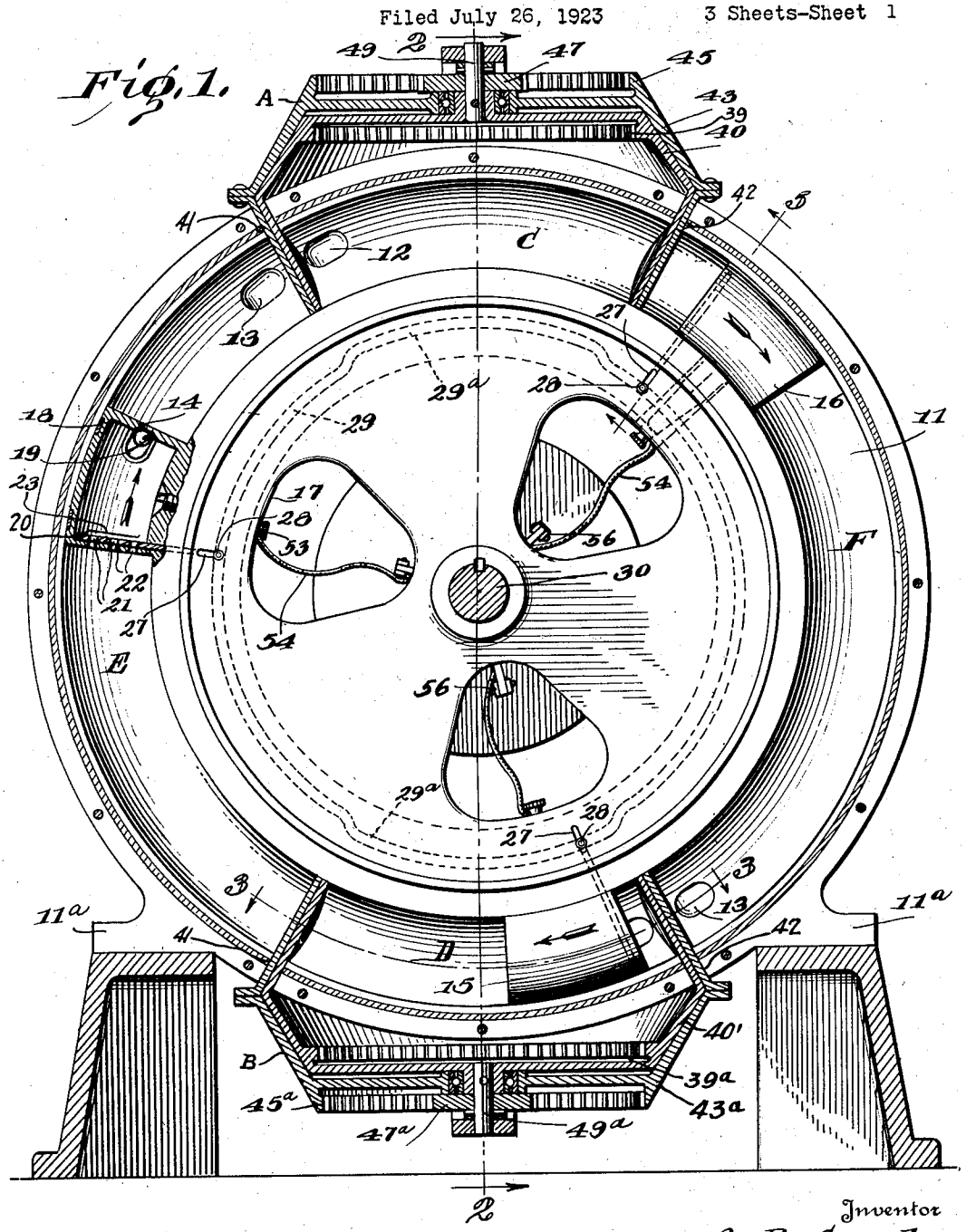
Nov. 17, 1925. 1,562,299

A. B. CUNDY

ROTARY INTERNAL COMBUSTION ENGINE

Filed July 26, 1923 3 Sheets-Sheet 1

Fig. 1.



Inventor
A. B. Cundy

By Fetherstonhaugh & Co.
Attorney.

Nov. 17, 1925. 1,562,299

A. B. CUNDY

ROTARY INTERNAL COMBUSTION ENGINE

Filed July 26, 1923 3 Sheets-Sheet 2

Fig. 2.

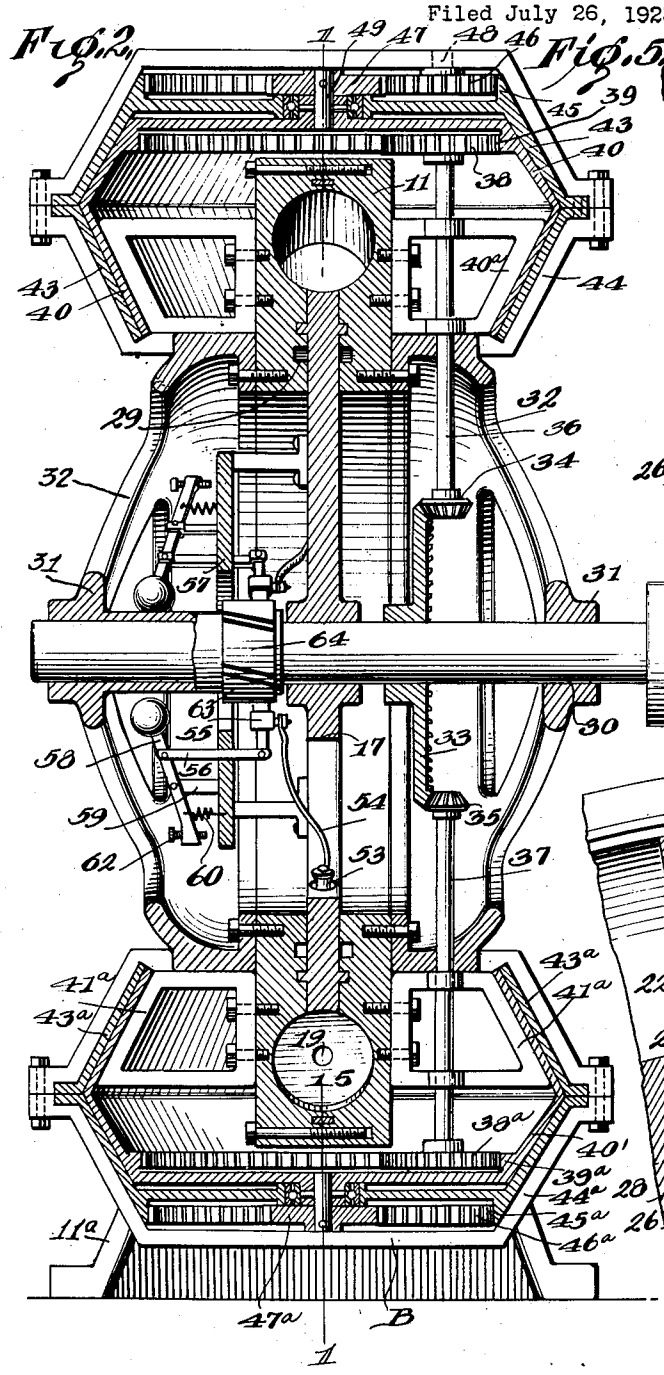


Fig. 5.

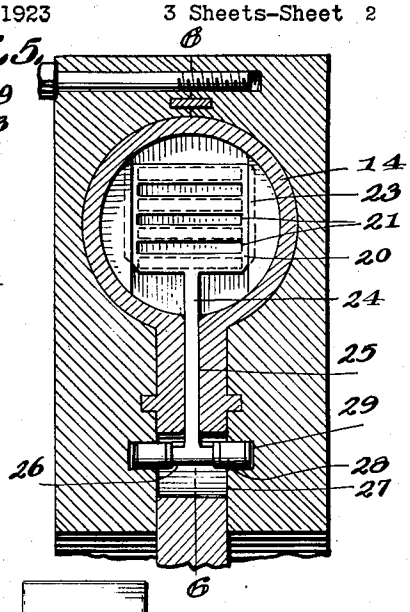
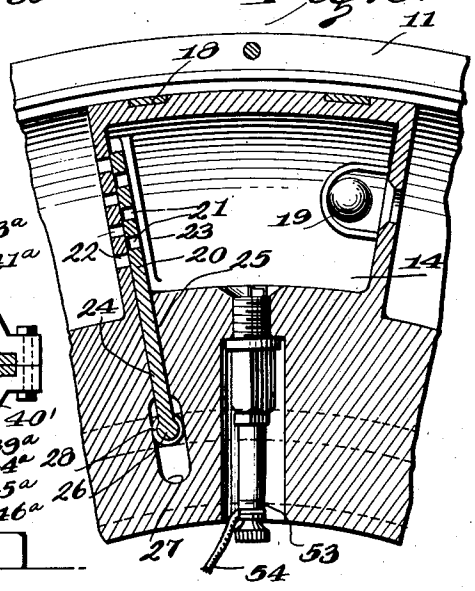


Fig. 6.



Inventor

A. B. Cundy

By Fetherstonhaugh & Co

Attorney

Nov. 17, 1925. 1,562,299

A. B. CUNDY

ROTARY INTERNAL COMBUSTION ENGINE

Filed July 26, 1923 3 Sheets-Sheet 3

Fig. 3.

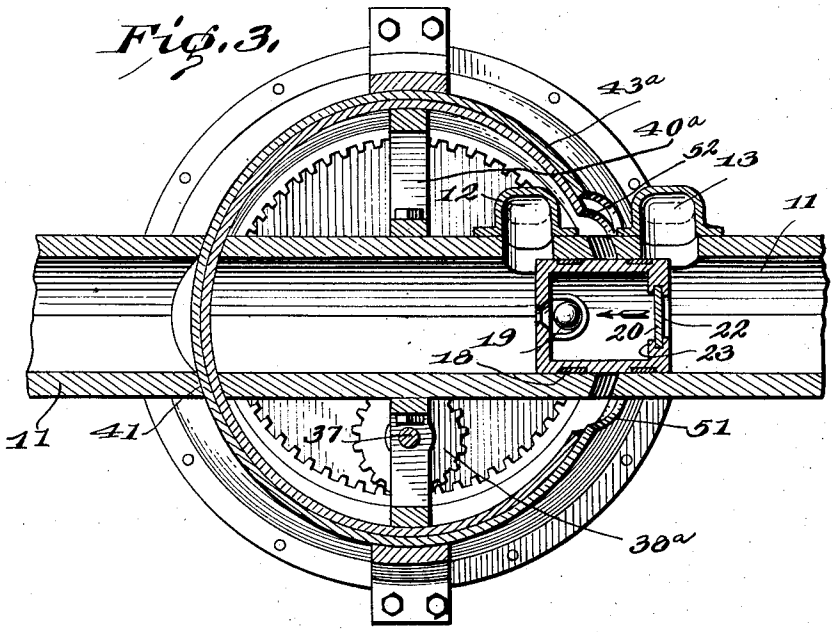
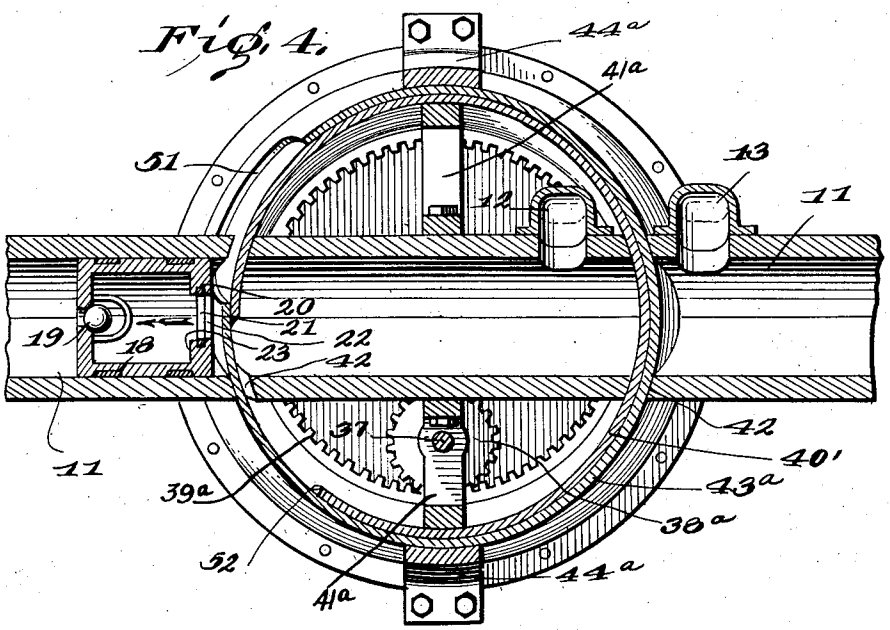


Fig. 4.



Inventor

A. B. Cundy

By F. Theuerkaufer

Attorney

Patented Nov. 17, 1925. 1,562,299

UNITED STATES PATENT OFFICE.

ARTHUR B. CUNDY, OF DURANGO, COLORADO, ASSIGNOR OF FOUR-TWELFTHS TO FRANK LAKE, JR., THREE-TWELFTHS TO GLEN A. STOKES, ONE TWENTY-FOURTH TO A. R. MOLLETTE, AND ONE TWENTY-FOURTH TO R. S. CLEMENTS, ALL OF DURANGO, COLORADO.

ROTARY INTERNAL-COMBUSTION ENGINE.

Application filed July 26, 1923. Serial No. 654,017.

To all whom it may concern:

Be it known that I, ARTHUR B. CUNDY, a subject of the King of Great Britain, and resident of Durango, county of La Plata, State of Colorado, have invented certain new and useful Improvements in Rotary Internal-Combustion Engines, of which the following is a specification.

The purpose of this invention is to provide a generally improved internal combustion engine of the rotary type, and a distinctive feature resides in the provision of means for effecting one or more explosions of a combustible mixture behind each of a series of pistons moving in a continuous circular path.

A further feature of the invention resides in the provision of cylinder heads of novel form, comprising wall means movable across the cylinder to position the same in or out of the path of the pistons, the movement of said wall means being controlled in timed relation to the movement of the pistons, so as to properly coact therewith.

A further feature of the invention resides in the provision of hollow pistons, each of which is provided with an inwardly opening inlet valve and a mechanically controlled outlet valve, the purpose being to enable the charge of fuel to be compressed and exploded within the interior of the piston, instead of the cylinder, as heretofore proposed.

A further feature of the invention resides in utilizing each piston for the purpose of scavenging the cylinder of the exhaust gases exploded within a preceding piston.

A still further feature of the invention resides in utilizing each piston to draw into the cylinder a charge of fuel to be compressed within a succeeding piston.

Other purposes and advantages of the invention as well as the particular construction and assemblage of parts which I have elected to disclose herein will be more readily understood from the following detailed description and accompanying drawings.

In the drawings:

Figure 1 is a vertical sectional view through the cylinder showing the construction of the rotor.

Fig. 2 is a transverse vertical sectional view.

Fig. 3 is a sectional view on the line 3—3 of Fig. 1.

Fig. 4 is a view similar to Fig. 3, but showing certain parts in a different position.

Fig. 5 is a sectional view on line 5—5 of Fig. 1, and

Fig. 6 is a sectional view on line 6—6 of Fig. 5.

Referring more particularly to the drawings, 11 represents a stationary annular cylinder, supported in upright position on suitable legs 11^a, and provided with valve controlled fuel inlet ports 12 and exhaust ports 13. The pistons 14, 15 and 16, operating in said cylinder, are carried by a rotatable disk 17, and may be provided with packing rings of any suitable design for properly engaging the inner wall of the cylinder. These pistons are of hollow construction, being each provided with a check valve 19 at one end, and a slide valve 20 at the opposite end. The valve 20 of each piston is provided with slots 21 adapted to move into and out of registration with the complementary slots 22 formed in the adjacent end wall of the piston, the valve being confined for sliding movement between the said end wall and suitable guide ribs 23. Each valve 20 is further provided with a stem 24, which is mounted to slide in a radial bore 25 of the disk 17 and terminates at its inner end in a cross head 26, which operates in a slot 27 formed in the disk at the inner end of bore 25. The ends of each cross head 26 carry rollers 28 disposed to travel in cam slots 29 formed in opposite sides of the cylinder. As shown in Fig. 1 each slot 29 is provided with two diametrically opposite offset portions 29^a forming cam lifts to be utilized as hereinafter explained.

Disk 17 is fixed to a shaft 30, which is supported to rotate in alined bearings 31 carried by a pair of frame members 32, which are bolted to opposite sides of the cylinder as shown to advantage in Fig. 2. Said shaft 30 is equipped with a relatively large gear 33, which is in constant mesh with oppositely disposed pinions 34 and 35, carried by the inner ends of shafts 36 and 37.

At its outer end shaft 36 is equipped with a pinion 38 having driving engagement with a ring gear 39 carried by a circular shell 40, which is mounted to rotate about an axis

perpendicular to the shaft 30, and is positioned to operate in slots 41 and 42 formed in cylinder 11. Shell 40 revolves between suitable guides 40ª and a correspondingly shaped outer shell 43, which, in turn is rotatably mounted within an outer casing 44, secured to the cylinder 11 in any approved manner. The outer shell 43 is provided at the top with a ring gear 45 adapted to be driven through the instrumentality of intermeshing gears 46 and 47 carried by shafts 48 and 49. At its lower end, shaft 49 is keyed to shell 40. With this particular form of gearing, it will be manifest that the rotation of shaft 30 is utilized to rotate the shells 40 and 43 in opposite directions, so as to cause slots or piston passages 51 and 52 formed in said shells to pass into and out of registration during rotation of the latter.

Shaft 37 is provided at its outer end with a pinion 38ª meshing with a ring gear 39ª carried by a rotatable shell 40′ corresponding to the shell 40 previously described. The shell 40′ revolves between guides 41ª and a correspondingly shaped outer shell 43ª housed within a casing 44ª corresponding to the aforementioned casing 44, and the said shells 40ª and 43ª are geared together through the instrumentality of the ring gear 45ª and pinions 46ª and 47ª. These shells 40ª and 43ª are provided with piston passages 51 and 52, corresponding to the aforementioned passages 51 and 52 of shells 40 and 43. The pair of shells housed within each of the casings 44 and 44ª constitute, in effect, rotatable cylinder heads, designated generally by reference characters A and B, and operated by the gearing described in connection therewith to move in timed relation to the movement of the pistons, the apertured portions of each pair of shells being periodically brought into registration within the bore of cylinder 11 to permit the piston to move therethrough, solid portions of the shell being subsequently presented to the piston to cooperate therewith in the manner of a cylinder head, as subsequently set forth in greater detail.

Each of the pistons 14, 15 and 16 is provided with a spark plug 53 connected by a suitable lead 54 to a contact brush 55, which is carried by the inner end of a rod 56. The several rods 56 are disposed in substantial parallelism with the shaft 30 and are mounted to slide through suitable openings formed in a supporting plate 57 bolted to one side of the disk 17. At its outer end each rod 56 is connected to a governor arm 58, adjacent the inner or ball end of the latter. These governor arms 58 are pivoted to suitable brackets 59 carried by the aforementioned plate 57 and are connected to said plate adjacent their outer ends by suitable springs 60. If desired, adjusting screws 62 may be threaded through the outer ends of the governor arms to contact with the plate 57 and thereby limit the swinging movement of the arms in one direction. The brushes 55 are adapted to be successively engaged by contact strips 63 carried by a disk 64 secured on the shaft 30, and these contact strips are inclined with respect to the axis of the disk 64, so that the engagement of said strips with the brushes 55 will be retarded or advanced according to the direction of sliding movement imparted to the said brushes by the operation of the governor arms 58.

On referring to Fig. 1, it will be observed that the bore of the cylinder is partitioned off by the shells 40 and 43 of the cylinder head A and the shells 40′ and 43ª of the cylinder head B to provide a pair of oppositely disposed compression chambers C—D and a pair of intervening chambers E—F.

In explaining the operation of the engine, we will assume that the parts are disposed, as shown in Fig. 1, and that the shaft 30 is rotating in a clockwise direction. As the piston 14 reaches the exhaust port 13, the shells 40 and 43 will have been rotated to such a position that the piston passages 51 and 52 of said shells are alined with one another within the bore of the cylinder 11 and between the upper ports 12 and 13, thereby permitting piston 14 to pass into the compression chamber C. As soon as the piston passes into this chamber, the openings 51 and 52 are moved out of registration by continued rotation of shells 40 and 43, thus bringing solid portions of said shell into position directly behind the piston. The continued movement of the piston 14 within the compression chamber C serves to create a suction in said chamber between the rear end of the piston and the opposing solid portions of the shells 40 and 43 with the result that an initial charge of explosive mixture is drawn into chamber C through the inlet port 12 positioned in said chamber. It will be noted, in this connection, that during the movement of the piston through the chamber C, the rollers 28 are travelling along the offset portion 29ª of the cam groove 29, so that the slots of the valve 20 are disposed out of registration with the slots in the piston, so as to close the rear end of the latter. At the time that piston 14 reaches the right hand end of chamber C, the shells 40 and 43 will have rotated a complete revolution, thus bringing the piston passages 51 and 52 into registration at this end of the compression chamber to permit the piston to escape therefrom and to enter the combustion chamber F. As the piston 14 moves through the said combustion chamber F, the continued rotation of the shells 40 and 43 causes the passages 50 and 51 to again register with one another between the ports 12 and 13 or in other words at the entrance end of the compression chamber C,

so that the piston 15 now passes into the said compression chamber, to compress the charge left therein by the preceding piston 14. This charge being compressed by advancement of piston 15, against the solid portions of the shells 40 and 43, at the discharge end of chamber C is caused to pass into the interior of the piston through the valve 19 to be entrapped therein until the piston escapes from the chamber C through the passages 51 and 52, when the latter are brought into registration at the discharge end of said chamber. During this movement of piston 15 through chamber C it will be evident that the vacuum occurring between the rear or the retreating end of the piston and the opposing solid portions of the shells 40 and 43 will serve to draw a second charge of fuel into the compression chamber C to be entrapped therein for compression by the following piston 16. As the piston 15 with its contained charge passes from the chamber C, the continued rotation of the shells 40 and 43 causes solid portions of the latter to be presented behind or opposite the rear end of the piston, and, at this moment, the rollers 28 carried by the stem 24 of the piston valve 20 pass out of engagement with the offset portion 29^a of the cam groove 29, so as to bring the openings 21 of said valve in registration in the openings 22 of the piston to permit the said charge to escape from the piston. At or before the instant the charge is thus permitted to escape from the piston, it is exploded by means of the spark plug 53, as the arrangement of the brushes 55 is such that the brush of the piston 15 will, at this particular moment, be in constant with one of the elements 63. The impact resulting from the explosion of the charge against the solid portions of the shells 40 and 43 closing the discharge end of chamber C will serve to impel the piston 15 through the combustion chamber F in the direction of the second compression chamber D.

From the foregoing explanation, it will be apparent that as each piston enters either the compression chamber C or the chamber D, it serves to compress and entrap the charge of fuel left in said chamber by the preceding piston, and at the same time also serves to draw into the said chamber a fresh charge of mixture to be left therein for compression by a succeeding piston. It will also be apparent that each piston as it is driven through either the explosion chamber E or the chamber F will serve to expel from said chamber the products of combustion left by a preceding piston, such products of combustion being driven outwardly through the exhaust ports 13. An important feature to be noted here is that the combustion chambers are made considerably longer than the compression chambers in order to provide for a material reduction in the pressure of the expanded fuel prior to discharge of the latter through the ports 13. Preferably, the length of the combustion chambers is such that the pressure of the expanded fuel will be approximately equal to that of the atmosphere at the instant of discharge. The relative operation of the pistons, and the shells of the movable cylinder heads A and B, as well as the functioning of the ignition means, is so timed, by the mechanism herein disclosed or in any other suitable manner, to permit the afore-mentioned operation to be carried out as described and without material loss of compression. With this particular design of engine, it will be manifest that great power is developed, owing to the fact that three pistons are provided, together with means for imparting two distinct driving impulses to each during a single rotation of the disk 17.

Having thus fully described my invention, it is to be understood that I am not to be limited to the exact details disclosed herein, but may clothe the novel principles disclosed in any desirable embodiment, falling within the scope and spirit of the appended claims.

What I claim is:

1. The combination, in a rotary engine, of an annular cylinder, a series of hollow pistons movable therein, an inlet valve carried by the front end of each piston, an outlet valve carried at the opposite end of each piston, a pair of cylinder heads comprising each a pair of circular shells mounted to rotate about an axis perpendicular to that of the cylinder and positioned to intersect the bore of the cylinder and to form therewith a pair of compression chambers separated by intervening combustion chambers, the shells of each pair being provided with slots adapted to be alternately brought into registration at opposite ends of the compression chamber to permit the pistons to pass into and out of the same, fuel inlets communicating with said compression chamber, exhaust passages leading from said combustion chambers, and means acting automatically to hold the outlet valve of each piston closed during movement of the piston through said compression chambers and to permit opening of said valve upon escape of the piston from said compression chambers.

2. A structure according to claim 1 in which the shells of each cylinder head are geared to one another and to a drive shaft carrying said piston.

3. A structure according to claim 1 in which the shells of each cylinder head are driven in opposite directions.

4. A structure according to claim 1 including a drive shaft carrying said piston and means gearing the shells of each cylinder

head to one another and to the drive shaft in such manner as to cause said shells to rotate in opposite directions and in proper timed relation with the movement of the piston.

5. A structure according to claim 1 including spark plugs carried by said pistons, normally open circuits including said plugs and means controlled by movement of the pistons for closing said circuits successively.

6. A structure according to claim 1, including spark plugs carried by said pistons, a drive shaft to which said pistons are rigidly secured, a disc fixed to said shaft, inclined contact strips carried by said discs, a brush engageable with said strips to successively close circuits including said plugs, and means for shifting said brush longitudinally of the shaft to vary the time of contact between the brush and the inclined strips.

7. The combination, in a rotary engine, of an annular cylinder, a slotted rotary shell intersecting said cylinder and forming a combined compression chamber and piston head, a fuel inlet communicating with the cylinder internally of said shell, an exhaust passage communicating with said cylinder externally of said shell, a hollow piston movable in said cylinder, an inlet valve at the front end of the piston, an outlet valve at the rear end of the piston, control means for the outlet valve acting automatically to maintain the valve closed during movement of the piston through the said shell and to permit opening of the valve as the piston escapes from the shell, and means for igniting a charge of fuel compressed into the piston during its passage through said shell.

In testimony whereof I hereunto affix my signature.

ARTHUR B. CUNDY.