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To
The controller of patents,
The patent office,
At Mumbai

APPLICATION FOR PATENT ALONG WITH COMPLETE SPECIFICATION

APPLICANT(S)

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Documents attached with the application:-

	Number of Pages
Form 1	3
Form 2	14
Form 3	1
Form 26	1
TOTAL	19 pages

Fee paid along with the application:-

1. Form 1 Rupees 1000(one thousand only)

TOTAL AMOUNT RUPEES 1000(ONE THOUSAND ONLY)
Mode of payment in Cash/Cheque/bank draft bearing no

FORM 1 (FOR OFFICE USE ONLY)

THE PATENT ACT 1970
(39 OF 1970)
And
The patent rules, 2003

Application number:
Filing date:
amount of fee paid:
CBR NO:

APPLICATION FOR GRANT OF PATENT
[See sec 7, 54,135 and rule20 (1)]

1 APPLICANT(S)

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2. TITLE OF INVENTION

Rotary Multiple Axial Round-Vane Internal Combustion Engine

4. ADDRESS FOR CORRESPONDANCE OF AUTHORISED PATENT AGENT IN INDIA:-

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5. DECLARATION:

(i) Declaration by the inventors

We the above named inventors are the true and first inventors for this invention
Dated this 15th day August 2010

Signature of the inventors

Name: (1) Ingole Vijay Tulshiram

(2) Ingole Ashutosh Vijay

(3) Ingole Paritosh Vijay

(ii) Declaration by the applicants

We the applicants hereby declare that:-
We are in possession of above mentioned invention.
The complete specification relating to the invention is filed with the application
There is no lawful ground of objection to the grant of patent to us.

Signature of the applicants

Name: (1) Ingole Vijay Tulshiram

(2) Ingole Ashutosh Vijay

(3) Ingole Paritosh Vijay

6. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION

(a)Complete specification in duplicate

(b)Drawings in duplicate

(c) Statement and undertaking on form 3 in duplicate

(d) Abstract in duplicate

(e) Form number 26 Power of authorization to patent agent.

(f) Form number 9.

(g) Form number 18.

Fee Rs in Cash/Cheque/bank draft bearing no

Date on Bank.

We hereby declare that to the best our knowledge, information and belief the facts and the matter stated herein are correct and we request that the patent may be granted to us for the said invention.

Dated this 15th day August 2010

Signature:

Name :(1) Ingole Vijay Tulshiram

(2) Ingole Ashutosh Vijay

(3) Ingole Paritosh Vijay

FORM 2

THE PATENT ACT 1970
(39 OF 1970)
AND
The patent rules, 2003

COMPLETE SPECIFICATION
(See section 10: rule 13)

1. TITLE OF INVENTION
Rotary Multiple Axial Round-Vane Internal Combustion Engine

2 APPLICANTS(S)

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Ingole Vijay Tulshiram	Indian	104 Ganediwal layout, camp, Amravati-444602
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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

Following specification particularly describes the invention and the manner in which it is to be performed.

4. DESCRIPTION.

Technical field of invention:

The present invention relates to internal combustion engine and more particularly to rotating vane rotary internal combustion engine.

Prior art:

Heat engines have been utilized to convert heat energy into mechanical energy. There are basically two types of heat engines namely external heat generation engine where fuel like coal, oil or gases are burned (combustion) externally to heat a liquid like water and the heat in the media is converted into mechanical energy by reciprocating engines or steam turbines. The reciprocating steam engine is nearly outdated and has very limited applications however, since the low cost low calorie fuel like coal can be used to produce steam the steam turbine has applications in large thermoelectric power plants. Second version of heat engine is known as internal combustion engine and popularly called IC engines. The liquid or gaseous fuel is burned inside the engine chamber and the energy of the expanding gas mixture is utilized to convert it into mechanical energy. There are basically three types of IC engines namely reciprocating IC engine, secondly gas turbine and thirdly rotating IC engine. The reciprocating engine is the most popular version of IC engine having maximum commercial applications. A secured cylindrical cavity known as cylinder is closed at one end and open at the other end to take up piston. The piston moves in and out inside the cylinder during the operation hence it is known as reciprocating IC engine. There are two types of such engines called four stroke and second is called two stroke engine. Since the reciprocating action of the piston is to be converted in to rotary motion by the help of connecting rod, crank shaft and power is generated in a phased manner such engines are inherently prone to vibrations, noise and require flywheel to store energy for successive compression cycle and to smoothen out the torque fluctuation. The four stroke engine complete one working cycle in two revolutions and undergoes four different cycle means strokes known as suction, compression, power and exhaust respectively. It requires gears, connecting rod, cam shaft and valves and its power to weight ratio is lower than two stroke engine, but it is more efficient and has got cleaner exhaust than its counterpart. In the two stroke IC engine the compression and power stroke takes place in two phases during one revolution where as gases are sucked through suction port which is provided by

compressed air in the crank case and it also clears out the burnt gases called scavenging simultaneously from the cylinder through exhaust port. Since it has one power stroke in one rotation its power to weight ratio is higher than four stroke IC engine and does not require valves and gears thus makes it bidirectional in rotation and simple in construction however its performance is poor and exhaust is not clean hence it is generally preferred only for light weight, small power application and for most of the applications four stroke IC engines are preferred. The conversion of reciprocating motion into rotary motion is the fundamental problem with such engines as it creates many associating problems such as to statically and dynamically balance moment of inertia of reciprocating piston and connecting rod with the rotating crank shaft, the length of the power stroke surpassing the designed length of the piston movement, varying the performance of the engine at different speeds, limited speed, knocking, backfire, inherent vibration and noise, un-burnt fuel in exhaust, mixing of inlet gases with the exhaust. Continuous research and modifications though have improved the performance of four stroke engine to a great extent but it still suffers from the basic design concept.

Rotary IC engines include gas turbines which have wide applications where large power but very high speed is tolerated. Another version of rotary IC engine is Wankel engine which works on four phase cycle principle. It has two main parts namely a triangular shaped rotor and two lobed epitrochoid shaped stator. The rotor has a compound motion as it has to be in contact with the two lobed stator therefore it oscillates while rotating hence it is mounted on an eccentric shaft with which it makes a line contact. Volume entrapped in the rotor periphery means apex and stator goes on varying during one rotation subjecting the inlet gases to undergo expansion, compression, expansion and compression. The first expansion is utilized as suction phase where gases are taken in through an inlet port, then the next compression phase is utilized to compress the gases, and at the beginning of the next expansion the gases are ignited and the power phase begins and it continues till the expansion phase is over, and in the last compression phase the burnt gases are pushed out through the exhaust port and in this manner the four phases of thermodynamics cycle are completed. In one rotation of the rotor's three faces means between apexes undergo through similar four phases and hence there are three power phases per revolution. Since it is a rotary engine there are fewer vibrations. Further it does not require valves and valve operating mechanism, cam shaft and associated gears.

However during its operation there is a wear of apex seals between lobes and inner wall of rotor housing. Since the rotor oscillates while rotation it does not have a solid center to take up pressure variation within hence the rotor apex seals are subjected to

uneven forces causing wear and further rotor lubrication and cooling becomes difficult which is the most serious drawback of this engine. Rotor apex seal is rectangular while side seals are triangular hence there is a possibility of charge leakage. Such type of engine the combustion of fuel is not complete, consumes more oil and emission is polluted. Another type of engine is rotary vane engine. The rotary vane engine overcomes the basic disadvantage of reciprocating IC engine by combining all basic phases during its rotary operation. The conventional rotary IC engine comprises an eccentric rotor rotating in a circular housing or housing. The periphery of the rotor is generally divided by radially extensible and retractable vane of which number varies from design to design. Charge cavity of such engine is defined between two successive vanes, part of the rotor periphery and part of the stator housing therein between. As the charge cavity rotates around the inside stator housing its enclosed volumes changes continuously due to eccentric rotation of rotor. Since the volume of charge cavity alternatively expands and contracts twice in succession and such variation in charge cavity is utilized for suction, compression, ignition with expansion and exhaust. The suction or charge inlet and exhaust ports are suitably located for optimum operation. As the speed of the engine increases the pressure exerted by the vanes on the inner housing of the cavity increases due to centrifugal force causing their rapid wear and tear. Different arrangements to hold the vane in proper position to minimize excessive wear during the rotation are proposed to overcome centrifugal forces however all such arrangement involves another vane retention guide grooves making the overall motion of the vane more complex and adding another element of causing wear and further it makes the manufacturing more complex. The vane is generally of rectangular in shape and sealing of such a shape introduces technical problems and sustained sealing of charge cavity becomes difficult over a period time.

Problems to be solved:

It would be therefore to have such an IC engine which is not reciprocating, free from vibrations and noise, which rotor does not oscillate and has a solid rotating centre means shaft, which has a lubricating system without external lubricant pump, which has all the advantages of rotary vane IC engine but its vanes are not subjected to centrifugal force and does not require vane guiding mechanism, which does not have rectangular vanes but has circular or round vanes for excellent sealing of gas mixture like reciprocating engine and provides simple and reliable usage of sprung rings on the round vane, which is very easy to manufacture requiring less components. A

novel vane IC engine with rotary multiple axial round-vane is proposed which free from disadvantages of existing and known IC engines.

These and other advantages will be more readily understood by referring to the following detailed description for a novel rotating vane IC engine disclosed hereinafter with reference to the accompanying drawings and which are generally applicable to other IC engines to fulfill particular application illustrated hereinafter.

Object:

1. Primary object of the present invention is to provide an internal combustion engine which is free of the shortcoming of the existing reciprocating IC engine by its unique feature of rotary motion to minimize wear, tear vibration and noise,
2. Another object of the present invention to provide inlet and exhaust port to dispense with charge inlet valve, exhaust valves and associated valve operating mechanism.
3. Further objective of the present invention is to provide an internal combustion engine that is free of unbalance and stresses incurred in reciprocating IC engine.
4. Yet another object of the present invention is to provide circular or round vanes with sprung rings to effectively minimize leakages in the entrapped gases and ease of maintenance.
5. A still further object of the present invention is to provide a separate metal lining for parts subjected to high temperature during operation and further to minimize friction and also for its easy replacement as and when required.
6. Still another object of the present invention is to provide a rotary IC engine having sinusoidal profile of housing grooves so that axial vanes movement is simple harmonic motion which is scientifically most desirable and further the volume displacement in charge cavity to vary sinusoidally.
7. Yet another object of the present invention is to provide axially moving vanes instead of radial vanes to minimize the effect of centrifugal force particularly under

high speed operation and further minimizing excessive friction, rubbing, warping, bending of vanes,

8. Another unique feature of the present invention is to provide two jointed axially moving vanes along with their respective and specifically oriented housing grooves such that the vanes always remain snugly in contact with respective grooves so that the need of vane retention guiding arrangement is dispensed with.

9. Still another object of the present invention is to provide direct transmission of the generated torque to the shaft unlike in the case of Wankel engine where the torque is indirectly transmitted due to combine rotating and oscillating motion of the rotor.

10. One of the object of the present invention is also to provide groove in the housing on both sides of the rotor to equalize combustion forces or pressure thereby minimizing stresses unlike Wankel engine where there is pressure imbalance on the rotor causing more wear of the apex vanes.

11. Still another feature of the present invention is to provide charge cavity suitable for volatile fuel like petrol means with spark plug ignition system as well as for fuel like diesel means compression ignition with fuel injection with atomizer.

12. Additional object of the present invention is to provide a self lubricating system for the whole engine including charge cavities and rotor so as to dispense with a separate pressuring lubrication oil pump whereas in Wankel engine rotor lubrication is difficult due to combine rotating and oscillating motion of the rotor.

13. Yet another object of the present invention is to provide a rotary IC engine which has most of the advantages of reciprocating as well as rotary vane IC engine but which is reliable, efficient, low in maintenance, requires minimum number components and is easy to manufacture.

Further objects and features can be readily understood by any person skilled in the art by referring to the detail description and appended claims of the invention.

STATEMENT:

Following specification provides rotary multiple axial round-vane internal combustion engine with two end-shield or end covers or housings and each comprising a novel circular groove on its inner side and these two housings sealing encloses the rotatably mounted rotor means fitted on its either side. The depth of each novel circular profile of the groove is sinusoidal and the radius of curvature of the groove is maintained constant. Another novelty is that where one preferred embodiment the grooves on housings are turned with respect to each other such that

the groove valley means maximum groove depth on one housing is aligned with groove crest means minimum groove depth of other housing so that the sum of the groove depths of these grooves at any point remains constant around its circular path and further and is always equal to the length of the jointed vane therefore the jointed vane fits snugly in both the grooves on either side of the rotor while the varying depth of the stator circular profile on each side makes the jointed vane move axially in and out in the vane housings and groove in simple harmonic motion. This is achieved by combining two vanes on either side of rotor and axially aligned in their respective vane housing by pin or support means jointed vanes so that the combination moves together in the grooves and further the length of the jointed vane is equal to the distance between the grooves which ensures that the round vane fits snugly in both the grooves and moves coherently. In another preferred embodiment such orientation is not required because each vane moves independently of each other and remains in contact with the respective groove profile by a spring force and other action remaining same. Each housing is provided with inlet port for air or mixture of fuel and air entry and an exhaust port for evacuating burnt gases at suitable locations. The housing is provided with inlet for lubricating oil by utilizing centrifugal force due to rotor motion for the supply to the vane housing, vanes, grooves and charge cavity. The housings and their outer sides are provided with engine cooling system and air cooling fins.

The rotor is rotatably mounted on a shaft within the housing comprising two housings with a plurality of axial vane housings formed for pluralities of vanes on a pitch circle diameter (PCD) equal to PCD of housing groove to house novel arrangement of axially extensible circular vanes. In one preferred embodiment, the circular vane provided for one housing groove is fixed to the respective vane provided for the other housing groove generally by pins or any other rigid support thus making a plurality of compound or jointed vane. Other novelty of the invention is that the end to end distance of such compound vane is such that it snugly fits in the grooves on both sides and slide in the vane housings coherently during entire rotational movement in the housing grooves with their axial movement because the distance between groove profile is the same as that of the jointed vane. Other novelty of the invention is that in other preferred embodiment plurality of vanes are supported on pins or rigid support fitted to the rotor vane housings and resting on springs. The spring is mounted on a pin and the circular vane slides on the pin. The spring force is just sufficient to make the circular vane fit snugly in the housing groove during its rotational movement.

A plurality of fuel charge cavity means volume are formed within the housing in the space between two adjacent vanes, the inner portion of the housing groove and the flat portion of the rotor there in between. The other novelty of invention in which the housing circular groove is made in such a way that its depth varies in a sinusoidal manner means it goes on increasing through first quarter of rotation means the volume goes on increasing means suction phase where air or fuel charge is sucked in through suction port, then the depth goes on decreasing for second quarter of rotation means the volume goes on decreasing means compression phase, then for the third quarter of rotation the depth goes on increasing means the volume goes on increasing means expansion phase however; at the beginning of this phase compressed fuel charge or air-fuel mixture is ignited by spark plug or atomized fuel is introduced by fuel injector which gets ignited by compression ignition which expands in the expansion phase known as power phase and in fourth or last quarter the volume goes on decreasing known as exhaust phase where burnt gas mixture is expelled or evacuated through exhaust port and thus in one rotation of rotor each charge cavity undergoes four distinct phases to complete one thermodynamic cycle and other novelty of the invention is that the radius of curvature of the groove is always same that of the jointed vane means the pluralities of jointed round vanes or part thereof snugly fits in both housing grooves during every single rotation.

These and other features and advantages will be more readily understood by referring to the following detailed illustrations for a novel rotary multiple axial round-vane internal combustion engine disclosed hereinafter with reference to the accompanying drawings and which are generally applicable to other IC engines to fulfill particular application illustrated hereinafter.

BRIEF DESCRIPTION OF DRAWING:

The invention is described by way of example with reference to the following drawings

Sheet 1 of 7 illustrate cross-sectional view of rotor elevation in Figure-1A, partial cross sectional end elevation in Figure-1B showing vane housings on either faces for rotor, metal liners, lubricating oil ducts, key-way for shaft, grooves for sealing rings, groove for oil seal and partial cross-sectional elevation and Figure-1C shows the elevation and plan of jointed vanes in a one preferred embodiment of the rotary multiple axial round vane internal combustion engine.

Sheet 2 of 7 illustrates the elevation of one of the housings in Figure-2A showing the cross section of groove at different angular positions, inlet and exhaust ports and

Figure-2B shows the cross-sectional end elevation of the housing groove cross sections, housing groove metal liner, bearing housing, spark plug or injector, lubricating oil inlet.

Sheet 3 of 7 comprises Figure-3A and Figure-3B showing elevation and cross-section of side elevation of one of the liquid and air cooling end-shields respectively. It illustrates water jacket, air cooling fins, openings for spark-plug or injector, liquid coolant inlet, lubricating oil inlet.

Sheet 4 of 7 illustrates in Figure-4A, Figure-4B, Figure-4C, Figure-4D, and Figure-4E showing the exploded cross-sectional view of the various sub-assemblies of left cooling end-shield, left housing with groove, centrally and concentrically mounted rotor with associated central shaft, bearings, shrink collar, axially movable multiple jointed vanes, right housing with groove, and right cooling end-shield and the manner in which they are to be assembled in the one preferred embodiment of rotary multiple axial round-vane internal combustion engine.

Sheet 5 of 7 illustrates Figure-5A the cross-section of one of the embodiments of the assembled rotary multiple axial round-vane internal combustion engine showing the relative position of various subassemblies, the position of jointed vane at different angular locations, position of spark plug or injector with respect to the direction of rotation, rotatably mounted rotor on the center shaft, lubricating oil system, liquid and air cooling system, and Figure-5B illustrates partial cross-section of the assembled engine showing housings groove relative orientation, groove profile, inlet port and exhaust port.

Sheet 6 of 7 illustrates other embodiment of rotor where in Figure-6A shows cross-section view showing vane housing for vanes on either side of the rotor faces and Figure-6B shows their relative angular orientation, independent movement of multiple vanes in the housing groove supported by pins and springs.

Sheet 7 of 7 illustrates Figure-7A the cross-section of one of the other embodiments of the assembled rotary multiple axial round-vane internal combustion engine showing the relative position of various subassemblies, the position of independent vane at different angular locations, springs, position of spark plug or injector with respect to the direction of rotation, rotatably mounted rotor on the center shaft, lubricating oil system, liquid and air cooling system, and Figure-5B illustrates partial cross-section of the assembled engine showing housings relative orientation, groove profile, inlet port and exhaust port.

In order that the manner in which the above-cited and other advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which

are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and therefore not to be considered limiting on its scope, the invention will be described with additional specificity and details through the use of the accompanying drawings.

Detailed description:

Sheet 1 of 7 comprises cross-section of rotor subassembly of one of the preferred embodiments of rotary multiple axial round-vane internal combustion engine. Figure-1A is a cross section of elevation of rotor 100 used in one of the preferred embodiment. Metal liner 129, 130 are provided on rotor surface to be in contact with housing grooves (not shown). Pluralities of vane housings 112-1, 112-8 being eight in number for the present embodiment are equally spaced on one side of the flat surface of rotor 100 and axially aligned with vane housing 121-2, 121-5 so that pluralities of vane housings 1112-1, 112-5 on one side of rotor face are aligned with respective pluralities of vane housing 121-2, 121-5 of other face of rotor 100. Pluralities of jointed vanes 120-1 placed inside of vane housing 112-1 and 121-2 shown. Similarly jointed vane 120-9 placed inside vane housing 121-5 and 121-8 shown. Under cuts 126 are formed on either side of the rotor 100. Circular grooves 116, 127, 128 are formed on the sides of the 126 for oil seal and sealing rings respectively. Pluralities of lubricating oil ducts 115, 125 are provided to lubricate the pluralities of vane housing 121-1 at opening 119 which are further connected to openings of pluralities of ducts 114, 124 to supply lubricating oil to the grooves (not shown) of housings on either side of rotor 100. Sealing rings 111 are located on the circumference of the rotor 100. Figure-1B shows the partial cross section of the side elevation of rotor 100. It shows eight vane housing 121 equally spaced around the flat surface of rotor 100. It further shows the pluralities jointed vanes 120-1 placed inside the pluralities of vane housing 121. It also shows in a circularly taken section B to show the pluralities of vane guiding holes 122 and profile 121-5 of the vane housing. Partial circular section A is taken to show lubricating oil duct 125 and its opening 123 in the vane hosing 122-1, its opening 124 for the housing groove (not shown), section of vane sprung ring 120D, cross section of vane 120E. It also shows rotor key-way slot 117. Figure-1C shows the assembly of jointed vane 120. It shows pluralities of sprung rings 120D put on the groove 120E formed on the pluralities of round vanes 120-1 and 120-2, partial cross-section of round vane 120-2 showing section of vane 120E , section of sprung ring 120D, pluralities of guiding pins 120C

joining the vanes 120-1 and 120-2 thus forming pluralities of jointed vane assembly 120. The pluralities of jointed vane pin slide in the directions of arrow through pluralities of holes 122 made in pluralities of vane housing 121-1 of rotor 100. PCD of vane assembly 130 is shown which is equal to the PCD of housing PCD 213 (not shown). Presently only eight in number of jointed vane 120 are shown in the present one of the embodiments however; number of such vane assemblies may be vary with applications.

Sheet 2 of 7 shows the elevation of one of the two housings 200 which is similar to housing 400 (not shown). Figure-2A shows air cooling fins 219, cooling liquid passage way 217, mounting holes 218, inlet duct 224, exhaust duct 222 lubricating oil duct 225, hole 220 for shaft 150 (not shown), inlet port 223, exhaust port 221 and relative direction of rotation by an arrow of rotor 100 (not shown) with respect to housing 200. It shows chamber groove liner 235. It further shows the PCD 213 and inner contour 226A and outer contour 226B of groove 210. The groove is divided in four quadrants means between S &T, T & U, U & V, and V & S. The depth of the groove varies in sinusoidal form at different angular position is shown in the sectional views 201, 202, 203, 204, and 205 from point T to U of rotation respectively in one of the quarters. The depth of the groove is maximum at points T and U means valley and minimum at points S and U means crest. The inlet port 223 is located between point S to T. Rotor jointed vanes fit snugly in the enclosure groove profile during entire rotation and the volume of inlet gases entrapped between two successive vanes, rotor surface and housing groove goes on increasing from point S to T thus creating a vacuum means suction phase therefore gases are drawn in from the inlet or suction port 223. When successive vanes move from T to U its entrapped volume goes on decreasing as readily seen from sections 205 through 201 in the direction of rotation, shown by arrow, of rotor 100 (not shown) means creating compression phase. The relative position of spark plug or injector 215B is shown where the compressed gas mixture at 211 is ignited to commence the power phase from point U to V where cross section of the groove goes on increasing so is the volume entrapped burning gases between the successive vanes. When the said successive vanes move from V to S the volume between them goes on decreasing thus creating a positive pressure to expel or exhaust burnt gases through the exhaust port 221. The exhaust port 221 is located between V & S. During this operation vane means jointed vanes move axially in the groove in a simple harmonic motion twice in one rotation between crests and valleys of housing groove 210. In this manner for eight vanes on each side the engine form their own charge cavities and thus go through eight power phases per housing means total 16 power phases per revolution.

The housing 200 and 400 (not shown) are angularly turned and oriented with respect to each other in such a manner that the valley means T of one housing groove is aligned with the crest means U of other housing groove means sum of the depth of the respective grooves of the housings at any angle remains constant so that each round vane of the jointed vane fits snugly in the respective grooves and further guided for its axial movement during entire rotation of rotor 100. Figure-2B shows the cross section view of the housing 200. It shows air cooling fins 219, holes 218 for fixing bolts, bearing housing 230, bearing 231, lubricating oil duct 225, grooves 232 for sealing rings, groove 233 for oil seal, profile of housing groove 211 and spark plug or injector 215B, housing groove 210 depth profile 226, exhaust port 221.

Sheet 3 of 7 shows the elevation of cooling system end-shield 300 two in numbers in Figure-3A. It shows air cooling fins 303, 304, engine fixing holes 301, end-shied fixing holes 302, lubricating oil inlet 325, cooling liquid inlet 310, clear holes 315A, 315B for spark plug or injector. Figure-3B shows cross section of cooling system 300. It shows air cooling fins 303, 304, engine fixing holes 301, end-shied fixing holes 302, lubricating oil inlet 325, cooling liquid inlet 310, clear holes 315A, 315B for spark plug or injector.

Sheet 4 of 7 illustrates various subassemblies described in sheets 1 of 7, 2 of 7 and 3 of 7 in the manner in which they are to be assembled to form one of the preferred embodiment of rotary multiple axial round-vane IC engine. Figure-4C shows the concentrically mounted rotor 100, concentrically located shaft 150, bearing seats 151, 152, shaft key-way 153, rotor key-way 117, shrink collar 155 and in the manner they are to be assembled by the direction of arrows. It further shows the extreme left hand and right hand positions of jointed vane assemblies 120-1in the rotor vane housings 121-1. Housings 200 and 400 are similar to each other except for the location of spark plug or injector 415 and 215 where they are located over the charge cavity immediately after compression phase means after point U (Figure-2A) in the direction of rotation. Further the housing 200 and 400 are turned and oriented angularly so as to align crest point U (Figure-2A) of housing 200 to valley T of housing 400 (Figure-2A) as explained elsewhere. They are placed on either sides of rotor 100 to form a sealed enclosure as shown in Figure-4B and Figure-4D respectively. Cooling system en-shields 500 and 300 as shown in Figure-4A and Figure-4E are placed on the respective housings as shown.

Sheet 5 of 7 illustrates the cross section of assembled rotary multiple axial round-vane internal combustion engine being one of the preferred embodiment comprising all subassemblies hitherto illustrated. It further shows the position of housing grooves and jointed vanes 120-1, 120-8, position of spark plugs or injectors

215, 415, lubricating oil system 325,525, cooling liquid system310, 510, sealing rings and oil seal. The side elevation as shown in Figure-5B shows the partial cross section of the complete assembly. It further shows the inlet port 221 with inlet duct 240 and exhaust port duct 241 of housing 200 and similarly it shows the inlet port duct 440 and exhaust port duct 441 of housing 400 and their relative angular orientation.

Sheet 6 of 7 shows other preferred embodiment of rotor of the rotary multiple axial round-vane internal combustion engine. Figure-6A shows the elevation of rotor 600. It further shows pluralities of vane housings 620 being eight in number on one side for the present embodiment are equally spaced on one side of the flat surface of rotor 600. Plurality of vane housings 640 presently eight in number on other side of rotor 600 are centrally located between two vanes 620 and are similarly formed on other side of the flat surface of rotor 600. It shows pluralities of holes 620C for fixing the mounting pins 620C. It further shows the position of pluralities of vanes 620 inside the pluralities of vane housing 610. It shows the PCD of the 645 of vanes which matches with PCD of housing grooves PCD (not shown). Metal liner 631, 632 are provided on rotor surface to be contact with housing grooves. Under cuts 626 are formed on either side of the rotor 600. It further shows the lubricating oil ducts supplying to the pluralities of vane housings 610, 640 of the rotor 600. It also shows the hole 650 and key-way 617 for mounting and locating the rotor 600 on shaft (not shown). Circular grooves 616, 627, 628 are formed on the sides of the 626 for oil seal and sealing rings respectively. Pluralities of lubricating oil ducts 624, 618 are provided to lubricate the pluralities of vane housings 620 and 630 at opening 619 which are further connected to openings of pluralities of ducts 615, 624 to supply lubricating oil to the grooves (not shown) of housings on either side of rotor 600. Figure-5B is cross section of side elevation of rotor 600. It shows sealing rings 611, 627, 628 and oil seal 616. It further shows pluralities of lubricating oil ducts opening 615, 625 and pluralities of ducts 623, 619 for pluralities of vane housings, pluralities of ducts 624, 618 for lubricating housing grooves (not shown). It also shows the under cuts 626 in the rotor 600 for facilitating sealing and lubrication system. It also illustrate the exploded view of the vane assembly comprising pins 620C, pin fixing holes 622, compression springs 620A, round vane 620, sprung ring 620D and holes 620B for the axial sliding movement of the round vane 620 on pins 620C to fit snugly in the groove profile. Depth of the housing grooves varies in a sinusoidal manner as shown in Figure-2A and Figure-2B. The round vanes 630 and 620 move independently in the grooves of housings 200 and 400 grooves 210 and 410, as shown in sheet 4 of 7, placed on either sides of rotor 600. During each rotation each

round vane goes twice over crests and valleys of the groove profile independently and thus moves axially in simple harmonic motion against the pressure of the springs.

Sheet 7 of 7 illustrates a cross elevation in Figure-7A and partial cross sectional end elevation in Figure-7B of the assembled rotary multiple axial round-vane internal combustion engine of other preferred embodiment. Figure-8A shows rotor 600 enclosed by housings 200 and 400. Cooling system end-shield 300, 500 are fixed on housing 200, 400. It further shows shaft 150 concentrically located and fixed to rotor 600 and rotor assembly is supported by bearings 431, 231 and pluralities of fixing bolts 155. It shows lubricating oil inlets 325, 525, cooling liquid inlets 310, 510. It further shows spark plugs or injectors 215, 415 fitted on housings 200 and 400 respectively. It further shows the grooves 210, 410, inlet port 221, 421 of housing 200 and 400. It also shows rotor vane 630 in groove 410 and vane 620 in groove 210 of housings 200 and 400 respectively. Gigure-7 B shows inlet port 221, exhaust port 421, inlet duct 240, exhaust duct 441 of housings 200 and 400 respectively and groove 620 of housing 600 and spark plug or injector 415 of housing 400. It shows pluralities of fixing bolts 155, cooling liquid passageway 217, shaft 150, bearing 231, cooling liquid inlet 510, lubricating oil inlet 525, and cooling system end-shield fixing bolts 502. In the present embodiment each vane axial movement is independent of each other so they move in the groove of respective housing by means of the pressure of compression spring where pressure exerted is just enough to for the vanes to be in contact with the groove. Operation and functioning of vane and groove profile combination to create suction, compression, power and exhaust phases is explained elsewhere. During the entire operation vanes independently move axially in the groove in a simple harmonic motion. In this manner for eight vanes on each side the rotor go through eight power phases means total 16 power phases per revolution for the present illustration.

There have thus been described certain preferred embodiments of rotary multiple axial round-vane internal combustion engine provided in accordance with the present invention. While preferred embodiments have been described and disclosed, it will be recognized by those with skill in the art that modifications are within the true spirit and scope of the invention. The claims are intended to cover all such modifications.

CLAIMS

We claim:-

1 A multiple axial and ideally round-vane internal combustion engine means vanes of different shapes and geometry can also be used and the device achieves unique feature of rotary motion to minimize wear, tear vibration, noise and to free the rotating vanes from harmful effect of centrifugal forces.

2 One of the preferred embodiments of the device as claimed in claim 1 comprising:

a. a pair of housings and each having a cavity on one of its surfaces to enclose and seal the rotatably mounted rotor;

b. each housing having a circular groove on housing inner side surface and being concentric to the axis of rotation of rotor;

c. the depth of the grooves varies in sinusoidal manner such that there being two crests means minimum depths and two valleys means maximum depths along the circle of groove means formed on housing inner surface;

d. the depth of the grooves can deviate from sinusoidal form however; there being two crests means minimum depths and two valleys means maximum depths along the circle of groove means formed on housing inner surface;

e. the radius of curvature of the groove being constant means radial to the circle of groove means on housing inner surface ;

f. radius of circle of grooves on two housings being identical and concentric with rotor means shaft axis;

g. the housings being rotationally and concentrically turned and oriented with respect to each other such that crest point of groove of one housing aligned with valley point of groove of remaining housing so that the sum total of the depths of both grooves remain same all along the circular path of grooves;

h. rotor in the form of a disc;

i. a rotor rotatably and concentrically mounted within the cavities of housings;

j. both sides of rotor in conjunction with two grooves of housings on either sides being utilized for the operation of the said engine;

k. axially means parallel to the axis of rotation;

l. jointed vane means two round vanes axially aligned on either side of the rotor joined together to each other to form pluralities of jointed vanes;

m. a pluralities of axially movable round jointed vanes located in axially aligned vane housings on both the surfaces of rotor;

n. each jointed vane moves axially and independently of other jointed vanes;

o. pluralities of vane housings equally spaced, axially aligned and formed on both surfaces of rotor;

p. jointed vane and vane housings being located on same pitch circle diameter as that of grooves of housings;

q. round vane radius being same to the radius of curvature of housing groove means perpendicular to the pitch circle diameter of housing groove;

r. the distance between the tips of the jointed vane being the same as the axial distance including the depth of the grooves means circular sides of the jointed vane fitting fully or partly and snugly in the round cavities of grooves during rotations of pluralities of jointed vanes;

s. charge cavity means volume of entrapped gases formed between two successive round jointed vanes being on same side of the rotor, portion of the groove and flat side surface of the rotor disc therein between;

t. each jointed vane axially moving twice during each rotation of rotor;

u. each vane housing on one side of rotor being aligned with similar vane housing on the other side of rotor;

v. each jointed vane located inside axially formed vane housings and moves axially and independently of other jointed vanes;

w. jointed round vanes axially moving fully or partly and snugly inside the vane housings;

x. intake port and exhaust port formed in each housing at a specific location with respect to direction of rotation of rotor.

3 other preferred embodiments of the device as claimed in claim 1 comprising:

a. a pair of housings and each having a cavity on one of its surfaces to enclose and seal the rotatably mounted rotor;

b. each housing having a circular groove on housing inner side surface and being concentric to the axis of rotation of rotor;

c. the depth of the grooves varies in sinusoidal manner such that there being two crests means minimum depths and two valleys means maximum depths along the circle of groove means formed on housing inner surface;

d. the depth of the grooves can deviate from sinusoidal form however; there being two crests means minimum depths and two valleys means maximum depths along the circle of groove means formed on housing inner surface;

e. the radius of curvature of the groove being constant means radial to the circle of groove means on housing inner surface ;

f. radius of circle of grooves on two housings being identical and concentric with rotor means shaft axis;

g. the housings being placed with respect to each other such that crest of groove of one housing aligned with crest of groove of remaining housing means the intake port and the exhaust port of both housings being aligned;

h. rotor in the form of a disc;

i. a rotor rotatably and concentrically mounted within the cavities of housings;

j. both sides of rotor in conjunction with two grooves of housings on either sides being utilized for the operation of the said engine;

k. axially means parallel to the axis of rotation;

l. axially movable round vanes located in vane housings on both the sides of rotor disc;

m. pluralities of axially aligned round vanes on either side of the rotor being supported by pluralities of spring located in the pluralities of vane housings;

n. each round vane moves axially and independently of other vanes;

o. round vanes and vane housings being located on same pitch circle diameter as that of grooves of housings;

p. round vane radius being same to the radius of curvature of housing groove means perpendicular to the pitch circle diameter of housing groove;

q. charge cavity means volume of entrapped gases formed between two successive round vanes means being on same side of the rotor, portion of the groove and flat surface of the rotor therein between;

r. each round vane axially moving twice during each rotation of rotor;

s. pluralities of vane housings equally spaced and formed on both sides of rotor disc;

t. each vane housing on one side of rotor being angularly and centrally located between two vane housings of the other side of rotor;

u. each round vane located inside axially formed vane housings and moves axially and independently of other round vanes;

v. round vanes axially moving fully or partly and snugly inside the vane housings;

w. intake port and exhaust port formed in each housing at a specific location with respect to direction of rotation of rotor.

4 The device as claimed in claim 2 and 3 wherein the formation of groove in housings being of special metal liner for higher temperature operation.

5 The device as recited in claim 2 and 3 wherein the rotor surface in contact with housing grooves being of special metal liner for higher temperature operation.

6 The device as recited in claim 2 and 3 wherein the vane be fitted with a replaceable sprung ring to minimize leakage in housing groove and easy replacement and maintenance.

7 The device as recited in claim 3 wherein the housings being turned with respect to each other at any other angular orientation.

8 The device as recited in claim 2 and 3 comprises means for utilizing the centrifugal force of rotating rotor to forcibly lubricate the vanes, vane housing, housing grooves, surfaces in relative motion of the engine comprising pluralities of lubricating oil ducts in contact with housing duct and further providing cooling of the rotor.

9 The device as recited in claim 2 and 3 comprises means for cooling the engine means air cooling, liquid media cooling.

10 The device as recited in claim 1 to 9 and as described and illustrated in preferred embodiments and ascertain the nature of this invention and the manner in which it is to be performed and revealed in diagrams of Sheet 1 of 7 comprising Figure-1A, Figure-1B, and Figure-1C; sheet 2 of 7 comprising Figure-2A, Figure-2B; sheet 3 of 7 comprising Figure-3A, Figure-3B; sheet 4 of 7 comprising Figure-4A, Figure-4B, Figure-4C, Figure-4D, Figure-4E; sheet 5 of 7 comprising Figure-5A, Figure-5B; sheet 6 of 7 comprising Figure-6A, Figure-6B; sheet 7 of 7 comprising Figure-7A, Figure-7B.

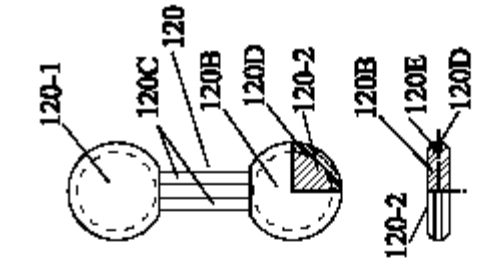

Figure-1C

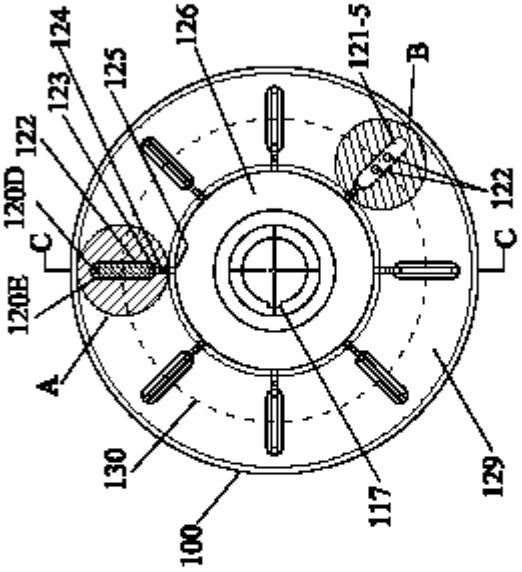

Figure-1B

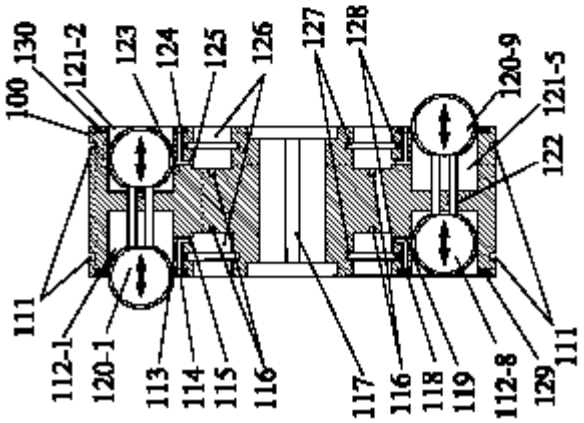

Figure-1A

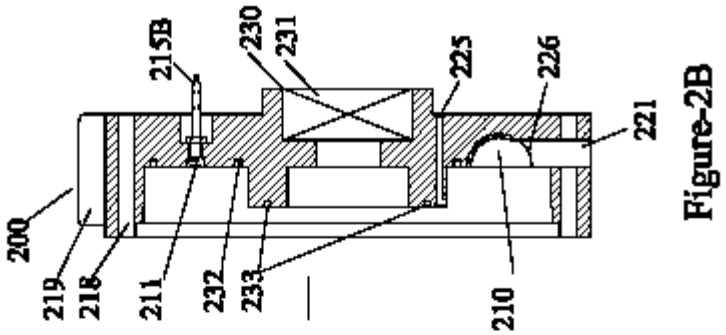

Figure-2B

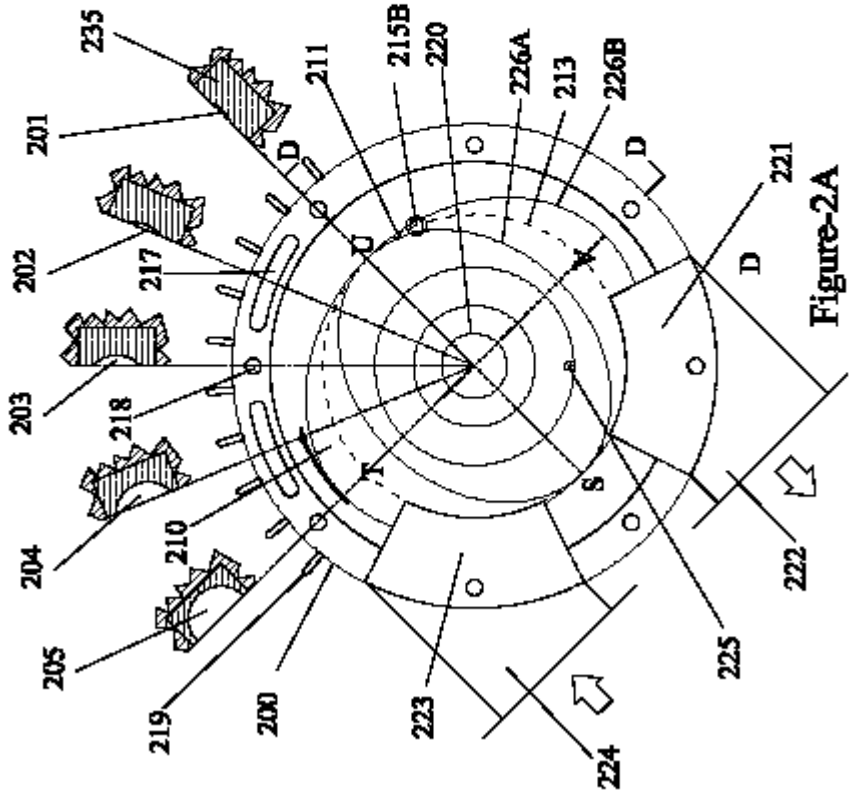

Figure-2A

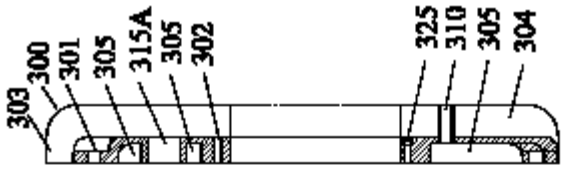

Figure-3B

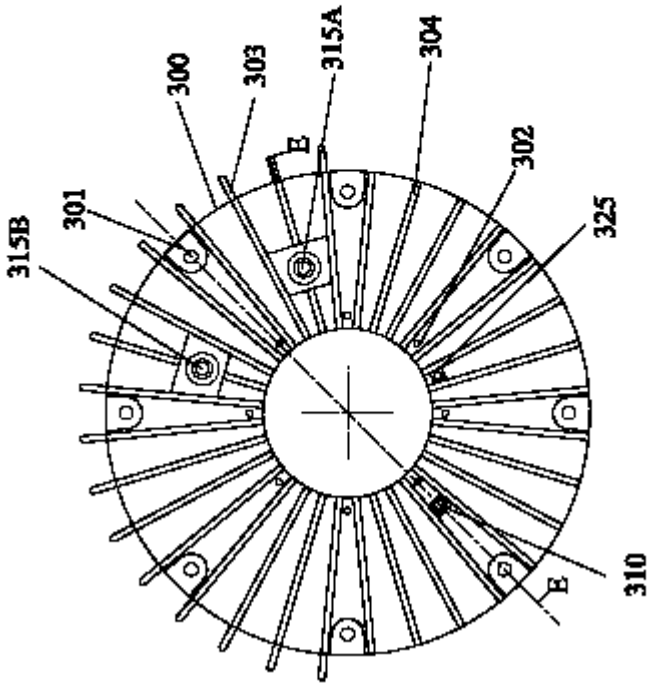

Figure-3A

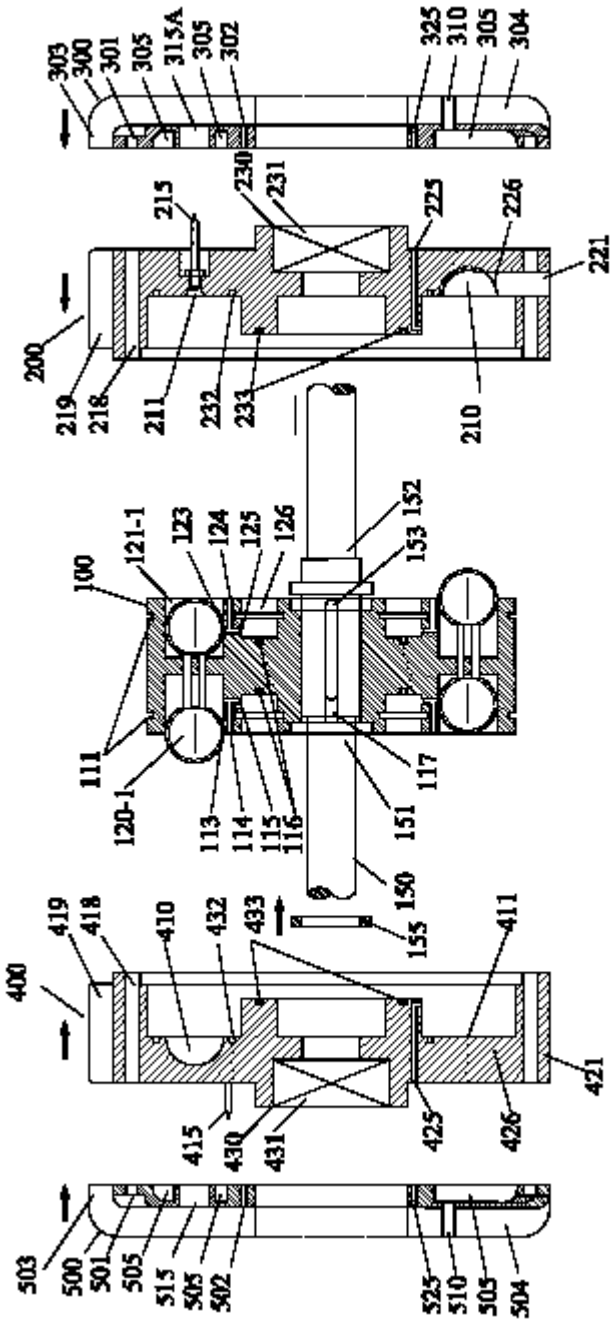

Figure-4A Figure-4B Figure-4C Figure-4D Figure-4E

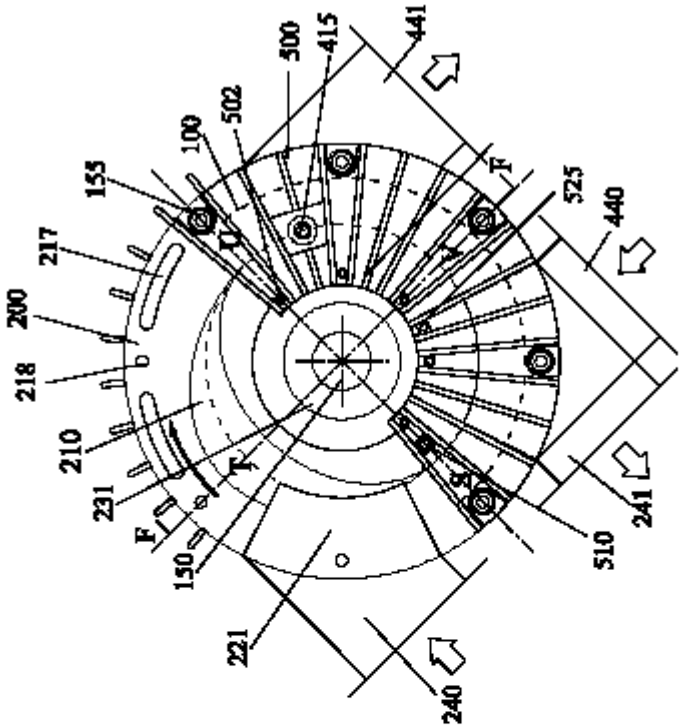

Figure-5B

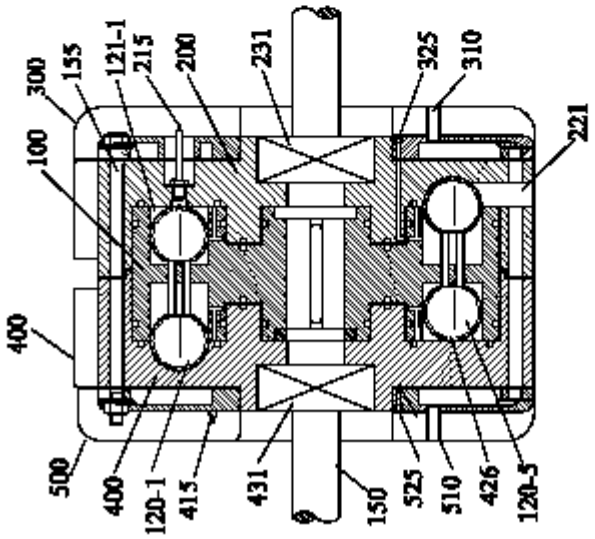

Figure-5A

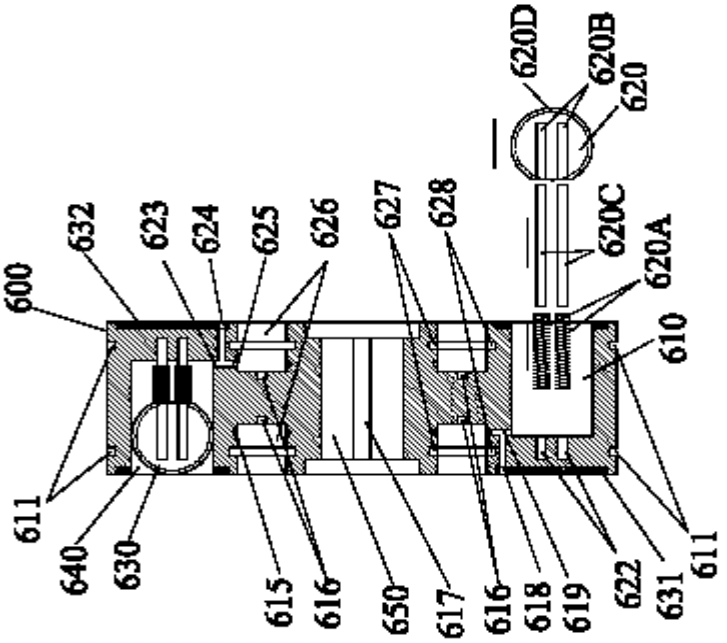

Figure-6B

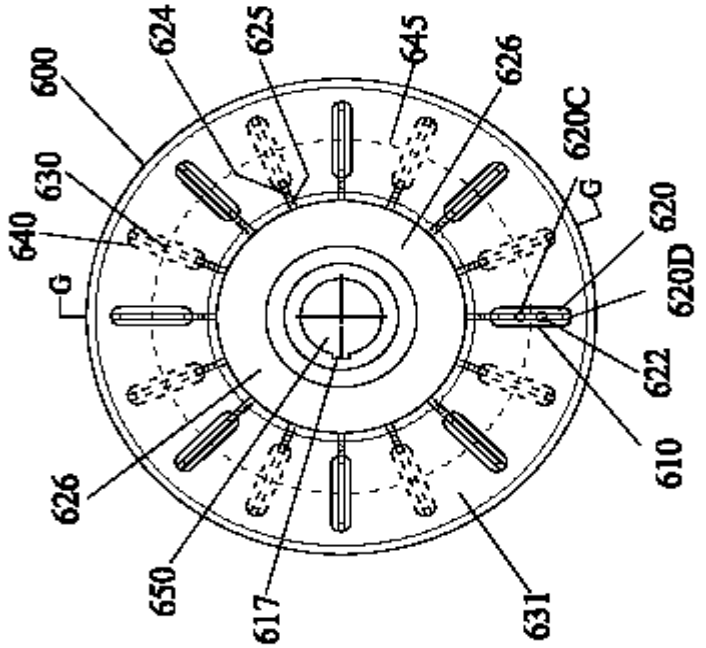

Figure-6A

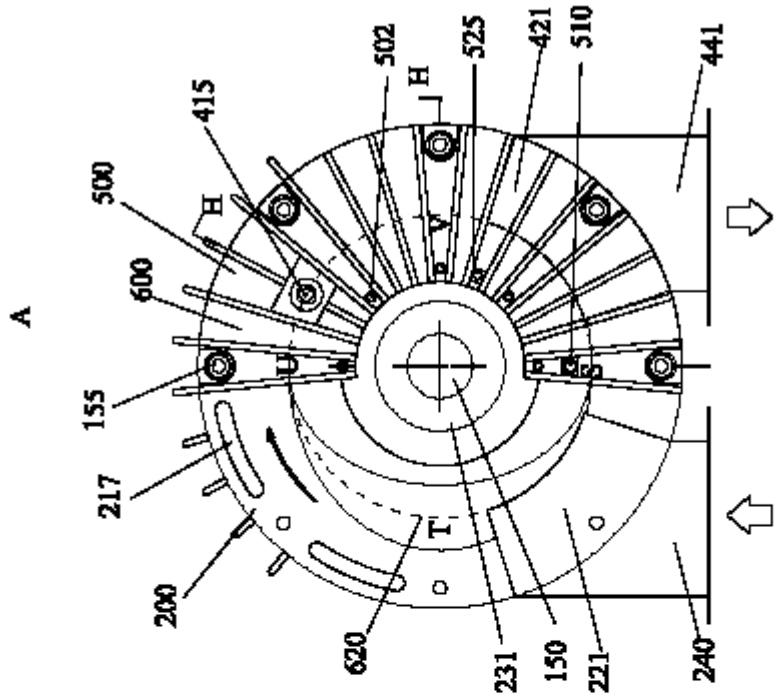

Figure-7B

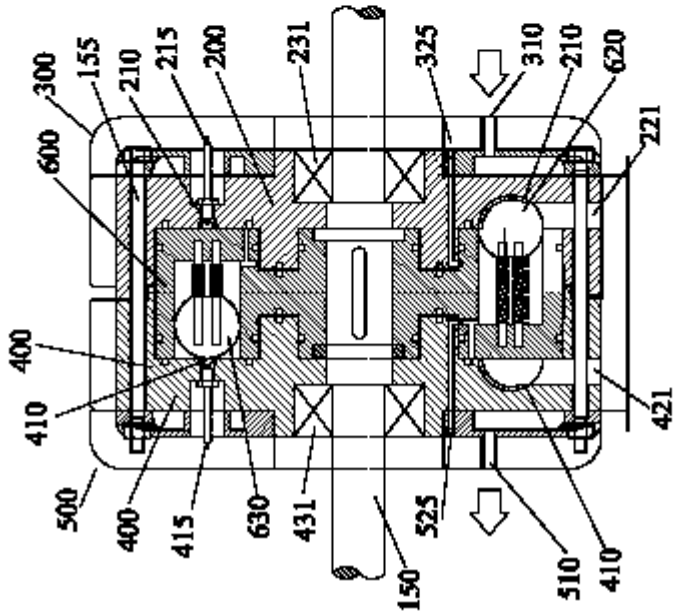

Figure-7A

ABSTRACT

The present invention comprises a novel rotor concentrically mounted on a shaft having plurality of vane housings supporting pluralities of vanes. One of the novelties of present invention is that the vanes are round in shape which prevents leakages. Other novelty of the present invention is that the vanes are located axially on either side faces of rotor disc. Since the vanes are not radial but axial thereby averting the effect of centrifugal force on the pluralities of vanes to prevent excessive rubbing during the rotation of the rotor and vanes. Another novelty of the present invention is that the round means circular vane has a groove on its circular face and fitted with a replaceable circular sprung ring means sealing ring for easy maintenance. The vane is retained in a snugly fitting vane housing provided on the flat surface of the rotor such that the vane moves in and out parallel to the axis of rotation of shaft means axially on which rotor is mounted. The vane is further guided for axial movement by pins or support. The rotor is enclosed in two concentric enclosures means housings. The two housings are generally similar to each other and having a circular groove. Another novelty of the present invention is that the depth of groove varies in a sinusoidal manner and is formed on the inner flat surfaces of enclosures wherein the pitch center diameter (PCD) of the groove is equal to the PCD of vanes and further the radius of curvature of groove is equal to the radius of vane thereby when the rotor rotates with pluralities of vanes, the vanes or part thereof fit snugly in the groove during each of its rotation means the grooves provide guiding path to the vanes. The housing circular groove depth is made in sinusoidal form in such a way that its goes on increasing through first 90^0 means quarter rotation, thereafter the depth goes on decreasing for next 90^0 of rotation and then the depth goes on increasing for next 90^0 and for remaining 90^0 it goes on decreasing and in this manner the depth profile is formed in a circular path thereby dividing the groove in four quadrants. A charge cavity is formed between two successive vanes, groove and rotor surface so the volume entrapped in such cavity varies in accordance with depth of the groove such one quadrant when depth goes on increasing the entrapped volume goes on increasing causing suction phase where inlet port is provide for the suction of gases, during second quadrant when depth goes on decreasing the entrapped volume goes on decreasing causing compression phase, in the beginning of third quadrant the entrapped gases are ignited and so also the depth goes on increasing causing power phase, and during fourth quadrant the depth goes on decreasing causing compression means exhaust phase to expel burnt gases where exhaust port is provided and in this manner the thermodynamic cycle is completed in

each single rotation of rotor. In one of the embodiments of the present invention two adjoining vane placed axially on either side of rotor are joined together to form a jointed vane. The novelty of the present invention is that grooves of housings are circularly oriented in such a manner that the sum of the axial depth of the grooves on either side of rotor remains constant at any given angle and is always equal to the length of the jointed vane therefore the jointed vane fits snugly in both the grooves on either side of the rotor however, the varying depth of the stator circular profile on each side makes the jointed vane move axially in and out in the vane housings and groove in simple harmonic motion. Another novelty of present invention is that in other embodiment the housings grooves are placed normally where independent pluralities of vanes on each sides of the rotor move axially in and out of the pluralities of vane housing and grooves of respective housing against the force of compression spring. Though the present description of the invention only eight vanes are shown the invention works with other combination of number of vanes. The cooling of the engine is provided by water chamber close to the stator sides which circulates through cavities provided on the stator peripheries and further cooling fins are provided on the cooling chamber and stator peripheries. The oil lubrication of rotor fins and housings is provided by self sustaining centrifugal action of rotor thus generally dispensing with a separate lubricating pump.

Further invention is described in detail with the help of Sheet 1 of 7 illustrate cross-sectional view of rotor elevation with the help of Figure-1A, Figure-1B, Figure-1C

Sheet 2 of 7 illustrates the elevation of one of the housings with the help of Figure-2A and Figure-2B. Sheet 3 of 7 comprises Figure-3A and Figure-3B showing elevation and cross-section of side elevation of one of the liquid and air cooling end-shields respectively. Sheet 4 of 7 illustrates in Figure-4A, Figure-4B, Figure-4C, Figure-4D, and Figure-4E showing the exploded cross-sectional view of the various sub-assemblies of left cooling end-shield, left housing with groove, centrally and concentrically mounted rotor. Sheet 5 of 7 illustrates Figure-5A the cross-section of one of the embodiments of the assembled rotary multiple axial round-vane internal combustion engine Figure-5B illustrates partial cross-section of the assembled engine. Sheet 6 of 7 illustrates other embodiment of rotor with the help of Figure-6A and Figure-6B. Sheet 7 of 7 illustrates Figure-7A the cross-section of one of the other embodiments of the assembled rotary multiple axial round-vane internal combustion engine and Figure-5B illustrates partial cross-section of the assembled engine showing housings relative orientation, groove profile, inlet port and exhaust port.

FORM 3

THE PATENT ACT 1970
(39 OF 1970)
AND
The patent rules, 2003
STATEMENT AND UNDERTAKING UNDER SECTION 8
(See section 8; rule 12)

We

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Ingole Ashutosh Vijay	Indian	104 Ganediwal layout,camp,Amravati-444602
Ingole Paritosh Vijay	Indian	104 Ganediwal layout,camp,Amravati-444602

Hereby declare:-
(i) That we have not made any this application for the same /substantially the same invention outside India.

Dated this 15th day August 2010

Signature

Ingole Vijay Tulshiram

To
The controller of patents,
The patent office,
At Mumbai

FORM 26

THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003

FORM OF AUTHORISATION OF A PATENT AGENT/ OR ANY PERSON IN A MATTER OR PROCEEDING UNDER THE ACT

[Section 127 and 132 and Rule 135]

We,

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Ingole Ashutosh Vijay	Indian	104 Ganediwal layout,camp,Amravati-444602
Ingole Paritosh Vijay	Indian	104 Ganediwal layout,camp,Amravati-444602

hereby authorize Swapnil J Gawande, Advocate and Patent Agent No. IN/PA 1587.of R-9 Harshnil,Eknath puram, nr yogakshem colony Amravati-444607,India to act on my behalf in connection with our patents, assignments, oppositions, rectifications, renewals and request that all notices, requisition and communication relating thereto may be sent to such person unless otherwise specified.

I hereby revoke all previous authorization, if any made, in respect of same matter or proceeding.

I hereby assent to the action already taken by the said person in the above matter.

Dated this 15th day August 2010

Name: Ingole Vijay Tulshiram

Ingole Ashutosh Vijay

Ingole Paritosh Vijay

To,
The Controller of Patents
The Patent Office
At Mumbai