided with substantially semi-spherical or cup shaped cut out portions 23 forming with a portion of the interior of the stator 11 the combustion

and explosion chambers of the rotary internal combustion engine. Certain of the spokes 19, more specifically the spokes 24 are hollow and have pistons 25 slidably mounted therein, and carried by piston rods 26. The pistons 25 are adapted to permit the passage of combustible fuel from the tubes 27′ into the hollow or tubular spoke 24 in advance of the pistons when the latter are retracted, and these valve pistons force the combustible fuel which enters the tubular spokes 24 outwardly through relatively small outlet pipes 27 and 28 into the cup-shaped recesses 23 for admitting a charge of fuel into the stator in front of each of the enlargements 22. The piston rods 26 each have an angled roller carrying arm 29 attached thereto which extends through a slot 30 in the respective tubular spokes and has a roller 31 upon its outer end. This roller 31 travels in an annular cam way 32, carried by the stator structure and having depressions or depressed portions 33 therein, which when engaged by the roller 31 will retract the piston 25, permitting fuel to flow from the tubes or manifold pipes 27′ into the tubular spokes 24. The tubular manifold or supply pipes 27′ have communication through radial openings 34 with the bore 35 formed axially within the shaft 20 for a portion of its length. The shaft 20 has its outer end opposite to that which carries the pulley or other transmitting mechanism 36 connected to a fuel supply pipe 37 by means of a coupling connection 38 constructed to permit unimpeded rotation of the shaft 20 without breaking the fluid tight connection between the shaft and coupling, and so as to permit fuel to pass through the pipe 37, coupling 38 into the bore 35 of the shaft 20 for feeding into the stator through the respective tubes 27′.

After the fuel enters the cup-shaped recesses 23 and the adjacent portion of the stator it is compressed by means of a plurality of pistons 40, one of which is disposed in facing relation to each of the abrupt shoulders of the enlargement 22 upon the rotor. The pistons 40 are slidably mounted in sleeves 41, which are in turn slidably supported by tangentially extending cylindrical extensions 42 formed upon the periphery of the stator 11. The sleeves 41 have arcuate recesses 44 in their outer ends for snugly fitting over the bulged portions 15 of the rings 14 of the rotor structor to provide comparatively fluid tight joints between the sleeves or cylinders 41 and the rotor. The cylinders 41 have expanding springs 45 connected to their inner ends which springs are also connected to the ends of the tangential extensions 42, tending to normally urge the cylinders inwardly into the stator. The inner ends of the cylinders 41 are provided with inwardly extending flanges 46 which engage about the inner end of the pistons 40 when the latter are at their innermost positions, and springs 47 are carried by the inner walls of the cylinders and are adapted to engage against the pistons 40 to connect the pistons and cylinders for synchronous movement. The piston rods 48 which are connected to the pistons 40 each have their outer ends connected, by means of a slot and pin connection as shown at 49 with a rocking arm 50. The rocking arm 50 is pivotally supported as shown at 51 by a suitable supporting arm 52 carried by the stator structure 11. The ends of the lever 50 remote from their connections with the piston rods 48 are connected to arms 53 which are in turn connected by means of bell cranks 54 to the shafts 55, carried by the stator structure. These shafts 55 are rotatably supported by the stator and have pinions 56 mounted thereon which mesh with a gear 57 carried by the power shaft 20 of the engine. The ratio between the pinions 56 and the gear 57 is such as to insure proper operation of the pistons during each cycle of operation of the motor. The compressed charge, in the stator or in the explosion chambers of the rotary engine is ignited, in the usual manner by means of spark plugs 58 and upon explosion, the expanding gases will impinge against the walls of the cup-shaped recesses 23 and force the rotor about its axis. This same expanding force of the exploding gases or fuel will act upon the inturned flange 46, tending to force the cylinders 41 rearwardly or outwardly into the extension 42. However, the cylinders will not be permitted to move faster than the pistons 40 owing to the said flanges 46. The enlargements 22 have outer arcuate surfaces eccentric of the circumference of the stator and rotor which eccentric surfaces are shaped to maintain a substantially fluid-tight engagement with the inner ends of the cylinders 41 during their outward or retracting movement, preventing the escape of the exploded gases from the combustion chamber of the engine. After the respective enlargements or abutments pass the cup-shaped enlargements 59 upon the stator, the spent gases or fuel enter these enlargements and pass outwardly through the exhaust pipes 60, exhausting into the extensions 42 and the pistons 40 upon their inward movement create a suction in the extensions 42 and through the exhaust pipes 60 for scavenging the interior of the stator and drawing the exhausted gases into the extensions 42 from which they exhaust upon the retracting movement of the pistons 40 through outlet pipes 62, in which are positioned check valves 63. The check valves 63 prevent the sucking of air into the extensions 42 upon the inward stroke of the pistons 40 but permits the forcing of the ex-

hausted gases out of the cylinders upon the retracting stroke of the pistons. Check valves 64 are positioned in each of the exhaust pipes 60 to prevent the spent gases from being forced back into the stator.

Changes in details may be made without departing from the spirit of this invention, but;

I claim:

1. In a rotary engine, the combination of a stator, a rotor therein, abrupt shoulders forming compression abutments, pistons extending tangentially from the circumference of the rotor for co-action with said abutment to compress fuel in the stator, means operated by rotation of said rotor for retracting said pistons, said abutments provided with cup-shaped recesses forming fuel-receiving pockets, fuel supply pipes extending into said pockets, and means operated by rotation of said rotor for controlling the inlet of fuel into said pocket.

2. In a rotary engine, the combination, of a stator, a main power shaft, a rotor carried by said shaft, abutments formed upon said rotor to form fuel compression chambers within said stator, said power shaft being hollow to receive and conduct fuel, and tubes having communication with the passageway in said power shaft and with the interior of the stator for feeding fuel into the stator, piston valves for controlling the flow of fuel into the stator and means operable during rotation of the rotor for operating said piston valves to control the flow of fuel into the stator.

3. In a rotary engine, the combination, of a stator, a main power shaft, a rotor carried by said shaft, abutments formed upon said rotor to form fuel compression chambers within said stator, said power shaft being hollow to receive and conduct fuel, tubes having communication with the passageway in said power shaft and with the interior of the stator for feeding fuel into the stator, piston valves for controlling the flow of fuel into the stator, means operable during rotation of the rotor for operating said piston valves to control the flow of fuel into the stator, tangential extensions formed upon said stator, pistons slidably carried by said extensions and adapted to co-act with said abutments to compress fuel between the pistons and abutments.

4. In a rotary engine, the combination, of a stator, a main power shaft, a rotor carried by said shaft, abutments formed upon said rotor to form fuel compression chambers within said stator, said power shaft being hollow to receive and conduct fuel, tubes having communication with the passageway in said power shaft and with the interior of the stator for feeding fuel into the stator, piston valves for controlling the flow of fuel into the stator, means operable during rotation of the rotor for operating said piston valves to control the flow of fuel into the stator, tangential extensions formed upon said stator, pistons slidably carried by said extensions and adapted to co-act with said abutments to compress fuel between the pistons and abutments, exhaust pipes having communication with the interior of said stator and with the interior of said tangential extension whereby the inward movement of the piston within these sections will create a suction through the exhaust pipe and stator for scavenging the latter.

5. In a rotary engine, the combination, of a stator, a main power shaft, a rotor carried by said shaft, abutments formed upon said rotor to form fuel compression chambers within said stator, said power shaft being hollow to receive and conduct fuel, tubes having communication with the passageway in said power shaft and with the interior of the stator for feeding fuel into the stator, piston valves for controlling the flow of fuel into the stator, means operable during rotation of the rotor for operating said piston valve to control the flow of fuel into the stator, tangential extensions formed upon said stator, pistons slidably carried by said extensions and adapted to co-act with said abutments to compress fuel between the pistons and abutments, exhaust pipes having communication with the interior of said stator and with the interior of said tangential extension whereby the inward movement of the piston within these sections will create a suction through the exhaust pipe and stator for scavenging the latter, and means operable by rotation of said rotor for operating said piston.

6. In a rotary engine, the combination, of a stator, a rotor therein, having abrupt shoulders thereon forming compression abutments, tangential extensions formed upon said stator, sleeves slidably mounted in said extensions, pistons slidably mounted in said sleeves for movement toward said abutments to co-act therewith to compress fuel within the stator, means operable by rotation of the rotor for operating said pistons, exhaust pipes having communication with the interior of said stator and with the interior of said tangential extensions whereby the inward movement of said pistons will create a suction in the portions of the stator of said abutment to draw exhausted gases therefrom.

7. In a rotary engine, the combination, of a stator, a rotor therein, having abrupt shoulders thereon forming compression abutments, tangential extensions formed upon said stator, sleeves slidably mounted in said extensions, pistons slidably mounted in said sleeves for movement toward said abutments to co-act therewith to compress fuel within the stator, means operable by rota-

tion of the rotor for operating said pistons, exhaust pipes having communication with the interior of said stator and with the interior of said tangential extensions whereby the inward movement of said pistons will create a suction in the portions of the stator of said abutment to draw exhausted gases therefrom, and a check valve for permitting the exhausting of the spent gases from said tangential extensions upon retracting movement of said pistons.

8. In a rotary engine, the combination, of a stator, a rotor therein having abrupt shoulders forming compression abutments, a power shaft operatively connected to said rotor and provided with a passageway, tubes carried by said shaft and having communication with the passageway therein and with the interior of the stator for supplying fuel through the main shaft and into the stator in front of said abutment, tangential extensions upon said stator, pistons slidable in said extension for co-action with said abutment to compress fuel between the abutments and pistons, means operable by rotation of said rotor for controlling the inlet of fuel into the stator, and sleeves slidable in said tangential extension and positioned about said pistons for maintaining substantial fluid-tight connection between the stator and rotor and the space between the facing surfaces of the piston and abutment.

9. In a rotary engine, the combination, of a stator, a rotor therein having abrupt shoulders forming compression abutments, a power shaft operatively connected to said rotor and provided with a passageway, tubes carried by said shaft and having communication with the passageway therein and with the interior of the stator for supplying fuel through the main shaft and into the stator in front of said abutment, tangential extensions upon said stator, pistons slidable in said extensions for coaction with said abutment to compress fuel between the abutments and pistons, means operable by rotation of said rotor for controlling the inlet of fuel into the stator, and sleeves slidable in said tangential extension and positioned about said pistons for maintaining substantial fluid-tight connection between the stator and rotor and the space between the facing surfaces of the piston and abutment, said sleeves adapted to telescope in said tangential extension during the power stroke of the rotor, and means operable by the rotation of the rotor for retracting said pistons during the power movement thereof.

10. In a rotary engine, the combination, of a stator, a rotor therein having abrupt shoulders forming compression abutments, a power shaft operatively connected to said rotor and provided with a passageway, tubes carried by said shaft and having communication with the passageway therein and with the interior of the stator for supplying fuel through the main shaft and into the stator in front of said abutment, tangential extensions upon said stator, pistons slidable in said extension for co-action with said abutment to compress fuel between the abutments and pistons, means operable by rotation of said rotor for controlling the inlet of fuel into the stator, sleeves slidable in said tangential extension and positioned about said pistons for maintaining substantial fluid-tight connection between the stator and rotor and the space between the facing surfaces of the piston and abutment, said sleeves adapted to telescope in said tangential extensions during the power stroke of the rotor, means operable by the rotation of said rotor for retracting said pistons during the power movement thereof, exhaust pipes having communication with the interior of said stator and said tangential extensions, whereby inward movement of said pistons will create a suction through the exhaust pipes for drawing spent gases into the tangential extensions, and check valves for permitting the exhaust of spent gases from said tangential extensions upon retracted movement of said pistons.

11. A rotary engine comprising in combination a stator, a rotor operatively mounted in said stator, a cylinder extension upon said stator, a piston operatively disposed in said cylinder extension for communication within said stator, a communicating means between the interior of said stator and said cylinder extension, and means for synchronous operation of said piston and rotor, whereby waste gases will be exhausted from said stator into said cylinder extension.

STUART R. THORNTON.