May 24, 1927.

1,629,580

N. P. LITHANDER

ROTARY ENGINE

Filed Nov. 6, 1924

3 Sheets-Sheet 1

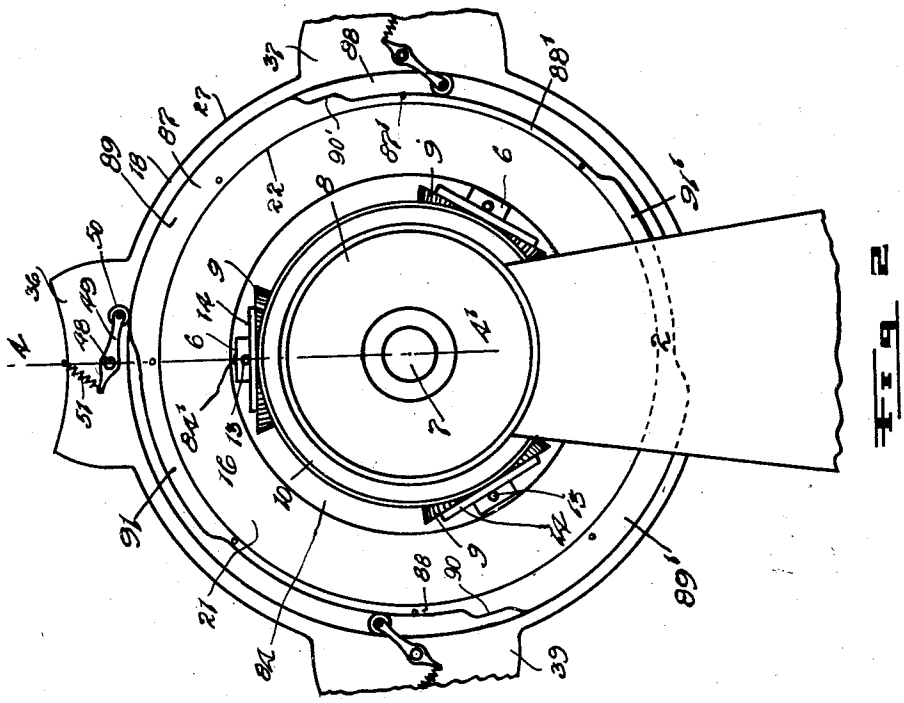

Fig 2

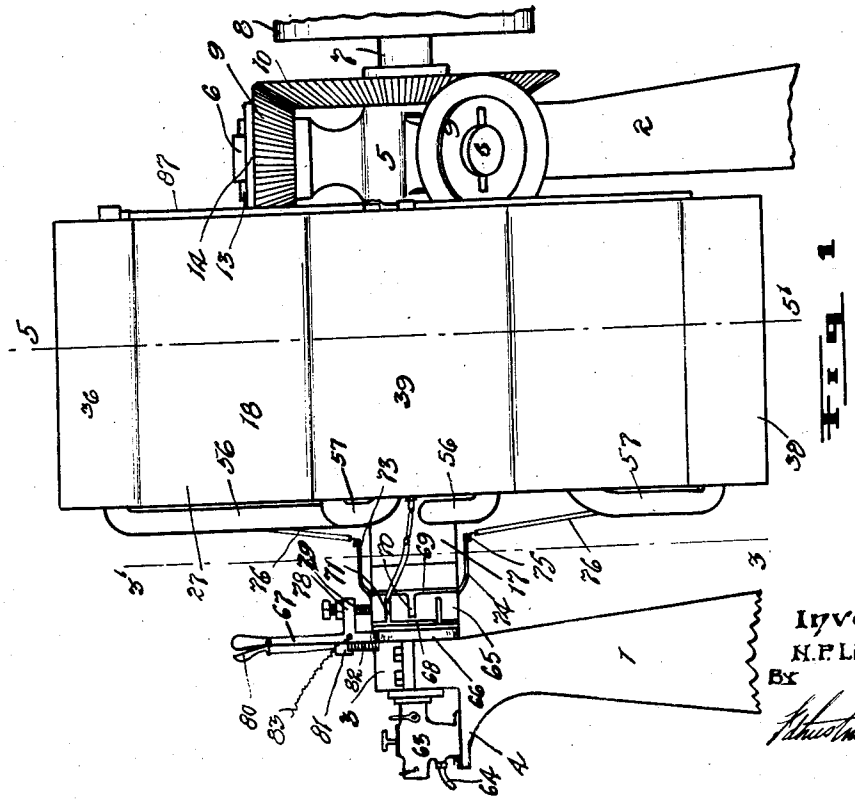

Fig 1

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3 Sheets-Sheet 2

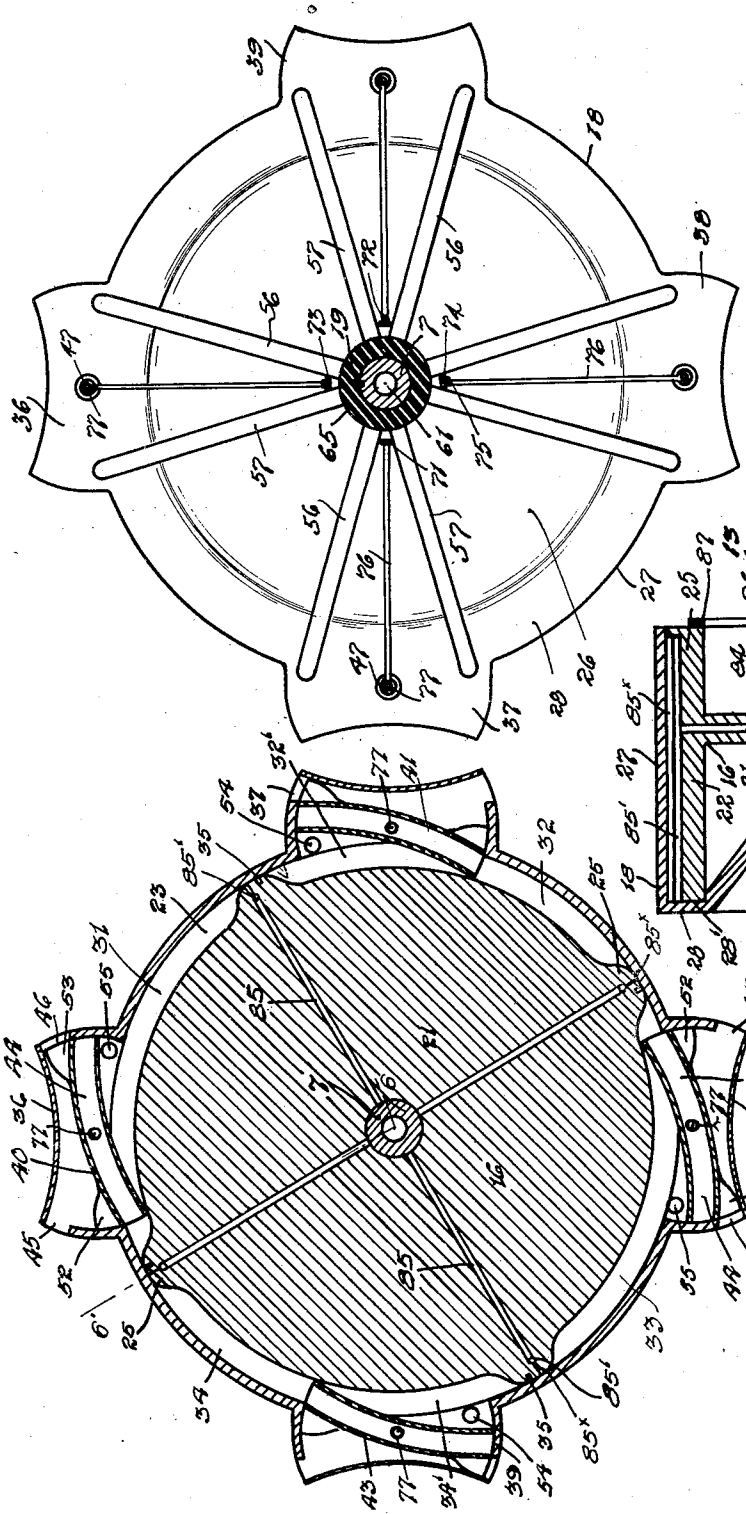

Fig 5

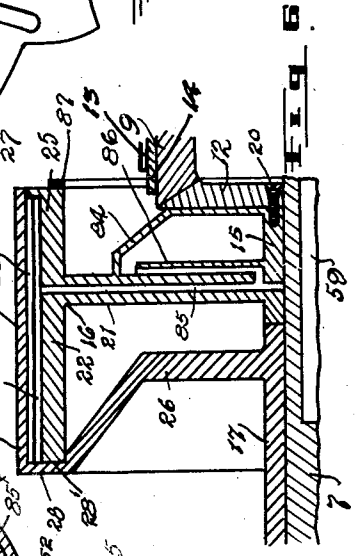

Fig 6.

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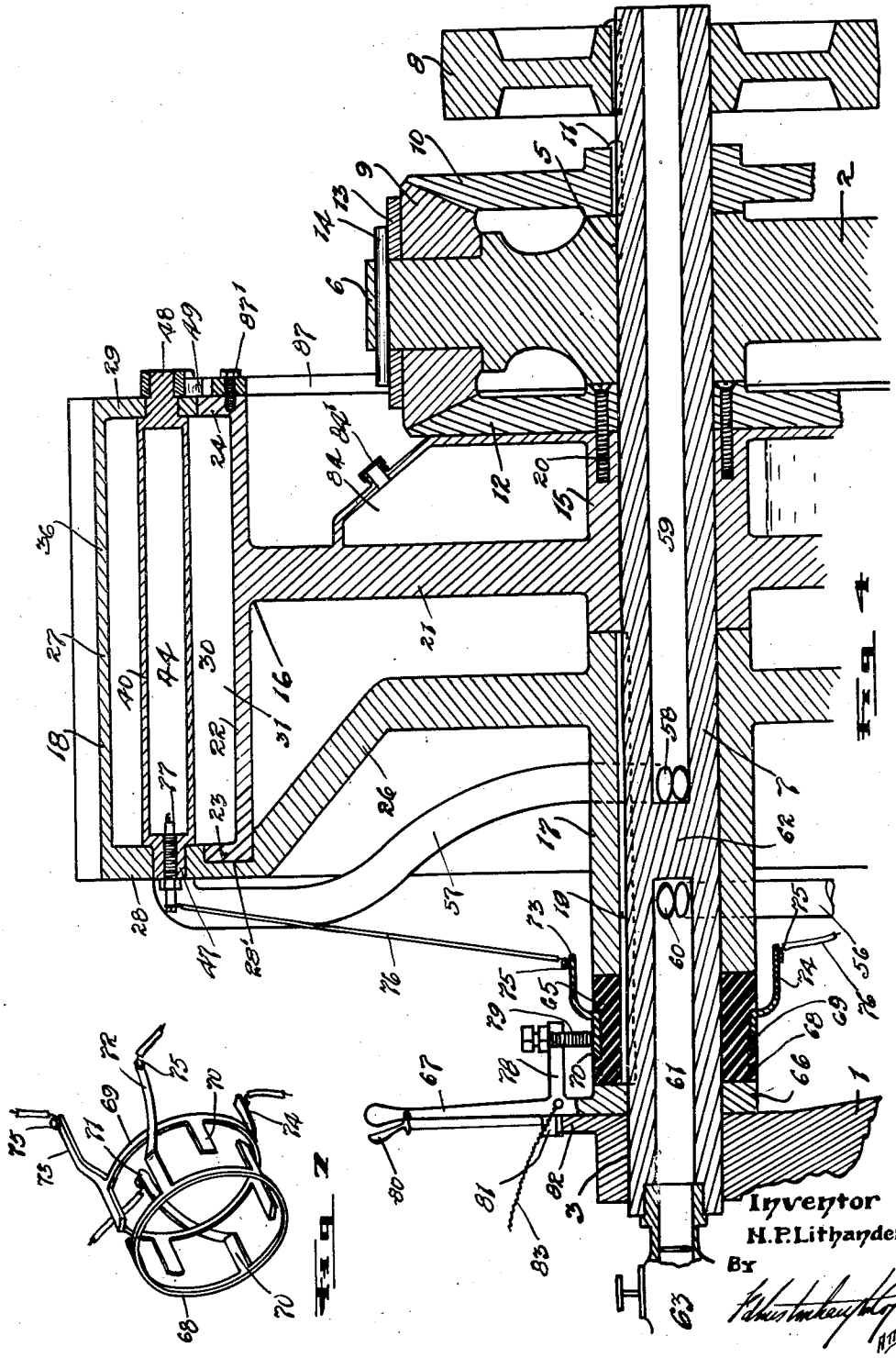

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UNITED STATES PATENT OFFICE.

NELSON P. LITHANDER, OF BRANDON, MANITOBA, CANADA.

ROTARY ENGINE.

Application filed November 6, 1924. Serial No. 748,150.

The invention relates to improvements in rotary engines and particularly rotary internal combustion engines, and an object of the invention is to provide an efficient, smooth running, economical engine of the above type and arranged such that there is almost a continuous explosion of previously compressed charges and such that there are explosions simultaneously occurring at diametrically opposite points to balance the engine and increase its power.

A further object of the invention is to provide an engine having few mechanically operated parts, and also an engine having mostly duplicate parts, which permits of standardizing and of quick and cheap assembly.

A further object is to construct an engine of the above type which can be effectively oiled, and also which has the transfer chambers thereof arranged so that they can be effectively air cooled.

A further object is to construct an engine which can be readily converted into a high or low speed engine such as occasion demands.

With the above more important and other minor objects in view, which become more apparent as the description proceeds, the invention consists essentially in the arrangement and construction of parts hereinafter more particularly described, reference being had to the accompanying drawings in which:—

Fig. 1 is a side view of the engine.

Fig. 2 is an end view thereof.

Fig. 3 is a vertical sectional view at 3—3′ Figure 1 and looking inwardly.

Fig. 4 is an enlarged detailed vertical sectional view at 4—4′ Figure 2.

Fig. 5 is a vertical sectional view at 5—5′ Fig. 1.

Fig. 6 is a sectional view at 6—6′ Figure 5.

Fig. 7 is a perspective view showing the arrangement of the commutator.

In the drawings like characters of reference indicate corresponding parts in the several figures.

A pair of supports or end standards 1 and 2 are provided, these being suitably mounted on a fixed base depending on where the engine is to be used. The standard 1 is provided at the upper end with a bearing 3 and with an outstanding bracket 4 adjoining the bearing. The standard 2 is supplied also with a bearing 5 axially in line with the bearing 3 and it is equipped also with three equally spaced outstanding stub shafts 6 utilized for supporting similar bevel pinions later described.

The main shaft 7 of the engine is rotatably mounted in the bearings 3 and 5 and it is provided at one end with a driving pulley 8 keyed thereto. The stub shafts 6 carry rotatably similar bevel pinions 9 which are continuously in mesh with an outer bevel gear 10 keyed to the shaft as indicated at 11 and with an inner bevel gear 12 rotatably mounted on the shaft adjacent the inner side of the bearing 5. The bevel pinions are held in place by a washer 13 and pin 14, the pin passing through the outer end of the stub shaft in each instance.

Adjoining the bevel gear 12 I mount rotatably on the shaft the hub 15 on what I herein term the inner rotor 16, and adjoining the hub 15 I mount the hub 17 of what I herein term an outer rotor 18, the hub 17 being fastened to the shaft 7 by a key 19. The bevel gear 12 is fastened to the hub 15 by suitably positioned screws 20. The rotor 16 is carried by a disc-like web 21 extending from the hub 15 and the outer edge of the web terminates in a comparatively wide rim 22 which is fitted at the edges with an outstanding similar continuous flanges 23 and 24 in locations 90 degrees apart. The rim is provided with similar outstanding ribs 25, the ends of which merge into the flanges. These ribs are more or less semicircular in cross section and they are of the same height as the flanges.

The hub 17 carries a web 26, the outer part of which is angularly deflected as best shown in Figure 4. The web carries the rim 27, presenting inturned flanges 28 and 29. The flange 28, which in reality is a connecting element between the rim 27 and the webs 26, is provided on the inner side with a continuous groove or channel 28′ which is adapted to receive the flange 23 of the rim 22. The rim 24 is positioned within the rim 29 and in this way the rims and flanges of the rotors enclose an annular interior chamber 30. The ribs 25 of the rotor 16 are designed so that their outer faces make sliding contact with the inner face of the rim 27 with the result that the annular chamber aforesaid is divided into four similar working chambers 21, 32, 33 and 34 which corresponds to the cylinders of

the customary internally combustion engine. Obviously the ribs 25 form the ends of these working chambers and suitable means, indicated at 35, is provided to prevent the escape of gases from one chamber to another.

The rotor 18 is provided with four similar equal spaced housings 36, 37, 38 and 39, in which I mount four similar rocker members 40, 41, 42 and 43. The rocker members each form an open ended transfer chamber 44. Each rocker member is substantially rectangular in cross section, as best shown in Figure 4, and the inner and outer walls thereof are formed concentric to the shaft 6. The ends of the rocker members are arranged to make sliding contact with the ends of the housings and the housings are fitted at their opposite ends with air outlet openings 45 and 46 which permit air to sweep through the housings when the rotor 18 is rotating and accordingly cool the rocker members. The rocker members are supported by aligned, comparatively short end spindles 47 and 48 rotatably mounted in the flanges 28 and 29 of the rotor 18 and the spindle 48 is extended beyond the flange 29 to carry in each instance, the crank 49 fitted at one end with a roller 50 and at the other end with a spring 51 attached to the housing and adapted to press the lower end of the crank in continuously.

The ends of the rocker members are fitted with outstanding wings 52 and 53, which form with the sides of the said rocker members, inlet and outlet valves adapted in the rocking of the rocker members to open and close at fixed times the inlet and exhaust ports 54 and 55. These ports are formed in each instance in one side of the respective housings 36, 37, 38 and 39 and they communicate in each instance with radially disposed inlet and exhaust pipes 56 and 57 carried by the rotor 18. The inner ends of the exhaust pipes 57 communicate through suitable openings 58 formed in the hub 17 and the shaft 7 with a common exhaust passage 59 provided in the shaft 7, the exhaust passage being actually made by centrally boring said shaft.

The inner ends of the inlet pipes 56 communicate in each instance through suitable holes 60 formed in the hub 17 and the shaft 7, with an inlet passage 61 provided in the shaft 7, this latter passage being actually formed by boring a hole in the opposite end of the shaft. The inlet and exhaust passages are separated by retaining an unbored portion 62 between the inner ends of the said passages.

A carburetor 63 of any approved design is provided and it is connected with the outer end of the inlet passage 61, the carburetor being mounted on the bracket 4 of the pedestal 1. The feed pipe for the liquid fuel, such as gasoline, passing to the carburetor is indicated by the reference number 64.

Between the hub 17 and the bearing 3 I locate a sleeve of insulating material 65 which is fastened to the shaft by the key 19 and between the sleeve 65 and the bearing I insert the head 66 of a lever 67, the head being rotatably mounted on the shaft 7. The insulation sleeve 65 carries a commutator which is formed from two metallic rings 68 and 69 which are embedded in the sleeve so that their outer faces are flush with the outer face of the sleeve. Each ring carries four arms 70, the arms of each ring being positioned 90 degrees apart and those of one ring being spaced intermediately between the arms of the other ring. The outer faces of the arms in all cases are flush with the outer face of the sleeve and they extend longitudinally of the sleeve. Two of the diametrically opposing arms of the ring 68 are fitted with out-bent extensions 71 and 72 and the ring 69 is also provided with a pair of diametrically opposing out-bent extension arms 73 and 74 and the arms are positioned 90 degrees apart, and they are fitted at their inner ends with binding screws 75. Feed wires 76 lead from the binding screws to similar spark plugs 77 of well known design, the spark plugs being screwed into the spindles 47 and having their inner ends, which bear the points, exposed within the transfer chambers 44.

The lever 67 carries a horizontally extending short arm 78 which is fitted with a brush 79 adapted to ride the face of the sleeve and sweep over the arms 70 in the rotation of the sleeve with the shaft 7. The lever is fitted also with a hand latch 80 and detent 81, the detent operating over a suitable quadrant 82 carried by the bearing 3. By manipulating the lever and setting it, one can advance or retard the spark as desired. A feed wire 83 connects with the lever and here it will be understood that one of the points of each of the spark plugs is grounded to the engine as is customary practice.

An oil well 84 is cast integrally with the web and hub of the inner rotor 16, the well being provided with a filling cap 84′. The web of the latter rotor is also supplied with radiating oil holes 85 which pass inwardly to the shaft 7 and outwardly to the ribs 25. The ribs are fitted with lengthwise extending holes 85′ communicating with those 85 and narrow slots 85× are cut in the rib and communicate with the holes 85′, the slots acting to lubricate the inner wall of the rotor 18 as the webs sweep over the same. In the well I locate similar radially extending tubes 86, the inner ends of which communicate with the oiling holes 85 and the outer ends of which are just nicely clear of the outer wall of the well. According to the above arrangement when the engine is

running, as later described, the oil in the well will be thrown out by centrifugal force against the outer wall of the well and will be forced by the centrifugal action into the tubes 86 and from the tubes into the various holes connected therewith so that the various moving parts of the rotors are lubricated.

The rollers 50, hereinbefore referred to, are held by the springs in continuous riding contact with a cam ring 87 permanently fastened to the rotor 16 by bolts 87'. The cam ring presents two diametrically opposing comparatively narrow portions 88 and 88', two diametrically opposing comparatively wide portions 89 and 89', and four intervening portions 90, 90', 91, 91'. The portions 90, 90' are comparatively short and those 91, 91' are comparatively long and the cam ring controls the rocker members 40, 41, 42 and 43, rocking them at the proper times in the rotation of rotors. The faces of the cam ring are all concentric to the axis of the shaft 7 and the portions 90, 90' and 91, 91' act to maintain the rocker members in their central rocked position sufficiently long to permit the ribs to clear the down moving ends of the rocker members.

The cam ring obviously can be in the nature of a continuous channel receiving the rollers, in which instance the spring would be unnecessary as the rollers could not escape from the channel and would follow the shape thereof during the rotation of the rotors.

When this engine is running the rotors turn in opposite directions and they both drive the shaft 7, the rotor 18 driving the shaft directly through the key 19, whilst the rotor 16 drives it through the differential gear arrangement and the key 11. The operation of the engine is as follows: Assuming that the firing mixture is admitted to the passage 61 from the carburetor in the ordinary manner and that the lever 67 has been set to time the sparks as desired.

Referring now particularly to Figure 5 it would be observed that the upper and lower inlet ports are closed by the valves and that the exhaust ports are open and that the inlet ports associated with the remaining housings 37 and 39 are open, whilst the exhaust ports thereof are closed. Those portions 32' and 34' of the working chambers 32 and 34 are receiving a charge of firing mixture. The working chambers 31 and 33 are exhausting. A firing charge has been compressed into the transfer chambers of the rocker members 40 and 42 and has been exploded therein by the spark plugs associated therewith, and the force of this explosion has caused the inner rotor 16 to rotate in a counter clock-wise direction and the outer rotor 18 to rotate in a clock-wise direction.

Assuming this rotation established, it is maintained by the succession of explosions in the transfer chambers, two explosions simultaneously occurring in diametrically opposing chambers and during the interval that those explosions are occurring there is a charge being compressed into the other two explosion chambers by the advancing ribs 25. This compression of the charge is taking place in the present instance in the chambers 41 and 43, as it will be observed that as the ribs 25 and the transfer chambers move towards each other the charge previously admitted into the chambers 32 and 34 will be totally expelled into the transfer chambers and compressed therein. In order that there may be no misunderstanding in the action of the engine I wish to point out that in each one-eighth of a revolution of the shaft 7 there are two charges being exploded in diametrically opposing transfer chambers, there are two transfer chambers receiving charges which are being compressed therein, there are two diametrically opposing working chambers exhausting spent gases and there are two diametrically opposing working chambers receiving the firing mixture from the intake passage 61. According to the above it would be obvious that the engine will be a particularly smooth running one and very powerful. Obviously the force of the explosion in each instance is in the direction of travel of the rotors and as the points where those explosions occur are at some distance from the shaft 7 the force of the explosion is considerably amplified by the leverage action provided.

The engine as herein shown would be what I term a slow speed engine. However, if it is desired to have a high speed engine it is only necessary to dispense with the differential gears and fasten the rotor 16 so that it becomes stationary. The action of the engine will be the same as hereinbefore explained, with the exception that the rotor 18 will rotate twice as fast as previously and there will only be eight explosions for each revolution of the shaft. The power of the engine will, of course, materially decrease in the latter arrangement. Suitable means would be required for forcing the oil through the oil passages provided.

What I claim as my invention is:

1. In a rotary internal combustion engine, an inner and an outer rotor forming therebetween a plurality of similar separated working chambers, a plurality of rocker members forming transfer chambers and corresponding in number to the number of working chambers and carried by the outer rotor, an inlet and an outlet port associated with each rocker member and controlled thereby and means for rocking each rocker member to permit of the entrance through the inlet port of a charge to a working cham-

ber, the subsequent compression of that charge in the next following transfer chamber and expansion of the said compressed charge in the said latter transfer chamber and the following working chamber and the exhausting of the spent charge through the exhaust port of the following transfer chamber.

2. In a rotary internal combustion engine inner and outer rotors forming there between a plurality of similar separate working chambers, means causing the rotors to rotate in opposite directions, a plurality of similar separate working chambers, a plurality of rocker members forming transfer chambers and corresponding in number to the number of working chambers and carried by the outer rotor, and inlet and an outlet port associated with each rocker member and controlled thereby and means for rocking each rocker member to permit of the entrance through the inlet port of a charge to a working chamber, the subsequent compression of that charge in the next following transfer chamber and expansion of the said compressed charge in the said latter transfer chamber and the following working chamber and the exhausting of the spent charge through the exhaust port of the following transfer chamber, and timed means for firing the expanding charges in the transfer chambers.

Signed at Brandon, this 28th day of August, 1924.

NELSON P. LITHANDER.