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

APPLICATION FOR PATENT ALONG WITH COMPLETE SPECIFICATION

APPLICANT(S)

Name	Nationality	Address
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Documents attached with the application:-

	Number of Pages
Form 1	3
Form 2	30
Form 3	1
Form 26	1
TOTAL	35 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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Ingole Vijay Tulshiram	Indian	104 Ganediwal layout, camp, Amravati-444602
Ingole Ashutosh Vijay	Indian	104 Ganediwal layout, camp, Amravati-444602
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Name	Nationality	Address
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Ingole Ashutosh Vijay	Indian	104 Ganediwal layout, camp, Amravati-444602
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2. TITLE OF INVENTION

Rotary 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 4th day August 2011

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 4th day August 2011

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 Internal Combustion Engine

2 APPLICANTS(S)

Name	Nationality	Address
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 rotary high speed internal combustion engine.

Prior art:

Heat engines have been utilized to convert heat energy into mechanical energy. There are basically two types of rotary IC engines namely Wankel engine and vane type engines whereas Wankel engine has no independent vanes and 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. 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. 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 may not be complete, consumes more oil and emission is polluted. Another type of engine is rotary vane engine there are independent radial vanes and such conventional rotary IC engine comprises an eccentric rotor rotating in a circular or elliptical housing. The periphery of the rotor is generally divided by radially extensible and retractable vane of which number and 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 inner housing therein between. As the charge cavity rotates around the inside stator housing and such 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 or other composite mechanisms 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. The rotary vane engine overcomes the basic disadvantage of reciprocating IC engine by combining all basic phases during its rotary operation. In rotary IC engine volume entrapped in the vanes and rotor periphery 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 to be 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 cycle 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. Since it is a rotary motion such engine produce less vibrations. Further it does not require valves and valve operating mechanism, cam shaft and associated gears.

Problems to be solved:

It would be therefore to have such an IC engine which is not reciprocating, free from vibrations and noise, where rotor does not oscillate and has a solid rotating centre means shaft, which is easy to lubricate and can have 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 forces and does not require vane guiding mechanism, and provides simple harmonic motion of the vanes, where the vane moves parallel to the shaft to minimizing sliding pressure due to centrifugal force on the fixed cavity and further having retaining mechanism attached to the opposite vanes to cancel centrifugal forces and further providing higher expansion ratio than compression ratio of the burning fuel to improve thermal efficiency of the engine and which is easy to manufacture requiring less components. A novel vane high speed efficient IC engine with rotary plural axial vane with sinusoidally varying stator profile means cavity in stationery part is proposed which is free from disadvantages of existing rotary IC engines and known reciprocating IC engines.

These and other advantages will be more readily understood by referring to the following detailed description for a novel rotary IC engine having plurality of united axial vanes 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. Further objective of the present invention is to provide an internal combustion engine that is free of engine unbalance and stresses incurred in reciprocating IC engine.
3. 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 on contact surfaces during high speed operation by a novel mechanism comprising plurality of united vanes to nullify centrifugal forces acting there upon and further minimizing excessive friction, rubbing, warping or bending of vanes as observed in present rotary IC engine.
4. 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 in simple harmonic motion which is scientifically most desirable and further the volume displacement in charge cavity preferably varying sinusoidally,
5. Another unique feature of the present invention is to provide a double acting plurality of fix length sliding vanes by novel axially oriented housings having sinusoidal profile means cavity means groove such that the axial distance between two points on the radius of such grooves always remains constant such that fixed length plurality of vanes always remain snugly in contact with grooves on either sides of the plurality of vanes so that the need of vane retention guiding arrangement is dispensed with.
6. Another unique feature of the present invention is to provide plurality of vanes forming multiple of charge cavities thus providing multiple thermodynamic cycles per rotation thus increasing the power of the said engine many fold thus increasing the power to weight ratio many fold than the conventional IC engine.

7. Another unique feature of the present invention is to provide such double acting vanes to operate in both the housings thereby doubling the output of the said engine.

8. 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.

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 objectives of the present invention is also to provide groove in the housings on either sides of the rotating part and each providing power thereby balancing axial combustion forces or pressure thereby minimizing stresses unlike other rotary 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 ignition system means SI engine as well as for fuel like diesel means compression ignition means CI and systems having direct fuel injection.

12. Still another feature of the present invention is to have mechanical arrangement which are easy to lubricate and further provides simple arrangement for cooling and simple lubricating system having inbuilt lubricating pump without change in the basic construction of the engine.

13. Yet another object of the present invention is to provide a rotary IC engine which is suitable for all types of fuels and which has high power to weight ratio, reliable, efficient, low in maintenance, requiring 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 internal combustion engine comprising plurality of axially oscillating vanes with two stationery end-shield or housings or stationary housings and each comprising a novel axially oriented circular groove on

certain radius with sinusoidal profile means depth of each novel circular profile of the groove varies sinusoidally, on their inner sides facing the rotary vane member means within the said housings encloses means sealed the rotatably mounted rotor means having axially movable plurality of united vane mounted in rotor vane hosing. Another novelty is that where one preferred embodiment the said axially oriented groove provided on each said housing on same radius has two diametrically located axial crests means bulges and two diametrically located troughs means furrows located between the said crests being part of the said sinusoidal axial profile means groove engraved on each stationary housing and further the said crests of one housing are rotably oriented with the said troughs of remaining housing so that the sum of the axial depths of said grooves at any point on said radius remains constant around its circular path on said radius and further axial length of the said rotor being constant means the axial distance of gap between the said grooves also remains constant and the length of the vane the plurality of vanes is made equal to the said length of said gap so that the said plurality of vane fits snugly in both the grooves on either side of the rotor though the depth of the said circular profiles vary along the circular path on the said radius and further during the rotation of said rotor the associated plurality of vane move axially being guided by the said grooves and in doing so move axially in and out in the said vane housings and said grooves in simple harmonic motion. In order to have higher expansion ratio than compression ratio the sinusoidal groove on the housing comprises two distinct sinusoidal grooves equally spaced around the radius having different depths so as to provide different volumes wherein lesser volume segment of the said profile is used for compression phase and higher volume segment of the said profile for expansion phase. 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 and for cooling of the engine if so needed. The housings and their outer sides may be provided with engine cooling system and air cooling fins. The rotor is fixed on a shaft mounted on bearings for free journaling in the bearing housing provided on each housing.

During the operation means rotation of the said novel embodiment, 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 whereas the depth of said grooves varies in a sinusoidal manner means it goes on increasing through first quarter of rotation means the charge cavity means the volume goes on increasing means creating a suction

phase thereby air or fuel charge or air, depending upon SI or CI system, is sucked in through suction port, then during second quarter of rotation the said depth goes on decreasing means the said volume goes on decreasing means creating a compression phase, then during the third quarter of rotation the said depth goes on increasing means the volume goes on increasing means an expansion phase however; at the end of said compression phase and beginning of the said expansion phase the said compressed fuel charge is ignited by spark ignition or air and directly injected atomized fuel being introduced by fuel injector (depending upon SI or CI system, gets ignited by compression ignition) and expands in the expansion phase known as power phase and lastly during remaining quarter of rotation means fourth quarter the said volume goes on decreasing known as exhaust phase where burnt gas mixture is pressurized and 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 further the said charge cavity is formed between two successive pair of vanes means the said thermodynamic cycles means said power phase repeats for each single vane on one side of the rotor means the said stator side there are plurality of power phase thus utilizing each stator groove for multiple power phases and there being two such stator grooves on either side of rotor and the plurality of vane being double acting similar action occurs on the remaining sides of vanes means on other housing means the said process occurs twice thus further doubling the output of the said embodiment thereby enhancing the output many fold and drastically decreasing the power to weight ratio of the said novel embodiment and other novelty of the invention is that the depth though varies sinusoidally but has different depth for each half of circular periphery of the so that expansion ratio can be higher than said compression ratio thereby enhancing the thermal efficiency of the said embodiment which is not possible in conventional IC engines.

These and other features and advantages will be more readily understood by referring to the following detailed illustrations for a novel rotary 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 1/11 illustrate views of one of the housings with embedded ring having sinusoidal profile, inlet port, outlet port and opening for spark or fuel inlet system in Figure-1 and Figure-2

Sheet 2/11 illustrates the views of remaining housing with differently oriented ring having sinusoidal profile inlet port, outlet port and opening for spark or fuel inlet system in Figure-3 and Figure-4.

Sheet 3/11 illustrates the views of the rotating member having a provision for mounting the plurality of vane assembly with supporting shaft in Figure-5 and Figure-6.

Sheet 4/11 illustrates the views of the plurality of vane comprising front elevation, side elevation and top view in Figure-7, Figure-8 and Figure-9 respectively.

Sheet 5/11 illustrates the views of the first vane assembly comprising two diagonally opposite vanes with central hub in Figure-10and Figure-11.

Sheet 6/11 illustrates the views of the second vane assembly comprising two diagonally opposite vanes with central hub in Figure-12 and Figure-13.

Sheet 7/10 illustrates the views of the third vane assembly comprising two diagonally opposite vanes with central hub in Figure-14 and Figure-15.

Sheet 8/10 illustrates the views of the remaining vane assembly comprising two diagonally opposite vanes with central hub in Figure-16 and Figure-17.

Sheet 9/10 illustrates the views of plurality of vanes and their assemblies highlighting principally the different diameters of the central hubs and their relative orientations of the present embodiment in Figure-18and Figure-19.

Sheet 10/11 illustrates the views of the entire vane assembly inside the cavity of rotating member means rotor in Figure-20 and Figure-21.

Sheet 11/11 illustrates the view of the assembly of the embodiments of the present invention in Figure-22 and Figure-23.

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 1/11 comprises views of cross-section of front elevation in Figure-1 and side elevation in Figure-2 of one of the housings, hereinafter referred to as first housing, of one of the preferred embodiments of rotary internal combustion engine. The first housing 100 is cylindrical in shape and having certain cross section 101 and arrangement for mounting and fixing other parts. It has a centre 105 and cavity 102 for mounting bearing and shaft. It has a cavity 103 to accommodate rotably mounted rotating member. For reference sake reference direction of rotation of shaft is shown by arrow 111. On a mean diameter 115 a cylindrical ring 104 is mounted in a cylindrical groove having internal radius 116 and outer radius 117. The ring is having sinusoidal profile surface106 carved parallel to the central axis 105 such that it has a crest 107, trough 108, a crest 109, and trough 110 means sinusoidal profile having two continuous full wave surfaces 106 are formed along the mean diameter 115. The axial cylindrical walls of groove 116 and sinusoidally varying profile means surface 106 of ring 108 forms a rectangular section whose axial depth varies sinusoidally twice along the mean diameter 115 means in the direction of rotation 111 at 107 the depth is zero means area is zero and further increases to maximum depth at 108 means area is maximum and depth further decreases to zero at 109 means said area decreases to zero and further increases up to 110 as the depth increases to maximum means said area becomes maximum and the said area further decreases up to 107 means the said variation happens four times in one rotation. The said depths at 108 and 110 are preferably identical however it can be different depending upon the application means said cross section means area at 108 different than the said area at 110. With respect to direction of rotation 111 inlet port means suction opening 112, outlet port means exhaust 113 and opening 114 for spark ignition or fuel inlet means fuel injector are provided on the mean diameter 115 in the front housing section 101 and ring 104.

Sheet 2/11 comprises views of cross-section of front elevation in Figure-4 and side elevation in Figure-3 of the remaining housing, hereinafter referred to as second housing, of one of the preferred embodiments of rotary internal combustion engine. The second housing 200 is cylindrical in shape and having certain cross section 201 and arrangement for mounting and fixing other parts (not shown). It has a centre 105 and cavity 202 for mounting bearing and shaft (not shown). It has a cavity 203 to accommodate rotably mounted rotating member (not shown). For reference sake reference direction of rotation of shaft is shown by arrow 111. On a mean diameter 115 a cylindrical ring 204 which is identical to ring 104 is mounted in a cylindrical groove having internal radius 216 which is same as radius 116 and outer radius 217

which is same as radius 117. The ring is having sinusoidal profile surface 206 carved parallel to the central axis 105 such that it has a crest 208, through 209, a crest 210, trough 207 means sinusoidal profile having two continuous full wave surfaces 206 are formed along the mean diameter 115. The axial cylindrical walls of groove 116 and sinusoidally varying profile means surface 206 of ring 208 208 and sides of groove 216 forms a rectangular section whose axial depth varies sinusoidally twice along the mean diameter 115 means in the direction of rotation 111 at 208 the depth is zero means area is zero and further increases to maximum depth at 209 means area is maximum and depth further decreases to zero at 210 means said area decreases to zero and further increases up to 207 as the depth increases to maximum means said area becomes maximum and the said area further decreases up to 208 means the said variation happens four times in one rotation. The said depths at 109 and 107 are preferably identical however it can be different depending upon the application means said cross section means area at 108 different than the said area at 110. With respect to direction of rotation 111 inlet port means suction opening 112, outlet port means exhaust 113 and opening 114 for spark ignition or fuel inlet means injector are provided in the front housing section 101 and ring 104. The ring 204 and ring 104 (Figure-1) similarly the sinusoidal profile 206 of ring 204 is identical to sinusoidal profile 106 of ring 104 (Figure-1). The said first housing 100 (Figure-1) and said second housing 200 are mounted and fixed such that the crest 210 of ring 204 is axially aligned to trough 110 of ring 104 (Figure-1). Such alignment ensures that the axial distance between the profile surface 206 and 106 (Figure-1) always remains constant around mean diameter 115. With respect to direction of rotation 111 inlet port means suction opening 212, outlet port means exhaust 213 and opening 214 for spark ignition or fuel inlet or fuel injector are provided on the mean diameter 115 in the second housing section 201 and ring 204.

Sheet 3/11 comprises views of cross-section of front elevation in Figure-5 and end elevation Figure-6 of the rotating member 300, hereinafter referred to as rotor. The rotor 300 is cylindrical in shape and having certain length and cross section 311 and further a cylindrical cavity 313 for mounting of plurality of vane assemblies (not shown). It has a centre 105 and opening 310 for mounting shaft 315. Plurality of axial through holes 301, 302, 303, 304, 305, 306, 307 and 308 being identical and equally spaced on mean diameter 115 for mounting plurality of sliding vanes (not shown). The internal radius of curvature of each hole 301 is 316 which is same as 116 and outer radius curvature 317 which is same as 117. The plurality of vane 10 are slidably mounted in plurality of hole 301 means cross section dimensions of each

hole 301 is same as vane 10 (Figure-8). The said rotor is rotably mounted in the cavities 103, 203 of housings 100 and 200 respectively.

Sheet 4/11 comprises front elevation in Figure-7, side elevation in Figure-8 and top view in figure-9 of plurality of vane 10 hereinafter referred to vane. The vane has a length 18. Each end has symmetrical taper faces 12 at an angle 11so as to avoid any fouling with the said sinusoidal profile 106, 206 during the rotation. Each end of the vane has edge 15 and 14 to be touch with the said sinusoidal profile 106, 206 respectively. Each vane has internal curvature 16 identical to said radius 116, 216, 316 and outer radius of curvature 17 identical to said radius 117, 217, 317 (Figure-2, Figure-3, Figure-5). Vane 10 is slidably mounted in hole 301(Figure-5) as vane cross section (Figure-8) being same.

Sheet 5/11 comprises views of cross-sections of the subassembly of one of the plurality of vanes hereinafter referred to as first united vane 400 as shown in Figure-10 as front elevation and Figure-11 shown as end elevation of the said first vane assembly 400 and comprising plurality of said vane 10 placed at two diametrically opposite locations 401 and 405 on mean diameter 115 by radial supporting members 407, 408 and the said radial members are further fixed to cylindrical member 406 having internal diameter 414 and external diameter 415 thus forming a united vanes. The said united vane being slidably mounted in said diametrically opposite holes 301, 305 of rotor 300 and further slidably mounted on shaft 315 as the internal diameter 414 of the said cylinder 406 is higher than the outside diameter 316 of shaft 315 (Figure-6). The said cylinder has suitable length for the said axial movement in the cavity 313 of said rotor 300 (Figure-6).

Sheet 6/11 comprises views of cross-sections of the subassembly of one of the plurality of vanes hereinafter referred to as second united vane 500 as shown in Figure-12 as front elevation and Figure-13 shown as end elevation of the said first united vane 500 and comprising plurality of said vane 10 placed at two diametrically opposite locations 501 and 505 on mean diameter 115 by radial supporting members 507, 508 and the said radial members are further fixed to cylindrical member 506 having internal diameter 514 and external diameter 515. The said vane assembly being slidably mounted in said diametrically opposite holes 302, 306 of rotor 300 and further slidably mounted on said cylinder 406 as the internal diameter 514 of the said cylinder 506 is higher than the outside diameter 415 (Figure-11). The said cylinder has suitable length for the said axial movement in the cavity 313 of said rotor 300 (Figure-6). The said cylinder is further provided with diametrically opposite axial

slots 504 and 512 of suitable length for the free slidable passage of supporting members 407, 408 of first united vane 400 for its free sliding movement.

Sheet 7/11 comprises views of cross-sections of the subassembly of one of the plurality of vanes hereinafter referred to as third united vane 600 as shown in Figure-14 as front elevation and Figure-15 shown as end elevation of the said third united vane 600 and comprising plurality of said vane 10 placed at two diametrically opposite locations 601 and 605 on mean diameter 115 by radial supporting members 607, 608 and the said radial members are further fixed to cylindrical member 606 having internal diameter 614 and external diameter 615. The said united vane being slidably mounted in said diametrically opposite holes 303, 307 of rotor 300 and further slidably mounted on said cylinder 506 as the internal diameter 614 of the said cylinder 606 is higher than the outside diameter 515 (Figure-13). The said cylinder has suitable length for the said axial movement in the cavity 313 of said rotor 300 (Figure-6). The said cylinder is further provided with diametrically opposite axial slots 604 and 612 of suitable length for the free slidable passage of supporting members 407, 408 of said first united vane 400 for its free sliding movement and further provided with diametrically opposite axial slots 603 and 611 of suitable length for the free slidable passage of supporting members 507, 508 of said second united vane 500 for its free sliding movement.

Sheet 8/11 comprises views of cross-sections of the subassembly of one of the plurality of vanes hereinafter referred to as fourth united vane 700 as shown in Figure-16 as front elevation and Figure-17 shown as end elevation of the said fourth united vane 700 and comprising plurality of said vane 10 placed at two diametrically opposite locations 701 and 705 on mean diameter 115 by radial supporting members 707, 708 and the said radial members are further fixed to cylindrical member 706 having internal diameter 714 and external diameter 715. The said vane assembly being slidably mounted in said diametrically opposite holes 304, 308 of rotor 300 and further slidably mounted on said cylinder 606 as the internal diameter 714 of the said cylinder 706 is higher than the outside diameter 615 (Figure-13). The said cylinder has suitable length for the said axial movement in the cavity 313 of said rotor 300 (Figure-6). The said cylinder is further provided with diametrically opposite axial slots 704 and 712 of suitable length for the free slidable passage of supporting members 407, 408 of said first united vane 400 for its free sliding movement and further provided with diametrically opposite axial slots 703 and 711 of suitable length for the free slidable passage of supporting members 507, 508 of said second united vane 500 for its free sliding movement and still further provided with diametrically opposite axial slots 702 and 710 of suitable length for the free slidable

passage of supporting members 607, 608 of said third united vane 500 for its free sliding movement.

Sheet 9/11 comprises views of cross-sections of the assembly 900 comprising united vane 400, 500, 600 and 700 as shown in Figure-18 as front elevation and Figure-19 shown as end elevation illustrating a typical axial location and angular positions of united vanes 400, 500, 600 and 700 with their respective to the centre 105 and mean diameter 115 slidably mounted on the shaft 315 in the opening 116. It further shows the placement of cylindrical element 406 of the said first united vame 400 immediately over the shaft 315 with the said supporting members 406 and 407 passing through the said axial slots 506 and 512 of united vane 500, said axial slot 604 and 612 of united vane 600, said axial slots 704 and 712 of united vane 700 for its free axial motion 115 and further cylindrical element 506 of the said second united vane 500 is slidably mounted over the said cylindrical element 406 of said united vane 400 with the said supporting members 506 and 507 passing through the said axial slots 605 and 611 of united vane 600 and further passing through the said axial slot 703 and 711 of united vane 700 for its free axial motion 115 and still further cylindrical element 606 of the said third united vane 600 is slidably mounted over the said cylindrical element 506 of said united vane 500 with the said supporting members 606 and 607 passing through the said axial slots 702 and 710 of united vane 700 for its free axial motion 115 and still further cylindrical element 706 of the said third united vane 700 is slidably mounted over the said cylindrical element 606 of said united vane 600 for its free axial motion 115. As shown in Figure-19 the assembly 900 comprising united vanes 400. 500, 600 and 700 are placed on mean diameter 115 and angularly placed and the angle between successive vanes bring equal and matching with the said through holes 301, 302, 303, 304, 305 306, 307 and 306 of said rotor 300 (Figure-5, Figure-6). While the assembly 900 rotates about centre 115 the axial positions of vanes of various said subassemblies depend on their respective angular positions and the said sinusoidal profile depth of 116 and 216 of said ring 104 and said ring 204 (Figure-1, Figure-2) respectively and axial position of each united vanes varies continuously during the rotation, relatively but independently during the rotation. When the assembly 900 is subjected to rotation in direction 111 (ref. only) the comprised united vanes 400, 500, 600 and 700 having the said respective rotating members 405, 406, 505, 506, 605, 606, 705, 706 and said vanes 401, 405, 501, 505, 601, 605, 701 and 705 are subjected to centrifugal force in radial outward directions however, since the said pair of vanes 401 and 405, 501 and 505, 601 and 605, 701 and 705 respectively together are placed diametrically opposite and attached to the cylinder by respective said supporting members the

opposing centrifugal forces are balanced and nullified and do not exert any outward force between on the said united vanes and said plurality of hole (Figure-5) while in sliding motion.

Sheet 10/11 comprises views of cross-sections of the assembly 900 and 300 as shown in Figure-20 as front elevation and Figure-21 shown as end elevation illustrating. a typical mounting of assembly 900 inside the space 113 of rotor 300 fitted on shaft 305 with centre 105 (Figure-6). It further shows typically one of the slidably mounted vane 401 from united vane 400 in rotor hole 301 while remaining other united vanes occupy remaining said holes in their respective positions being on same mean diameter 115. The projections 401, 701 of respective united vanes on either sides of the said rotor 300 are typically depicted while remaining said vanes follow suit as explained earlier.

Sheet 11/11 comprises views of cross-sections of the assembly 100, 200, 300 and 900 as shown in Figure-22 as front elevation and Figure-23 shown as end elevation of the embodiments of the present invention illustrating the mounting of housing 100 and housing 200 on either sides of the assembly of rotor 300 embodying vane assembly 900 (only vane assembly 700 is shown and remaining vane assemblies 400, 500 and 600 are removed for illustration purpose only for the sake of clarity) and all being centered on centre 105. It shows the shaft 315 fitted to rotor 300 and supported on bearing (not shown) in the space 316, 317 provided in said housings 100 and 200. It further shows the rings 104 and 204 having sinusoidal profile wherein their crest 106 is axially aligned to the trough 206 in the respective housings. Rotor 300 rotably mounted in the said cavity 103, 203 of housings 100, 200. Said vane length 18 is equal to the distance means gap between trough of said sinusoidal surface 106 of said ring 104 and said crest of sinusoidal surface 206 of said ring 204 which further shows that the edge 15 of said vane 701 touching the said surface 106 and edge 14 of same vane 701 simultaneously touching surface 206 thus forming a sealed compartment means cavity and when the said vane assembly rotates the axial depth of the said surface 106 increases and axial depth of said surface 206 increases such that the length of the said distance means gap remains constant means the said sealed cavity angularly shifts while the said vane 701 moves axially 115 in the said rotor holes 301 and similar sealed charge cavities are formed between the said ends of diametrically opposite vane 705 and when a vane assembly 700 with successive vane assembly (say 600) rotates on said surface 106 (say on 100) from said crest 107 towards trough 108 the volume of cavity thus formed increases thus creating a vacuum and gas enters in the said cavity from suction port 112 means suction cycle and the said suction process continues till the vane 701 reaches near the

said trough 108 means during said first quarter rotation and further quarter of rotation starts from trough 108 towards crest 109 the volume of the cavity decreases thus creating a compression of the sucked gases means charge means the said compression cycle to continue up to crest 109 means during second quarter of rotation for the commencement of power cycle and further rotation from crest 109 towards trough 110 volume of the cavity starts increasing where a provision is made to place either spark ignition or fuel injector at 114 for the ignition the air-gas mixture means a power stroke means power cycle means the increase in volume of cavity thus provided is utilized for the expansion of burning gas mixture means power stroke means in third quarter of rotation, and further quarter of rotation starts from trough 110 towards crest 107 the volume of the cavity decreases thus creating a compression of the burnt gases means expelled through the exhaust port 113 means exhaust cycle which continue up to crest 107 means during fourth quarter of rotation means in one complete rotation of the said rotor 300 and vane assembly 900 mounted therein. It is further noted from the geometry of the grooves the thermodynamic cycle on either side of the rotor is shifted by quarter cycle with respect to the said housings. The surfaces 106, 206 therein of the rings 104, 204 being on either side of vane and there being such 400, 500, 600 and 700 means four united vane means eight vanes means eight cavities are formed between the said vanes and said surface on one side means sixteen sealed cavities are formed on both sides means in one rotation of the rotor 300 means vane assembly 900 goes through sixteen thermodynamic cycles. Suction ports 114 (not shown), 214, exhaust port 113 (not shown), 213, opening 114 (not shown), 214 for spark ignition or fuel injection are depicted relative to the direction of rotation 111 and further the maximum volume of the cavity between successive vanes is same since the depth of the said profile at both troughs is same however, if the depth of the profile at 110 is more than 108 then the volume in the said power stroke becomes more than the said compression stroke means the burnt gases burn in a larger volume means the expansion ratio becomes higher than the compression ratio means the temperature of burnt gases becomes less means the thermal efficiency of the thermodynamic cycle increases as compared to conventional engines. Further for completion of one thermodynamic cycle means four stroke cycle the vanes have to encounter trough and crest twice as per the pattern of the said profile though explained earlier however; if the number of such profiles are in multiple on the said housings (not shown) the said cycle will repeat that many times during one rotation of the said rotor assembly means power output of the said embodiment will further multiply by same order. Further the curved surface of the rotor is rotably mounted in the said housings which can be utilized to accommodate a

centrifugal pump (not shown) for the lubrication and cooling purpose of the said embodiment.

There have thus been described certain preferred embodiments of rotary 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 housing all such modifications.

CLAIMS

We claim:-

1 A rotary internal combustion engine comprising plurality of rotating vanes means united vane sliding and axially oscillating on a fixed members means housings having a periodically varying surface profile thus forming multiple cavities for multiple thermodynamic cycles during single rotation where the vane having different shapes and geometry and the device achieves unique feature of rotary motion to improve thermal efficiency and minimize wear, tear, vibration, noise and to free the rotating vanes and by novel united vane design providing a freedom from harmful effect of centrifugal forces under high speed operation and further application as pneumatic compressor, pump;

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

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

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

c. the axial depth of the circular grooves means profile varies preferably in sinusoidal manner such that there being two crests means minimum axial depths and two troughs means maximum axial depths along the circle of groove means forming preferably a rectangular section on housing means preferably on a ring inner surface;

d. the maximum axial depth of the grooves can deviate however; there remains two crests means minimum depths and two trough means depths along the circle of groove means formed on housing inner surface;

e. the radial dimension means width and mean radius of grooves on two housings being identical and concentric with rotor means shaft axis;

f. crest of groove of one housing is axially aligned to the trough of groove of remaining housing being rotationally and concentrically oriented with respect to each other so that the sum total of the axial depths between both grooves remain same all along the circular path thereof;

g. rotor in the form of a disc having certain length;

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

i. both sides of rotor in conjunction with two axial rectangular grooves of housings on either sides being utilized as sealed means airtight cavity for the operation of the said engine;

j. axially slidable vanes means parallel to the axis of rotation;

k. double acting vane means two ends of the said vane engaging with the said similar sections of the profile formed on two housings axially aligned on either side of the rotor;

l. a pluralities of axially movable vanes located in axially aligned in the rotor holes on both sides of rotor;

m. united vane means mechanically joining means uniting two diametrically opposite vanes by radial attaching members mounted on a preferably cylindrical part having suitable diameter on which axial slots suitably formed on the for the free axial movement with respect to similar remaining plurality of united vane means vane subassemblies where each united vane having cylindrical member having different diameter so as to pass through each other of the plurality of united vane for the free axial movement of each united vane with respect to others;

n. pluralities of vane assemblies equally spaced, axially aligned and mounted inside the rotor cavity and the vanes aligned to the similar holes on both surface of the rotor for their free axial movement;

o. the mean diameter of the said holes on rotor, mean diameter of plurality of vane means comprised united vane and mean diameter of said grooves being same;

p. the length of the said vane means united vane means the axial distance between the inner surface of said profiles and axial length of the said rotor being same means constant means during one complete rotation means the said vane remains in touch with the said profiles on either sides means fitting snugly in the said cavities of grooves during rotations of rotor means each vane means united vane described;

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

r. each vane means plurality of united vane moving means sliding axially during said thermodynamic cycle;

s. axial hole means passages on equal angular position formed on the both surfaces of rotor for free and independent axial movement of plurality of vane means united vanes;

t. vane axially moving smoothly and snugly inside the rotor hole without leakage;

u. spark ignition system, fuel injector system, intake port and exhaust port formed in each housing at a specific location with respect to direction of rotation of rotor means engine;

3. The device as claimed in claim 2 wherein vane means united vane comprising mechanically joined means attached two diametrically opposite vanes by radial attaching members mounted on a preferably cylindrical part having suitable diameters when subjected to rotation, counter balances means nullifies centrifugal forces means forces working radially outwards being exerted on each said vane;

4. The device as claimed in claim 2 wherein the said preferred embodiment working with singly means independently moving means sliding vanes;

5. The device as claimed in claims 2 wherein the axial groove means engraved cavity having preferably sinusoidal profile formed on each housing requiring two crest and two troughs for each thermodynamic cycle means to be completed in each rotation wherein the same ring having multiplicity of said profiles means to complete multiple of such thermodynamic cycles to be accomplished in each rotation;

6. The device as claimed in claims 2, 3, 4, 5 wherein the axial groove means engraved cavity having preferably sinusoidal profile formed on each housing requiring two crest and two troughs for each thermodynamic cycle means to be completed in each rotation however the one housing with associated said vanes means united vane being used for thermodynamic cycle and remaining housing being used for guiding the vane means united vane;

7. The device as claimed in claim 2,5,6 wherein the groove on the housing be formed on preferably on separate ring and the rotor surface in contact with housing grooves and said vanes be fitted with a special metal liner for higher temperature operation and minimize leakage in charge cavities and easy replacement and maintenance.

8. The device as recited in claim 2 comprising means for utilizing the centrifugal force of rotating rotor to lubricate the vanes, rotor holes, groove in the housing surfaces during the motion of the engine and further providing cooling of the rotor, the housings and their outer sides being provided with engine cooling system and air cooling fins.

9. The grooves of the device as claimed in claim 2,3,4,5,6,7 on stationary housings are rotably aligned such that the crest of one sinusoidal groove on one housing is aligned with trough of sinusoidal groove of remaining housing so that the sum of the axial depths of these grooves and axial length of the said rotor at any point on the radius remains constant around its circular path and further and is always equal to the length of the vane therefore the plurality of vanes fits snugly in both the grooves on either side of the rotor simultaneously while the varying depth of the stator sinusoidal groove on each side makes the vane move axially in and out in the vane housings holes in simple harmonic motion during the rotary motion.

ABSTRACT

The present invention comprises a novel rotary internal combustion engine comprising 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, free of unbalance and stresses incurred in reciprocating IC engine. Providing axially moving vanes instead of radial vanes to minimize the effect of centrifugal

force particularly under high speed operation by further providing novel mechanism to nullify centrifugal forces acting there upon to minimizing excessive friction, rubbing, warping, bending of vanes. It is having sinusoidal profile of housing grooves so that axial vanes movement is in simple harmonic motion which is scientifically most desirable and further the volume displacement in charge cavity varying sinusoidally. It provides plurality of vanes forming multiple of charge cavities thus providing multiple thermodynamic cycles per rotation thus increasing the power of the said engine many fold thus increasing the power to weight ratio many times. It provides double acting vanes to operate in both the housings thereby doubling the output of the said engine and further balancing the axial forces due to fuel ignition means power stroke forces on the housings and rotor. It provides inlet and exhaust port and dispenses with complex inlet valve, exhaust valves and associated valve operating mechanism. It provides direct transmission of the generated torque to the shaft. It has grooves in the housings on either sides of the rotating part to counter combustion forces or pressure thereby minimizing stresses. It works equally efficiently with SI as well as CI system. It provides simple arrangement for cooling and lubricating arrangement with ease for providing inbuilt lubricating pump without change in the basic construction of the engine. It provides high power to weight ratio, reliable, efficient, low in maintenance, requiring minimum number components and is easy to manufacture.

FIGURE-1

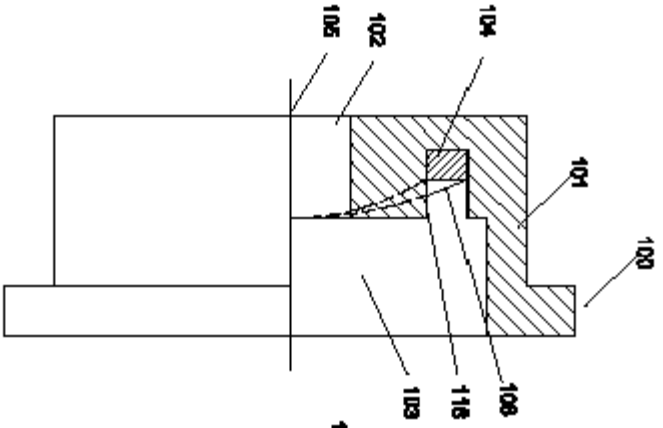
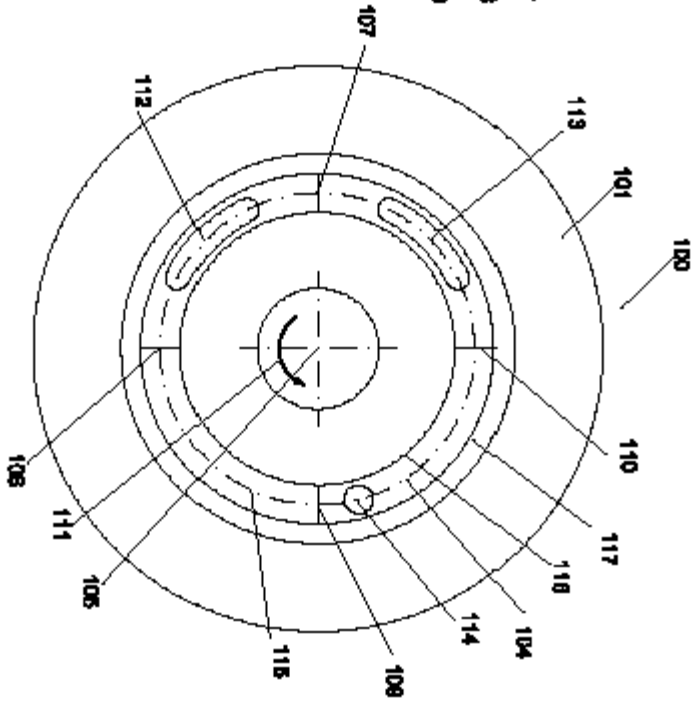


FIGURE-2



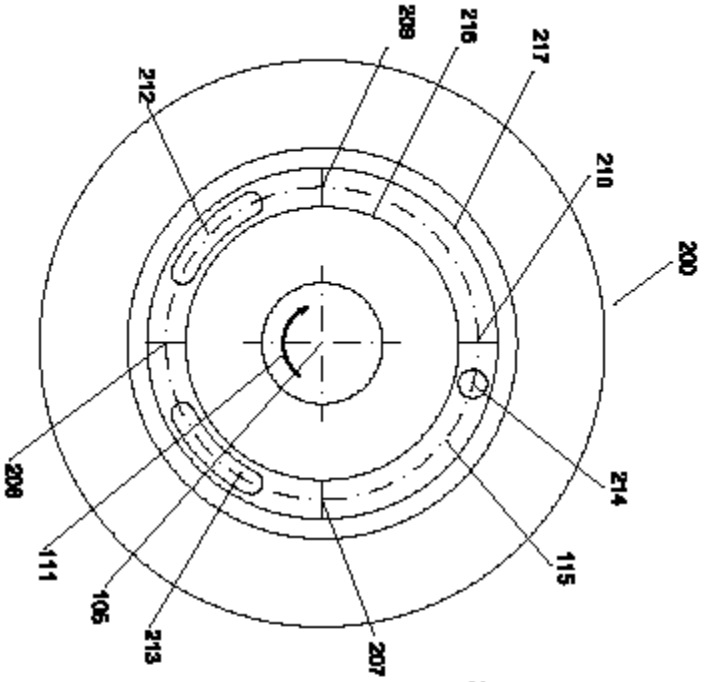


FIGURE-3

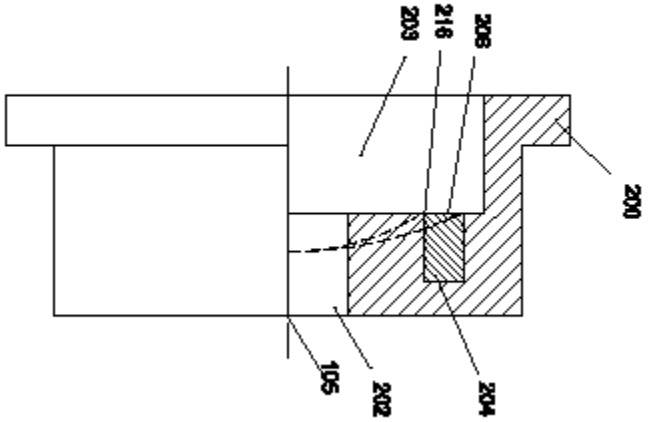


FIGURE-4

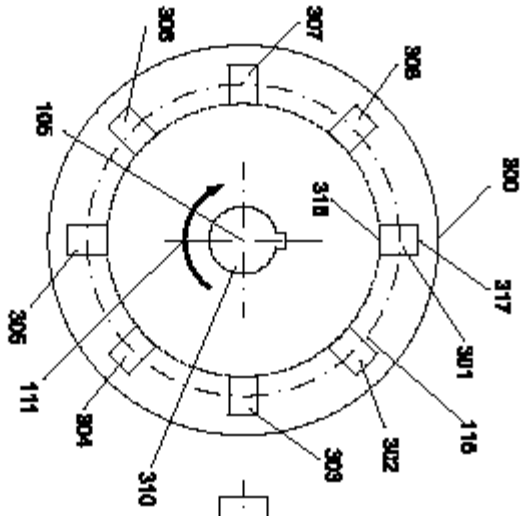


FIGURE-5

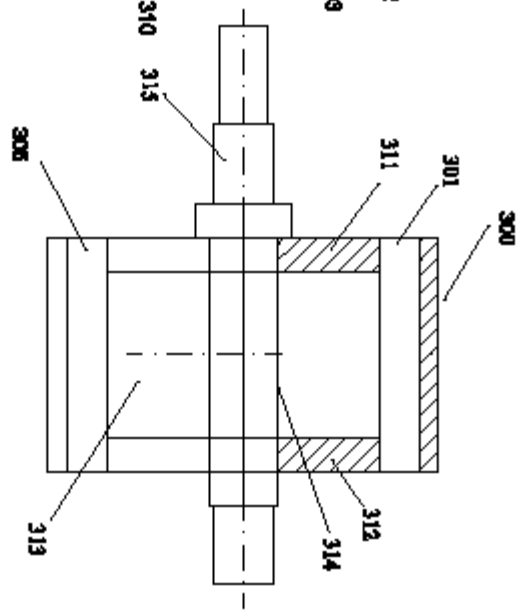


FIGURE-6

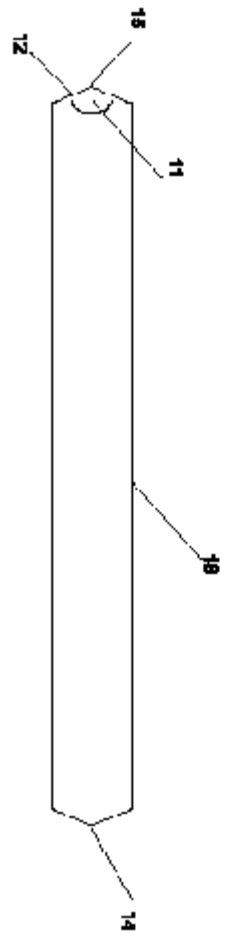


FIGURE-9

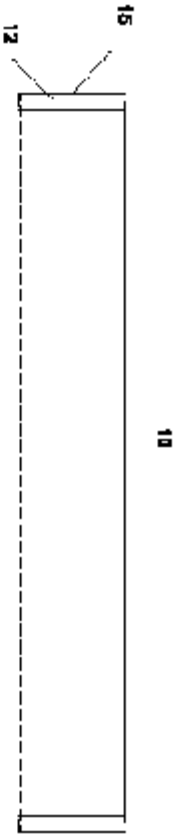


FIGURE-7

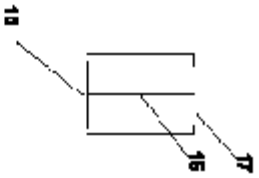


FIGURE-8

FIGURE-10

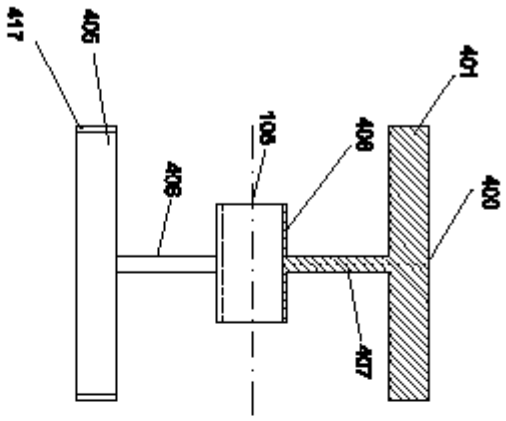


FIGURE-11

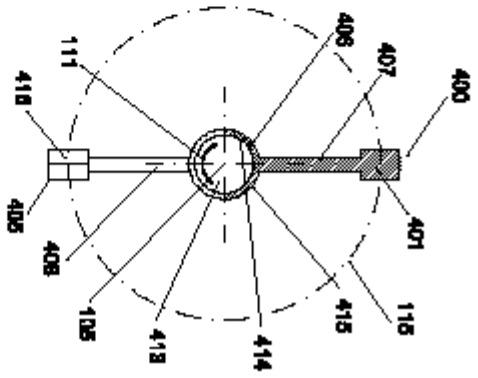


FIGURE-12

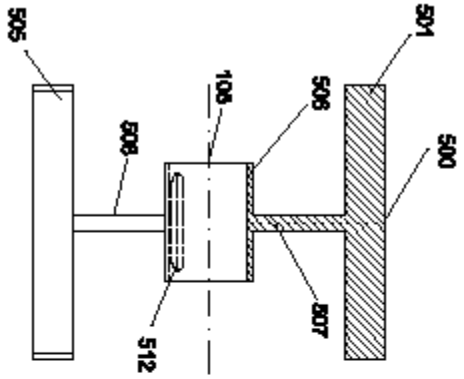


FIGURE-13

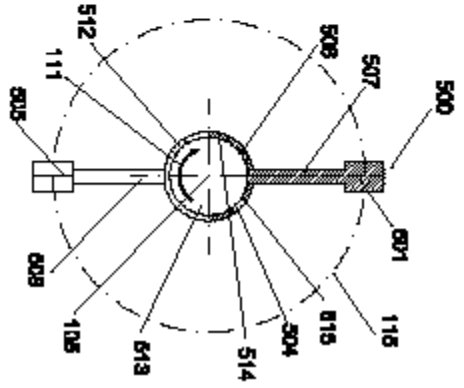


FIGURE-14

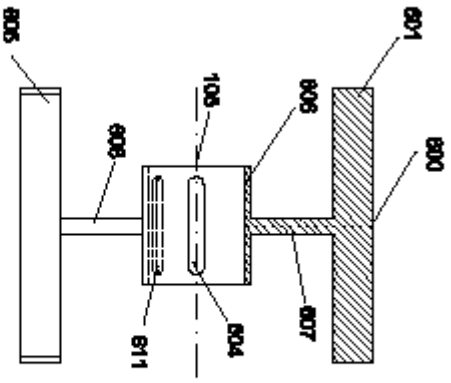
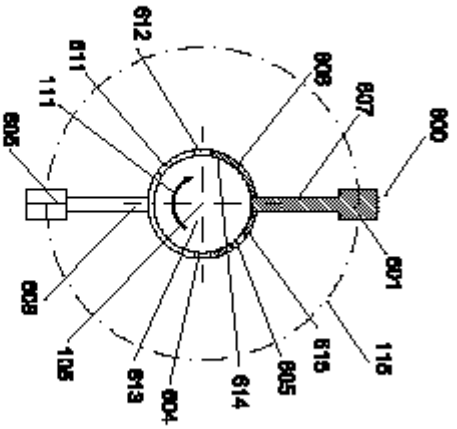


FIGURE-15



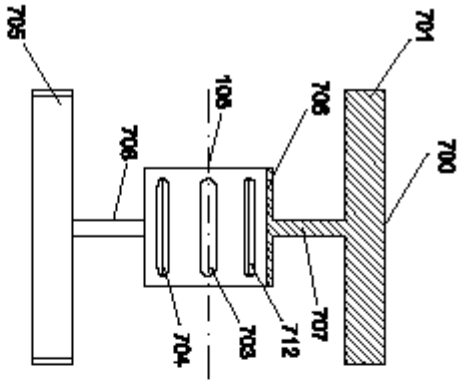


FIGURE-16

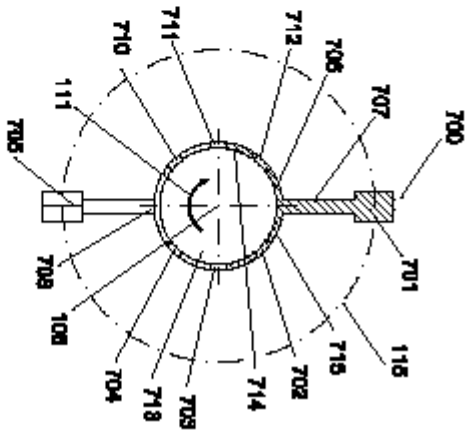


FIGURE-17

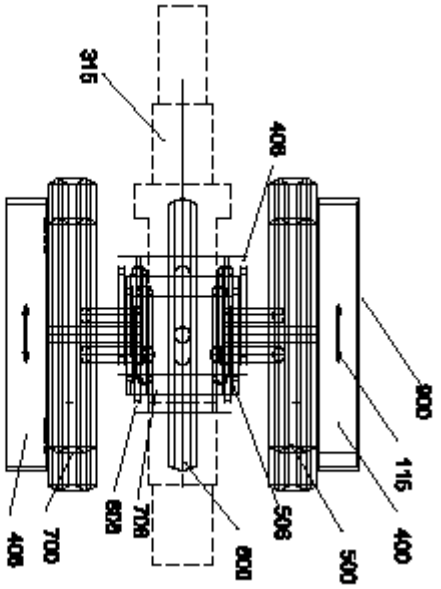


FIGURE-18

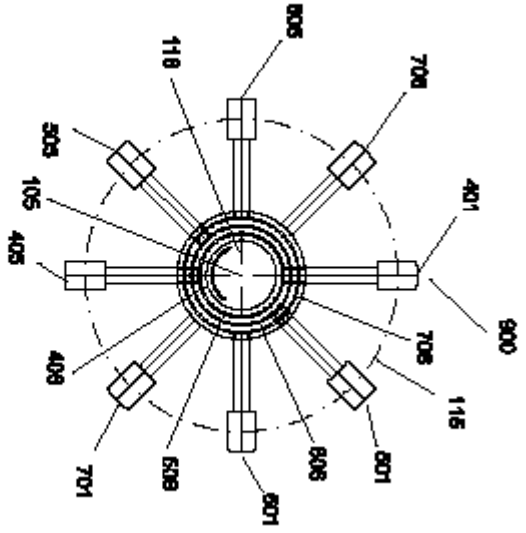


FIGURE-19

FIGURE-20

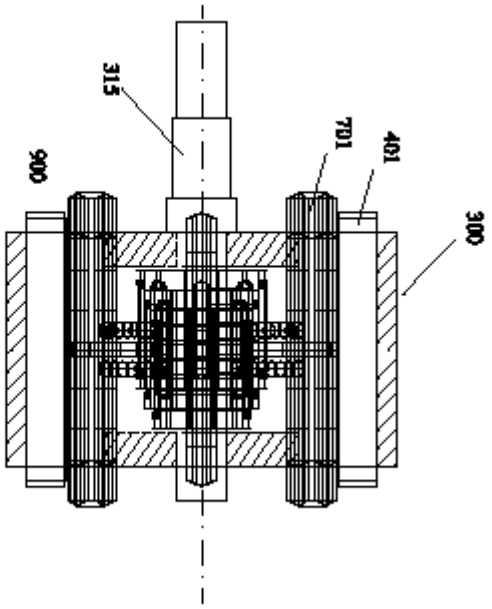
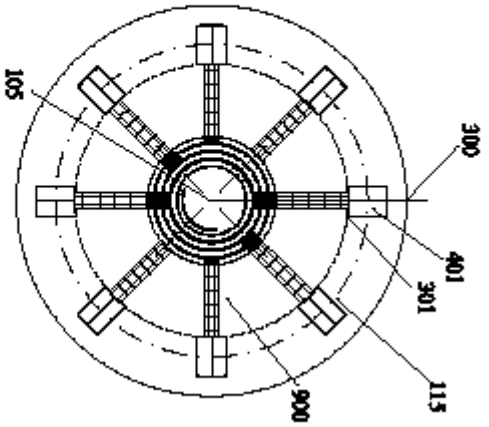


FIGURE-21



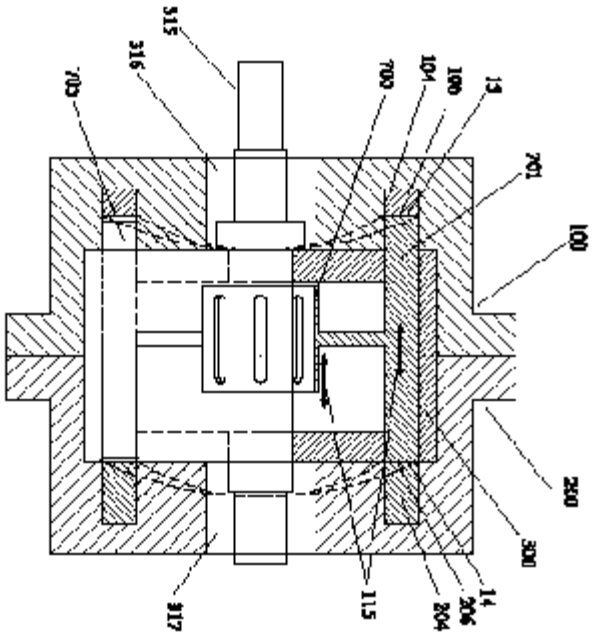


FIGURE-22

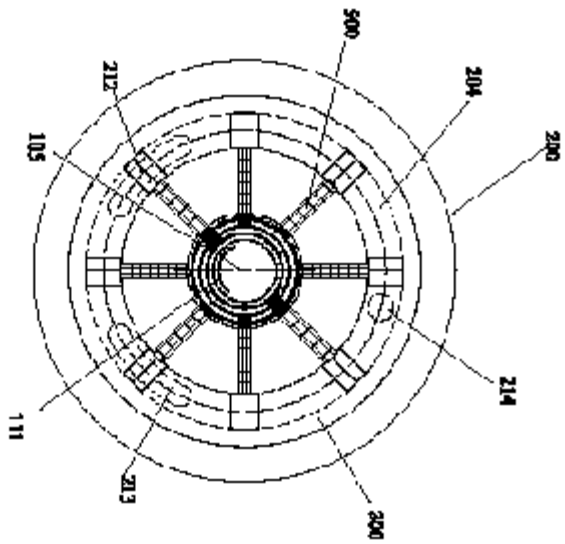


FIGURE-23

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

Name	Nationality	Address
Ingole Vijay Tulshiram	Indian	104 Ganediwal layout, camp, Amravati-444602
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