

[54] **ROTARY PISTON ENGINE WITH MULTI
EXPLOSION CHAMBERS**

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[52] U.S. Cl. **123/8.45**, 418/61, 418/94,
418/117, 418/124

[51] Int. Cl. **F02b 55/14**, F01c 1/02, F04c 17/02

[58] Field of Search 418/61, 113, 124,
418/91, 94, 268, 101, 83; 123/8.45; 74/801

[56] **References Cited**

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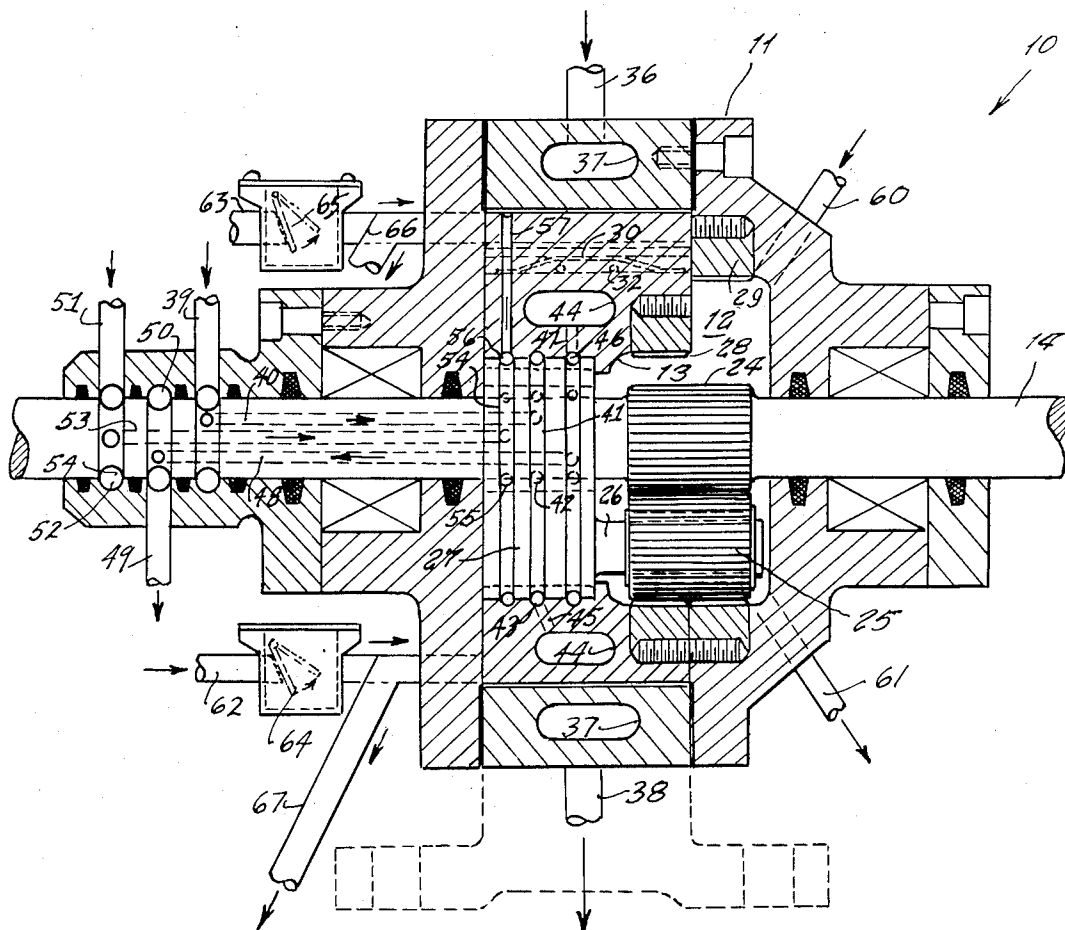
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Assistant Examiner—Louis T. Casaregola

[57] **ABSTRACT**

An improved rotary piston engine which provides a plurality of explosion chambers formed by the trochoidal contour of the rotary piston relative to quadrachoidal housing configuration whereby explosions occur in more than one chamber during a single rotation of the piston. The provision of multi-explosion chambers produces greater power and efficiency than in conventional rotary engines which have one explosion chamber. This improved engine also incorporates novel twin seals separating the various compression, exhaust and explosion chambers and is provided with an effective cooling system. The rotary piston is eccentrically mounted about the main drive shaft and power is transmitted from the piston to the main drive shaft via a novel planetary gear system.

11 Claims, 6 Drawing Figures



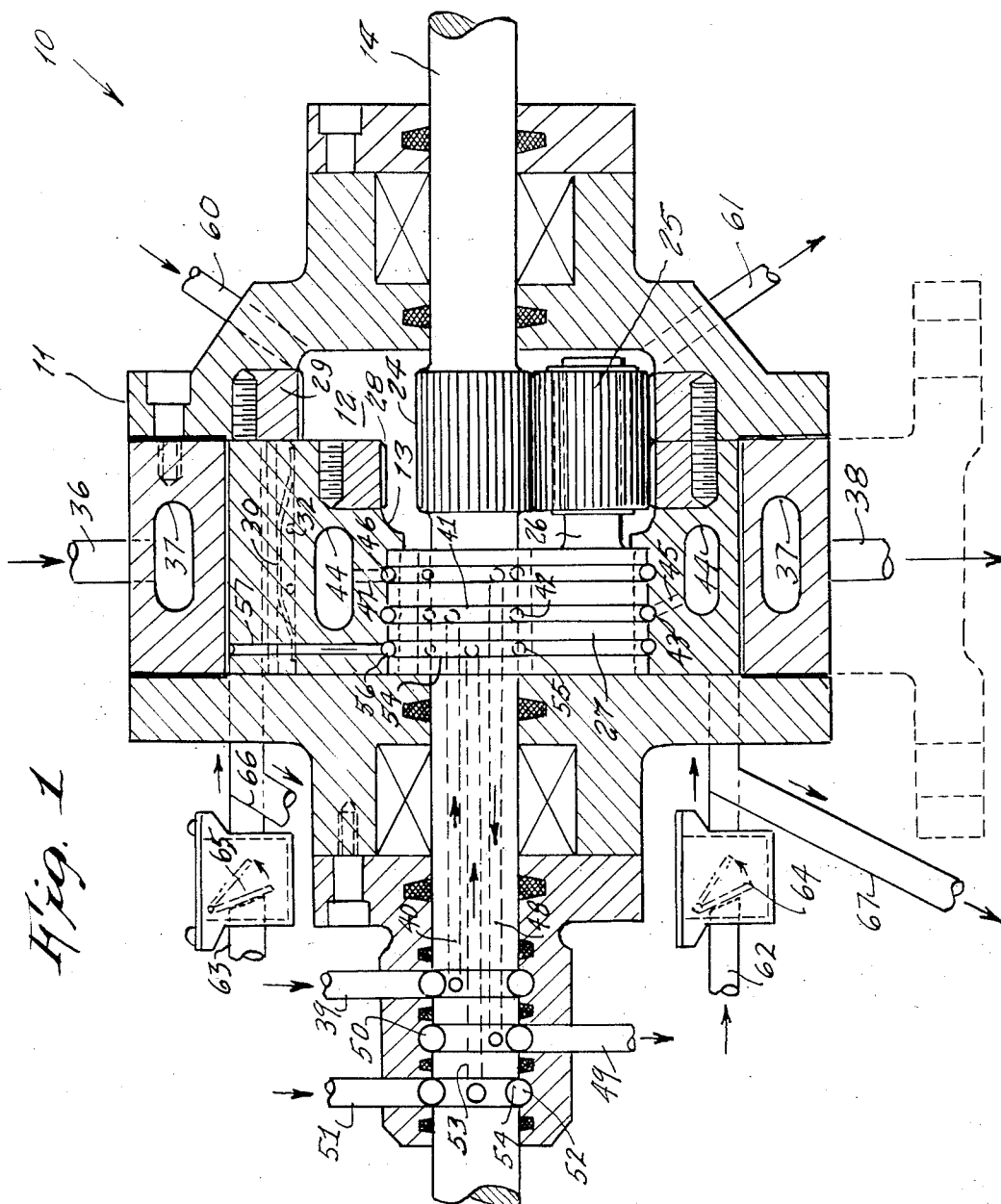


Fig. 1

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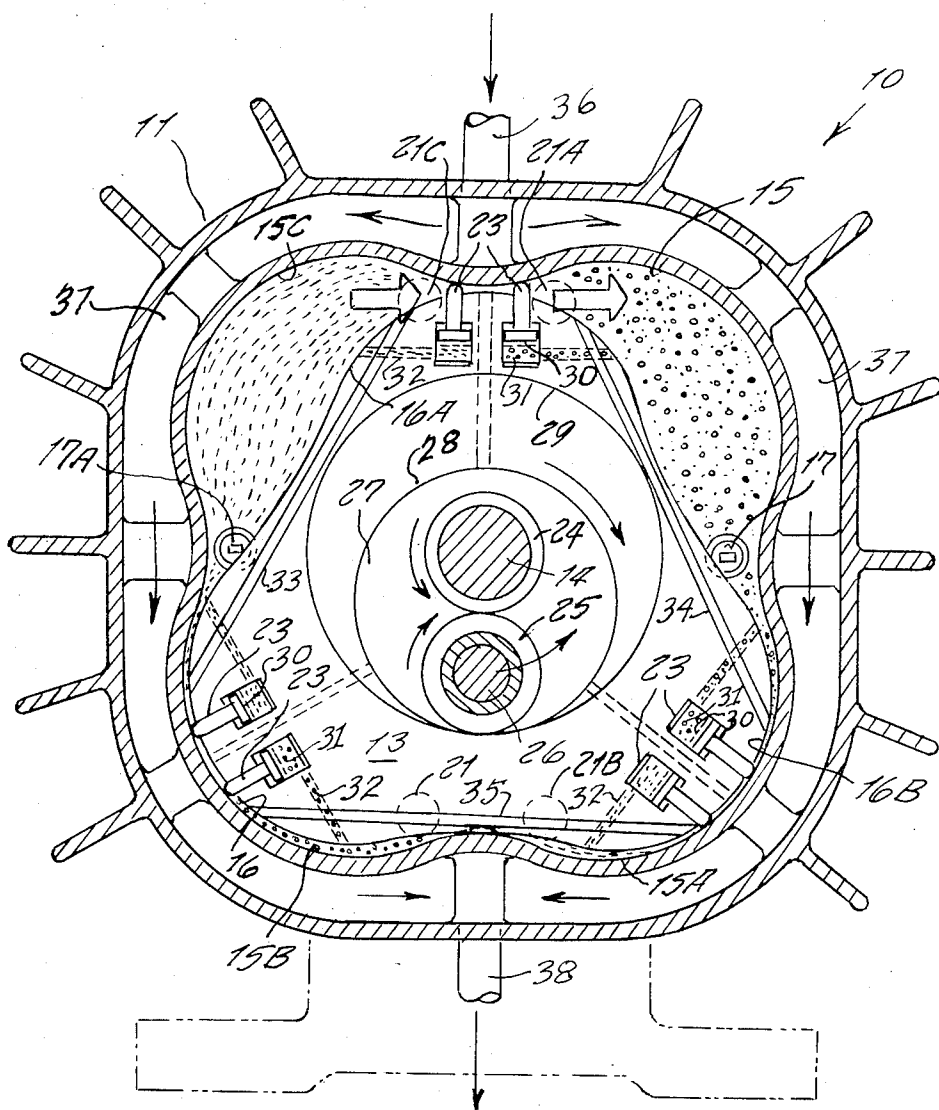


Fig. 2

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Fig. 3

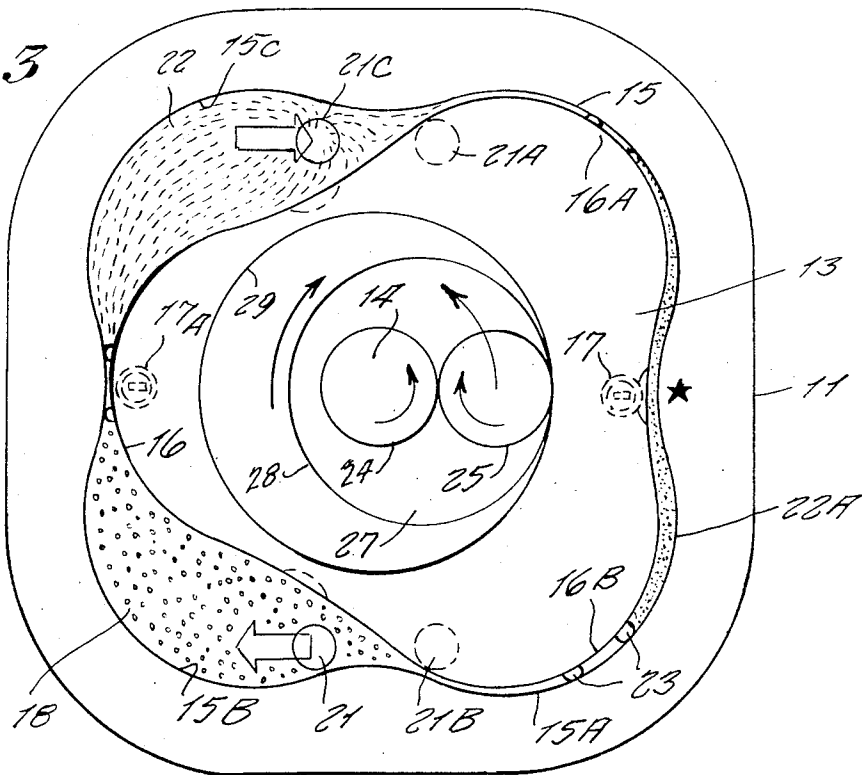
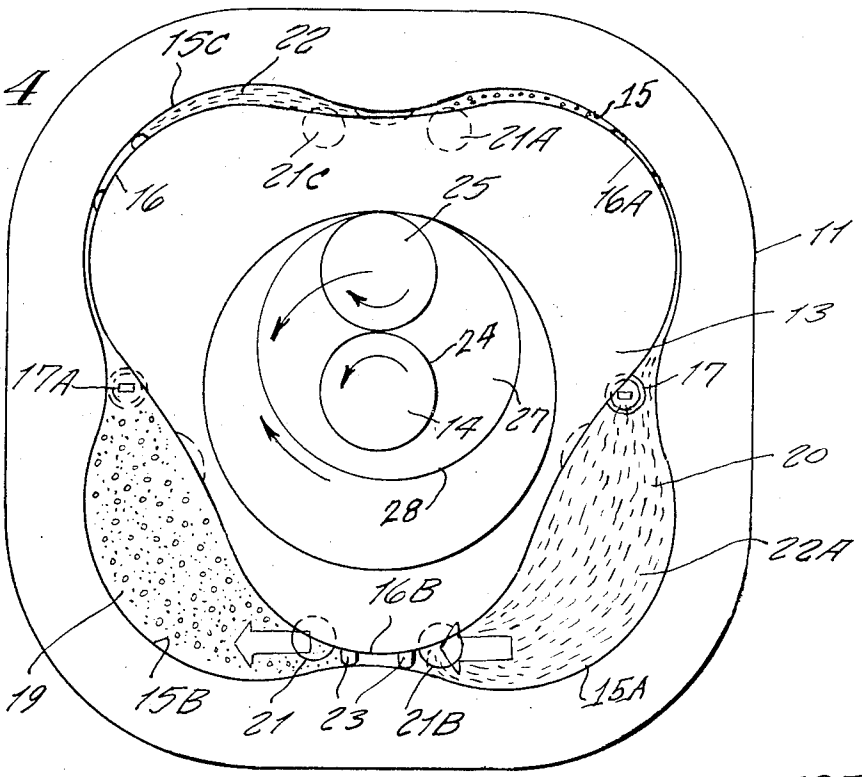


Fig. 4



INVENTOR
TIBOR LOUIS de DOBO

Fig. 5

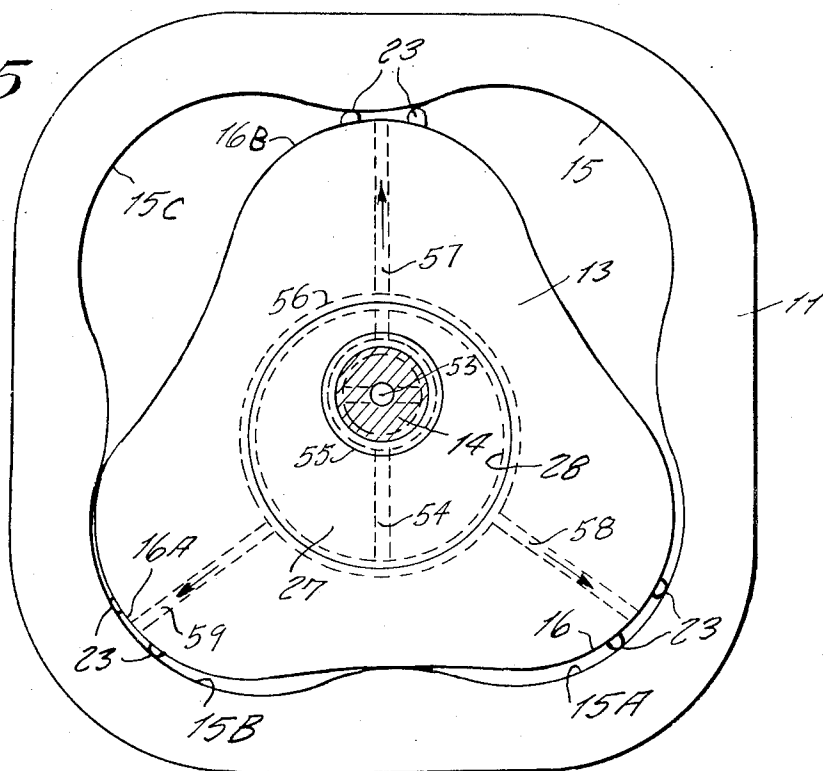
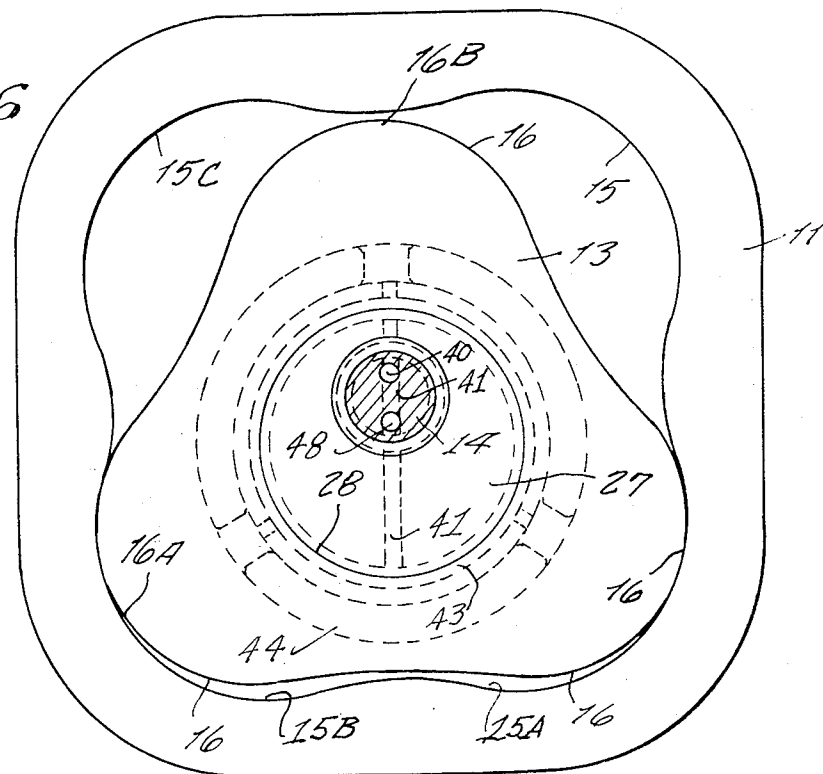


Fig. 6



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ROTARY PISTON ENGINE WITH MULTI EXPLOSION CHAMBERS

This invention relates to a rotary engine having a plurality of explosion chambers for a single revolution of the rotary piston, whereby a highly efficient means is provided to actuate a power shaft.

The plurality of explosion chambers is created by a novel geometric relationship of the peripheral contour of the rotary piston to the internal contour of the engine housing in which the rotary piston is mounted. Moreover because of the novel geometric relationship of the piston to the housing precise mathematical rules result governing the number of explosion chambers and also the number of explosion caused by one revolution of the piston. The invention also relates to a highly efficient novel planetary gear system for transmitting power from the eccentrically mounted rotary piston to the output shaft whereby said planetary gear system is designed to be especially effective with the particular shape of the piston and related housing. Other important components of this invention are the novel dual sealing means for the various chambers that are utilized in the power producing cycle and a engine cooling system adapted particularly for this engine.

Accordingly it is a principal object of this invention to provide a rotary piston which produces maximum power through the creation and utilization of a plurality of explosion chambers for a single revolution of the piston.

It is a further object of this invention to provide a rotary piston engine which effectively utilizes special geometrical relationships between the contour of the piston and the internal shape of the engine housing to create a combustion work cycle having a plurality of explosion chambers for a single rotation of the piston.

It is still a further object of this invention to provide a rotary multi-explosion chamber engine having a planetary gear system especially designed to effectively transmit power from the plurality of explosion chambers to an eccentric output shaft.

It is yet a further object of this invention to provide a rotary engine of plural explosion chambers as herein disclosed with effective sealing and cooling systems.

These and other objects will be readily evident upon careful examination of the following specifications and accompanying drawings wherein.

FIG. 1, is a longitudinal cross-section of this invention.

FIG. 2, is a transverse cross-sectional view thereof.

FIG. 3, and 4 are transverse views showing diagrammatically various relative positions of the piston, the gear system the housing chambers, etc. during a sequence in the operation thereof.

FIGS. 5 and 6 are transverse schematics showing the sealing and cooling means.

Referring now to the drawings in detail, the reference numeral 10 represents a rotary piston engine with plural explosion chambers, according to the present invention wherein there is a housing 11 having a hollow interior 12 within which a rotary piston 13 is rotatably mounted eccentrically about a main drive output shaft 14.

The interior 12 is designed to have four similar symmetrical recesses 15, 15A, 15B, 15C and the piston 13 is provided with three similar symmetrical lobes 16 which conform to and enter the recesses 15, 15A, 15B, 15C as the piston eccentrically rotates. Thus at all

times areas in the housing interior 11 are formed which constitute chambers for the intake of air and fuel, compression thereof, firing and exhausting of the same. A pair of spark plugs 17 and 17A are mounted 180° apart on the housing sides for association with the operating cycle. Thus there is an intake port 21 to an intake chamber 18 which becomes a compression chamber 19 (FIG. 3 and 4); a firing chamber 20 communicating with the spark plug 17, and an exhaust port 21C in an exhaust chamber 22 thus formed. Appropriate dual seals 23 are mounted at each lobe 16A, 16B and 16C along the interior 11 wall so as to sealingly separate the areas defining the chambers.

To transmit power to the shaft 14, a gear system is provided wherein, the main drive shaft 14 has a sprocket 24 affixed thereto that engages a planetary gear 25 affixed on a shaft 26 integral with an eccentric disc 27 mounted rotatably in the piston. The gear 25 engages an internal gear 28 affixed to the rotary piston, and also engages an internal gear 29 of larger size that is secured to the housing concentrically about the shaft. Accordingly, (refer to FIGS. 3 and 4) as the rotary piston is caused to revolve in a clockwise direction the gear 25 rotates about its axis in a clockwise direction which causes gear 25 and the attached disc 27 to orbit eccentrically counterclockwise about the drive shaft 14. The clockwise rotation of the gear 25 about its axis results in counterclockwise rotation of the drive shaft 14. Thus it is seen that gear 25 orbits in planetary fashion about the drive shaft 14 while causing the drive shaft to rotate counterclockwise. The orbital movement of gear 25 forces the rotary piston to move eccentrically about the drive shaft 14 in a predetermined path whereby lobe 16 of the piston is moved radially outward from its position in FIG. 3 adjacent sparkplug 17A into compression chamber 22 in close conformity with recess 15C of the housing. As seen in FIG. 4. Note that in moving lobe 16 to its position in FIG. 4, the gear 25 has moved 90 degrees to a position along a vertical diameter bisecting the piston and the housing. This planetary motion of gear 25 causes the successive movement of each lobe into its sequential position either within a housing recess (such as 15, 15A, 15B or 15C) or at one of the concave portions of the housing midway between said recesses adjacent either the spark plugs or the intake and outlet ports.

In the drawings, there is illustrated the case of an engine having two or dual explosion chambers such as the compressed chambers formed adjacent each of the oppositely positioned spark plugs. It should be realized that engines having more than two explosion chambers can be constructed using the same principles (not shown). For example, to have 3 explosion chambers, the rotary piston is provided with 5 lobes and the housing with 6 corresponding recesses with three spark plugs provided to coact with the three explosion chambers. It should be further understood that there is an exact mathematical relationship between the number of explosion chambers, the number of piston and housing lobes and the number of explosions per one revolution etc. which will be set out in more detail herein below.

To simplify understanding the mode of operation in the operating cycle of a multi-explosion chamber rotary engine, the dual chamber construction, illustrated herein, will be referred wherein FIG. 3, an explosion is taking place in chamber 22A under maximum com-

pression adjacent spark plug 17. The explosion causes rotation of the eccentric piston about shaft 14 in a clockwise direction. Due to the gear system as previously described, the lobe 16B is moved to the position in FIG. 4 adjacent the ports 21 and 21B, exhaust gases in chamber 22A exit through exhaust port 21B, whereas fuel enters chamber 19 through inlet port 21. The exhaust port 21B being sealed from inlet port 21 by the seals 23. During this piston movement, lobe 16 has pushed exhaust gases in chamber 22 out through exhaust port 21C. Further rotation of the piston will cause compression and explosion in chamber 19 by the firing of spark plug 17A, wherein lobe 16B enter chamber 19. The process continues in sequence with each opposing compression chamber 19 firing alternately as the lobes rotate. It should be noted that the piston (in the construction shown in these drawings for dual explosion chamber) will assume 12 different positions during one revolution. In six of these positions one of the explosion chambers (19 and 20) adjacent the spark plugs are in maximum compression only when successive lobes are in close conformity with the recesses surrounding the spark plugs; this condition occurs only one out of every two positions of the piston. Thus it is seen that for a dual explosion chamber rotary engine far more power is delivered than in the conventional single explosion chamber engine.

As previously indicated herein exact mathematical relationships exist regarding the number of explosion chambers, explosions, etc. per cycle, that can be used effectively in the design of a rotary engine with plural explosion chambers of the type disclosed herein. These relationships will now be developed in more detail.

The following equations show the mathematical rules of the above matter. First will be shown the trochoidal type rotary piston engine with single explosion chamber.

$$N = (H \cdot P)/2 = (2 \cdot 3)/2 = 3$$

(1)

where

N = Number of the explosion by one revolution of the rotary piston.

H = Number of the geometrical epitrochoid curve, or the trichoidal sides of the housing. (Two sides)

P = Number of the geometrical arcuate sides of the spherical-like triangle rotary piston. (Three sides)

$$N_E = H/2 = 2/2 = 1$$

(2)

where

N_E = Number of the explosion chamber.

Further equations prove this fact of the rotary piston engine with dual explosion chamber, without the conventional valves, in the following way:

$$N = (H \cdot P)/2 = (4 \cdot 3)/2 = 6$$

(3)

where

N = Number of the explosion by one revolution of the rotary piston.

H = Number of the geometrical convex corners, or the concave arcs of the housing. (Four corners)

P = Number of the geometrical concave arcuate sides of the rotary piston. (Three sides)

$$N_E = H/2 = 4/2 = 2$$

(4)

where

N_E = Number of the explosion chamber.

The below equations relate to a rotary piston engine with three explosion chambers.

$$N = (H \cdot P)/2 = (6 \cdot 5)/2 = 15$$

(5)

where

N = Number of the explosion for one revolution of the rotary piston.

H = Number of the geometrical convex corners, or the concave arcs of the housing. (Six Corners)

P = Number of the geometrical concave arcuate sides of the rotary piston. (five sides)

$$N_E = H/2 = 6/2 = 3$$

(6)

where

N_E = Number of the explosion chamber.

Conditions for the above mathematical rules, in connection with a rotary piston engine with multi explosion chambers is that $H = P + 1$, or $P = H - 1$ and that H is an even number.

The rotary piston engine with multi explosion chambers, for example where $H = 5$ and $P = 4$, or every kind of such type of engines where the H is an uneven number, has H number of explosion chambers.

In all cases the number H is limited because of the technical and the economical considerations.

The following equations shown how to develop mathematically a rotary piston engine with multi explosion chamber. Suppose nothing is known only the number of the explosion chambers which are required. The following equations show how this is computed.

$$N = (2 \cdot N_E^2) - N_E$$

(7)

where

N = Number of the explosion for one revolution of the rotary piston.

N_E = Number of the explosion chambers.

Let now examine this equation for a rotary piston engine with dual explosion chambers.

$$N = (2 \cdot N_E^2) - N_E = (2 \cdot 2^2) - 2 = 6$$

(8)

For a rotary piston engine with triple explosion chambers, we have:

$$N = (2 \cdot N_E^2) - N_E = (2 \cdot 3^2) - 3 = 15$$

(9)

$$H = 2 \cdot N_E$$

(10)

$$P = (2 \cdot N_E) - 1 = H - 1$$

(11)

where

H = Number of the geometrical convex corners, or the concave arcs of the housing.

P = Number of the geometrical concave arcuate sides of the rotary piston.

N_E = Number of the explosion chambers.

Note that for the rotary piston engine with multi explosion chambers H is always an even number and P is always an uneven number.

Let us examine these equations for a rotary piston engine with dual explosion chambers.

$$H = 2 \cdot N_E = 2 \cdot 2 = 4$$

(12) 15

$$P = (2 \cdot N_E) - 1 = (2 \cdot 2) - 1 = 3$$

(13) 20

The below equations relate to a rotary piston engine with triple explosion chambers.

$$H = 2 \cdot N_E = 2 \cdot 3 = 6$$

(14) 25

$$P = (2 \cdot N_E) - 1 = (2 \cdot 3) - 1 = 5$$

(15) 30

Note, that no matter that how many explosion chambers are involved in this invention, the above equations are always valid.

The below equations further show additional mathematical rules in connection of the rotary piston engine with multi explosion chambers.

$$N = (H \cdot N_E) - N_E$$

(16) 40

$$N = P \cdot N_E$$

(17) 55

These equations are developed for designing purposes and are accurate, as will be apparent to the reader thorough further consideration.

The mathematical relationships will now be developed and explained below regarding gear system components that transmit power to the output shaft.

The below equations show the development of these rules.

$$R_G = H : P$$

(18) 60

where

R_G = Ratio between the number of the teeth of the internal gear No. 29 to the number of the teeth of the internal gear No. 28.

Let us examine this equation for the rotary piston engine with dual explosion chambers.

$$R_G = H : P = 4 : 3$$

(19) 65

Further equations prove this fact for the rotary piston engine with triple explosion chambers wherein.

$$R_G = H : P = 6 : 5$$

(20)

Further ratios will be developed as follows:

$$R_T = 3 : 1 \text{ constant}$$

(21)

where

R_T = Ratio between the number of the teeth of the internal gear No. 29 to the number of the teeth of the internal cam track with a toothed sprocket 25.

$$R_O = 3 : 1 \text{ constant}$$

(22)

where

R_O = Ratio between the number of the teeth of the internal gear No. 29 to the number of teeth of the output shaft with a fixed toothed sprocket 24.

$$R_E = 1 : 1 \text{ constant}$$

(23)

where

R_E = Ratio between the number of the teeth of the output shaft with a fixed toothed sprocket 24 to the number of the teeth of the internal cam track with a toothed sprocket 25.

The following equations show the relationship between the number of explosions for the amount of piston rotation.

$$T_E = 1/N$$

(24)

where

T_E = Revolution of the rotary piston per explosion.

Lets examine this equation for the Rotary piston engine with dual explosion chambers.

$$T_E = 1/N = 1/6 = 0.167R/E$$

(25)

where

R = Revolutions

E = Explosions

The below equation shows the result for a rotary piston engine with triple explosion chambers.

$$T_E = 1/N = 1/15 = 0.067R/E$$

(26)

The following equations shows the relationship regarding revolution of the internal cam 26 (or the revolution of the eccentric disk) for one complete revolution of the rotary piston 13.

$$T_C = P$$

(27)

where

T_C = Revolution of the internal cam 26 (or the revolution of the eccentric disk) for one complete revolution of the rotary piston 13.

Let us apply this equation to the rotary piston engine with dual explosion chambers.

$$T_C = P = 3R/R_1$$

where

R = Revolution of the internal cam 26 (or of the eccentric disk 27.)

R_1 = Revolution of the rotary piston 13.

The below equation applies this relationship to the rotary piston engine with triple explosion chambers.

$$T_C = P = 5R/R_1$$

The following equation shows the relationship between the revolution of the internal cam 26 (or for one revolution of the eccentric disk 27). To the revolutions of the toothed sprocket 25.

$$T_S = R_T - 1 \text{ constant}$$

where

T_S = Revolution of the toothed sprocket 25 of the internal cam 26 for one revolution of the internal cam 26 (or for one revolution of the eccentric disk 27).

$$T_S = R_T - 1 = 3 - 1 = 2R/R \text{ constant}$$

The following equation shows the relationship between the revolution of the output shaft 14 with the fixed toothed sprocket 24 for one revolution of the internal cam 26 (or for one revolution of the eccentric disk 27).

$$T_O = R_O + 1 \text{ constant}$$

where

T_O = Revolution of the output shaft 14 with the fixed toothed sprocket 24 for one revolution of the internal cam 26 (or for one revolution of the eccentric disk 27).

$$T_O = R_O + 1 = 3 + 1 = 4R/R \text{ constant}$$

The following equation shows the relationship between the revolution of the toothed sprocket 25 of the internal cam 26, for one revolution of the rotary piston 13.

$$T_T = T_S \cdot T_C$$

where

T_T = Revolution of the toothed sprocket 25 of the internal cam 26 for one revolution of the rotary piston 13.

Let us check this statement for the rotary piston engine with dual explosion chambers.

$$T_T = T_S \cdot T_C = 2 \cdot 3 = 6R/R$$

The below equation applies this relationship for the rotary piston engine with triple explosion chambers.

$$T_T = T_S \cdot T_C = 2 \cdot 5 = 10R/R$$

The following equation shows the relationship between the revolution of the output shaft 14 with a fixed toothed sprocket 24 for one revolution of the rotary piston 13.

$$T_R = T_O \cdot T_C$$

where

T_R = Revolution of the output shaft 14 with a fixed toothed sprocket 24 for one revolution of the rotary piston 13.

Let us apply this equation to the rotary piston engine with dual explosion chambers.

$$T_R = T_O \cdot T_C = 4 \cdot 3 = 12R/R$$

Let us apply this equation to the rotary piston engine with triple explosion chambers.

$$T_R = T_O \cdot T_C = 4 \cdot 5 = 20R/R$$

The following equation shows the variation in the radical distance to the center of the rotary piston 13 for various rotational positions of the rotary piston.

$$R_P = R_G1 - T_C2$$

where

R_P = Radius from the shaft axis 14 to the center of gravity of the rotary piston 13 for various positions of the rotary piston.

R_G1 = Radius of the internal gear No. 29.

R_G2 = Radius of the internal gear No. 28.

It is apparent from the foregoing explanation that the number of explosion chambers and the number of explosions per each revolution are predetermined functions of the specific contour of the piston in relation to the coacting housing piston chamber. Moreover the number of explosions and explosion chambers combine with and are functionally related to the disclosed planetary gear power transmission system.

Referring now again to the sealing means, it is seen that in FIG. 2 each convex lobe of the triangular like piston 13, is provided with the dual seals 23 thereby providing three sealed operating chambers therebetween about the periphery of the piston. Each seal 23 is biased radially outward against the housing wall by a spring 30 and compressed vapor 31 from the compression chambers via ducts 32 formed in the piston and connecting each seal chamber with a compression chamber. It is to be noted that the inlet to the seal chamber can be provided with a check valve to prevent

escape of vapor pressure and resulting reduction of pressure acting upon the seals 23.

The transverse side walls of the piston are sealed against the piston housing chamber by the three seals 33, 34 and 35 (FIG. 2) which are arranged generally in triangular configuration converging at each lobe of the piston adjacent to the peripheral seals 23.

The housing is cooled by a system specially designed for plural explosion chambers wherein an inlet duct 36 conducts water to an internal canal 37 in the housing which is adjacent to and encompasses the working chambers between the piston and the housing and is connected to an outlet duct 38. The piston 13 is cooled by water entering inlet 39 (FIGS. 1 & 6) which is connected to a bore 40 in the drive shaft 14. Bore 40 leads to a transverse duct 41 which in turn is in communication with peripheral channels 42 and 43. Cooling water then is conducted to a circular canal 44 via duct 45 concentrically formed about the piston axis. A second channel 46 girdling the eccentric disc 27 receives cooling water from canal 44 via duct 47. Return flow is provided via bore 48 which is formed in the shaft 14 and communicates with an outlet duct 49 via peripheral channel 50.

Lubricating oil is provided via an inlet 51 (FIG. 1) connected with a channel 52 about the shaft and conducted longitudinally through the shaft in a bore 53 to a radial bore 54 which in turn communicates with channels 55 and 56 encircling respectively the shaft 14 and the eccentric disc 27. Oil is then conducted to the periphery of the piston via radial bores 57, 58 and 59 (See FIGS. 1 and 5).

Lubricating and cooling oil enters the housing chamber via inlet 60 and is emitted via outlet 61.

Fuel is introduced to the compression chambers via similar supply ducts 62 and 63 (FIG. 1) which are provided with balancing valves 64 and 65 respectively. The exhaust ports are connected to outlets 66 and 67.

Accordingly it is not apparent that the rotary internal combustion engine described herein generates power in an efficient and economic manner through the provision of a plurality of explosion chamber coacting with a unique planetary gear system especially designed to move the piston in an appropriate course and to transmit the power generated to an output shaft.

It is to be further understood that additional forms regarding the use of more than two explosion chambers and variations in the shape of the piston are within the scope of this invention.

I claim as follows:

1. A rotary piston engine comprising a housing having a cavity axially aligned in the housing with a piston rotatably mounted in said cavity, including a straight shaft rotatably mounted in said housing in axial alignment with the housing and extending transversely through the housing, piston, and cavity linearly, including means for rotating said piston eccentrically about said shaft, said means being movable relative to said shaft in combination with coacting means for transmit-

ting eccentric rotation of said piston relative to said shaft to cause concentric rotation of said shaft in said housing, wherein piston is provided with peripheral surface contoured and spaced relative to said housing forming thereby within said cavity a plurality of spaced recesses between said housing and said piston, said recesses including at least a pair of spaced explosion chambers, each provided with spark plugs, including fuel intake and gas exhaust ports, said peripheral surfaces encompassing piston lobes adapted to sequentially compress fuel and exhaust combustion gases as the piston rotates, wherein the first said means coacts with the lobe contour to cause the fuel in the explosion chambers to be in a state of maximum compression when the spark plugs cause combustion.

2. An engine as in claim 1 wherein the piston lobes are fewer in number than the said recesses and wherein each lobe substantially conforms to the shape of each recess.

3. An engine as in claim 2 wherein the piston lobes are similar and symmetrical about the piston axis of rotation, and wherein, the recesses conform substantially to the shape of said lobes, the number of said lobes being such that the lobes will substantially occupy all recesses except two in any position of the piston.

4. An engine as in claim 3 wherein the piston has three similar, equispaced arcuate lobes disposed symmetrically about the piston axis.

5. An engine as in claim 4 wherein said means comprises a disc rotatably mounted axially in said piston and a planetary gear mounted on said disc rotatably including gears mounted on the piston and shaft coacting with said planetary gear to transmit motion from the piston to the shaft, said housing having an internal gear coacting with said planetary gear, said gears being synchronized to position the lobes in the recesses to cause maximum combustion pressure during ignition.

6. An engine as in claim 1, wherein each of said piston lobes includes twin spaced sealing means mounted radially movable in said piston and extending beyond said peripheral surface at the apex of said lobes into sliding resilient abutment with the housing.

7. An engine as in claim 6 wherein said sealing means are fluid pressure biased outward of the pistons.

8. An engine as in claim 7 including a cooling canal provided in the housing encompassing the recesses.

9. An engine as in claim 1 wherein the first said means includes a disc mounted axially rotatably within said piston between said shaft and said piston.

10. An engine as in claim 9 wherein said disc is mounted eccentrically rotatably about said shaft.

11. An engine as in claim 10 wherein said disc includes a rotatable gear extending laterally from said disc and parallel to said shaft, said gear coacting with the second means to simultaneously cause eccentric rotation of the piston and concentric rotation of the shaft relative to the housing axis.

* * * * *

UNITED STATES PATENT OFFICE Page 1 of 8
CERTIFICATE OF CORRECTION

Patent No. 3,771,501 Dated JUNE 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Abstract, line 2, delete "trochoi-", insert --trichoi- --.

line 3, delete "quadra-", insert --quadri- --.

Column 1, line 12 after housing, insert --,--.

line 14, delete "explosion", insert

--explosions--.

line 18, before "output shaft", insert

--main drive--.

line 40, delete "an eccentric", insert

--a concentric--.

lines 57 and 58 - delete "plural", insert

--multi--.

line 66, after "16", insert ~~16A~~, 16B--

Column 2, line 1, delete "11", insert --12--.

line 7, after "19", insert --A--.

line 11, delete "16A, 16B and 16C", insert

--16, 16A and 16B--.

line 12, delete "11", insert --12--.

line 36, delete "compression", insert

--exhaust--.

UNITED STATES PATENT OFFICE Page 2 of 8
CERTIFICATE OF CORRECTION

Patent No 3,771,501

Dated June 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 44, delete "of", insert --within--.

line 50, delete "compressed", insert
--compression--.

line 68, delete "22A", insert --20--.

Column 3, line 7, delete "19", insert --18--.

line 12, delete "19", insert --19A and 19--.

line 14, delete "19", insert --18--.

line 15, delete "compression chamber 19",
insert --explosion chambers 19 and 20--.

line 32, delete "plural", insert --multi--.

line 36, delete "trochoidal", insert
--trichoidal--.

line 44, delete "the explosion by", insert
--explosions for--.

line 47, delete "trichoidal", insert
--trochoidal--.

line 56, delete "fact", insert --property--.

line 57, delete "chamber", insert --chambers--.

UNITED STATES PATENT OFFICE Page 3 of 8
CERTIFICATE OF CORRECTION

Patent No. 3,771,501 Dated June 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 64, delete "the explosion by", insert
--explosions for--.

line 65, after the word "piston", insert
--13--.

line 67, after the word "housing", insert
--11--.

Column 4, line 2, after the word "piston", insert
--13--.

line 8, delete "chamber", insert --chambers--.
line 16, delete "the explosion", insert
--explosions--.

line 17, after the word "piston", insert
--13--.

line 19, after the word "housing", insert
--11--.

line 21, after the word "piston", insert
--13--.

line 27, delete "chamber", insert --chambers--.

UNITED STATES PATENT OFFICE Page 4 of 8
CERTIFICATE OF CORRECTION

Patent No. 3,771,501 Dated June 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 39, delete "shown", insert --show--.

line 48, delete "the explosion", insert
--explosions--.

line 49, after the word "piston", insert
--13--.

Column 5, line 3, after the word "housing", insert
--11--.

line 5, after the word "piston", insert
--13--.

line 10, delete "alway", insert --always--.

line 10, after the word "number", insert
--if not furnished with conventional values.--.

line 43, delete "designing", insert --design--.

Column 6, line 12, delete "No.".

line 13, delete "internal cam track", insert
--planetary shaft 26--.

line 30, delete "internal cam track", insert
--planetary shaft 26--.

UNITED STATES PATENT OFFICE Page 5 of 8
CERTIFICATE OF CORRECTION

Patent No. 3,771,501 Dated June 6, 1975

Inventor(s) Tibor Louis DeDoba

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 40, delete "Lets", insert --Let us--.
line 40, delete "Rotary", insert --rotary--.
line 44 directly after the formula, insert

--approx.--.

line 54 directly after the formula, insert

--approx.--.

line 56, delete "shows", insert --show--.

line 57, delete "internal cam", insert

--planetary shaft--.

line 58, delete "disk", insert --disc 27--.

line 66, delete "internal cam", insert

--planetary shaft--.

line 67, delete "disk", insert --disc 27--.

Column 7, line 8, delete "internal cam", insert

--planetary shaft--.

line 19, delete "internal cam", insert

--planetary shaft--.

lines 27, 28 and 29 inclusive, delete both

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CERTIFICATE OF CORRECTION

Patent No. 3,771,501 Dated June 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

instances "internal cam", insert both instances --planetary shaft--

Column 7, lines 37 and 38, delete "internal cam", insert --planetary shaft--.

lines 47 and 48, delete "internal cam", insert --planetary shaft--.

line 56, delete "internal cam", insert --planetary shaft--.

lines 63 and 64, delete "internal cam", insert --planetary shaft--.

Column 8, line 38, after the word "piston" insert --13--.

line 46, after the word "piston" insert --13--.

lines 48 and 49, delete "No." both instances.
line 52, after thw word "piston", insert --13--.

line 59 after the word "lobe", insert --16,
16A, 16B--.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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Patent No. 3,771,501

Dated June 6, 1975

Inventor(s) Tibor Louis DeDobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8, line 62 after the word "piston", insert

--13--.

line 63, after the word "housing", insert

--11--.

line 65, after the word "piston", insert

--13--.

line 66, delete "chamber", insert --chambers

19A or 20A--.

line 67, after the word "chamber", insert

--31A--.

Column 9, line 5, after "35", insert --with three seal springs 33A, 34A, 35A and with compressed vapor similar to 31--.

line 9, delete "plural", insert --multi--.

line 12, after the word "piston", insert

--13--; after the word "housing", insert --11--.

line 19, after the word "piston", insert

--13--.

line 35, after the word "chambers", insert

--19A, 20A--.

UNITED STATES PATENT OFFICE Page 8 of 8
CERTIFICATE OF CORRECTION

Patent No. 3,771,501

Dated June 6, 1975

Inventor(s) Tibor Louis Dedobo

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 9, line 38, after the word "ports/", insert
--21B, 21C--.

line 55, delete "alignmnt", insert
--alignment--.

Claim 5, line 30, after the word "means" insert --for
rotating said piston--.

Claim 9, line 49, after the word "means", insert
--for rotating said piston--.

line 48, after the word "the", delete "first
said".

Signed and Sealed this

Seventeenth Day of October 1978

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

DONALD W. BANNER
Commissioner of Patents and Trademarks