

Concept of Rotary Vane Engine

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Abstract - In globalization market scenario world economy has been highly dominated by automobiles sectors by means of transportation in the era of automobile organization mostly in almost automobiles reciprocating internal combustion engine used in spite of having draw backs have more no. of moving parts , due to which balancing of engine becomes a tedious task also weight to power ratio high. Complete Combustion of fuel is not taking place, require bigger size Fly wheel. This paper presents an alternative approach of rotary vane type internal combustion spark ignition engine . Consists of rotor, stator& six vanes used. In addition to this conventional fuel supply and spark ignition system used in it. Working and constructional feature of this design based on principle of vane pump . in this study for getting optimum value of compression ratio < 8 chosen dimension of stator & rotor are 100mm,70mm.respectively and analyzed . And obtained value of cc becomes 294cm³ capacity with compression ratio 8.64

Key Words – Rotary vane engine, stator, rotor, balancing, shaft output, compression ratio.

Introduction

Mostly in all prime movers, internal combustion engines are used. Reciprocating type in spite it has drawback of incomplete combustion of fuel. Because of which engine

ejects harmful gases like CO₂ which cause global pollution & ecological nuisance. In addition to this, it occupies more space due to which weight to power ratio is high. Also require wasteful dynamics of an extra revolution to evacuate the exhaust. On the contrary rotary wankle engines are more compact, light in weight almost free from vibration & cheaper to manufacturer. The main drawback of wankle is leakages occurs at rotor tips. Even though they are mostly used in racing cars. Today world is facing conventional fuel shortage. U.S. based geophysics Marion king Hubbert who predicted according to principle of geology, physics & mathematics conventional crude production will attain peak around 1976, there after it will start depleting & within 40 Yrs by 1995 it may cause serious threat to mankind. He also mentioned that worldwide faster consumption of fossil fuel in transport vehicle will result fast depletion to energy resources thereby releasing, huge quantity of pollutant in atmosphere. Considering the above serious issue and lacunas of conventional reciprocating type I.C. engine a thought is given for design & development of rotary vane engine with some objectives having less moving parts, can be balanced completely and also free from vibration in addition to this compact is size, with moderate improvements power to weight ratio.

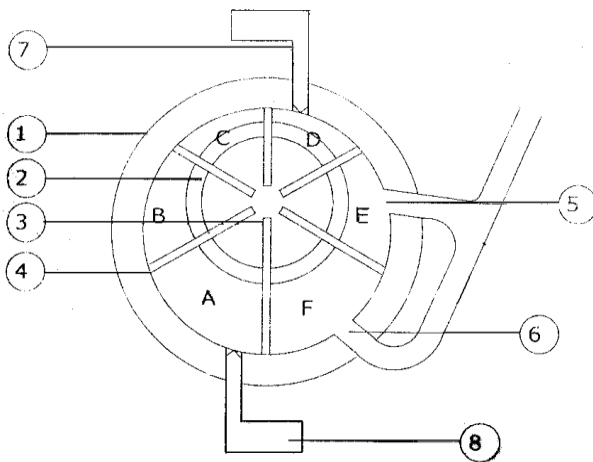
Literature Review

It is essential to understand the past and present status of rotary type internal combustion engine process to suggest future area of work. Literature survey has been carried out to find the state of art at rotary engine concept. It provides less moving parts, cheaper to manufacturer and power to weight ratio becomes moderately high with complete combustion of fuel. Initially different US. Patents has been discussed.

{1} Variable vane Rotary Engine. Pub. No. us2003/0159673a1 by inventor Matthew Brandon King invented with some objectives, to provide a rotary engine compact and light in weight achieve improved efficiency and increased fuel economy. Yet another object of this invention to provide a engine that can use variety of fuel . In this invention stator , rotor , front and rear cover and shaft vanes has been used. 5 vanes are pivoted at 72° on shaft which is fixed on rotor. The vanes act as a barrier dividing the chambers in to an expansion compression region. In it compressed air atomized fuel enter separately . A high degree of efficiency is achieved by the simplicity of the whole structure rotating concentrically about the movement of torque while completing multiple cycles in one revolution. {2} Oil cooled internal combustion engine with rotary piston wall pub no.us 2007/0125320 by inventor Jerry L. Smith and Christine lomeli with some objectives. Highly efficient engine with few moving parts , highly fuel efficient & horse power to weight ratio is extremely high. In this invention a 4 cycle 4 cylinder i.c. engine which consists of a hallow cylinder engine casing with only 3 moving parts . A single rotary piston wall and two rotatable valve cylinder. A hallow type cylindrical motor casing is divided in half vertically by an internal dividing wall . A single oil cooled rotary piston wall pivots back and forth with the firing of 4 spark plugs. Each firing into one of the four cylinders. {3} Method for operating rotary engine pub. No. us 1980/ 4203,410 by inventor James R Ramer with

3 objectives i.e. with less moving parts , power to weight ratio is extremely high & highly fuel efficient by providing low emission. In this patent a rotary engine has a housing and a pair of spaced co axial rotor in the housing connected for joint movement. Each rotor rotates in a separate rotor chamber and each carries radially movable vanes. The outer edges of which engage the configured inner surface of the housing. An axially extending passage in the housing communicate the rotor chambers. The parts are few in number . A gasoline or diesel fuel can be used for operating such rotary engine. {4} Design and experimental results of small scale Rotary Wankle Engine by “ Kenji Miyaska and Kaory Maruta “ in proceeding of 2001 ASME congress Nov 11-16 2001. A micro rotary engine with an epitrochoidal shaped housing under 1 mm³ in size and with rotor swept volume .08 mm³. To investigate the engine behavior and design issue mini rotary engine have been fabricated from steel with chamber s of 1000mm³ to 1700 mm³ in size and their displacement range from 78 mm³ to 348 mm³. Testing of mini rotary engine has led to the conclusion. There are no fundamental phenomena that would prevents the operation of rotary engine. Primary testing has shown net power output 2.7 w at 9300 r.p.m. {5} Development of vanned type novel air turbine by “ B.R. Singh and omkar singh on DOI; 10 1243/09344062 JME993 with objective for search of an alternative to fossil fuel driven engine. Author has presented small air turbine with vane type rotor by using compressed air as a potential working fluid generates shaft work by testing maximum power obtained to the order of 4.95 kw (6,6) which is sufficient to run the motor bikes.

Rotary Vane Type Engine



- | | |
|----------------|-------------------|
| 1. Stator | 5. Exhaust outlet |
| 2. Rotor | 6. Exhaust outlet |
| 3. Radial Slot | 7. Spark Ignition |
| 4. Vane | 8. Fuel supply |

Fig. 1. Construction of Rotary Vane Engine

Assembly of this Design is consist of stator, rotor with integrated shaft, dowel pins & vanes the rotor is provided with 6 slots at 60° interval consists of 2 through holes in each slot vanes opposite to each other can be attached via dowel pins as the rotor rotates. The rotor is fix eccentricly on stator & during rotation vanes slides via dowel pins & proper sealing is provided between stator & rotor using concept of vane pump compression volume obtained at top end position & swept volume obtained at bottom end position .During suction stroke by using carburetor/MPFI compressed A/F mixture is sucked through suction port in chamber (A) within the combustion area considering the rotor to be rotating position to next position at chamber(B) where compression of air fuel mixture begins at position (C) compression is completely as the rotor further advances and at position (b) spark occurs by conventional spark ignition system as a result of which combustion place and power stroke rotates the rotor 2 to position (E) & (F) the complete combustion of petrol takes place after the fuel gases are exhausted from PORT E&F entire cycle complete d during 360° of rotation.

Working Principle

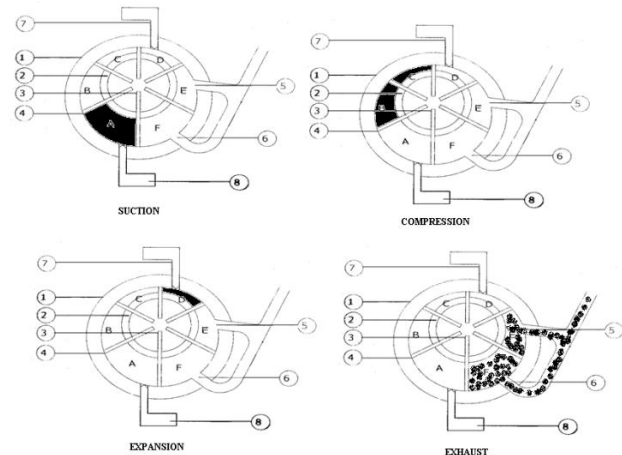


Fig. 2. Different Stages of Rotary Vane Engine

Material & Method

It is 4 stroke petro mix lubricated spark ignition engine by having casing diameter 100mm & rotor diameter 70mm, swept volume , compression ratio and cubic capacity is to be found and the obtained values are $48.99\text{cm}^3(\text{SV})$, $9(\text{CR})$ & $294\text{Cm}^3(\text{CC})$.

Swept Volume: Different volume obtained at respective ports A,B,C,D,E,&F. are 48.99; 22.95; 5.68;5.68;22.94; and 48.99; Cm^3 maximum volume at port a has been consider as swept volume by considering. Compression Ratio: Maximum & minimum values of volume C.R obtained is to be 8.94 vanes.

Conclusion

The general conclusions drawn from conceptual Design of rotary vane engines are as follows.

1. It is the object of this concept to provide a rotary engine that is compact , light in weight and simple to manufacturer.
2. In comparison with reciprocating engine it has very few moving parts i.e. rotor and vanes
3. It can use variety of fuel
4. All moving parts rotates about the main shaft axis and contribute to a common movement torque.

5. During one revolution of shaft multiple sequential cycle performs different operations and six sparks occurs so it eliminates bigger size of fly wheel.
6. Power to weight ratio of engine becomes very high

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