iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** VII **Month of publication:** July 2020

DOI: http://doi.org/10.22214/ijraset.2020.7075

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue VII July 2020- Available at www.ijraset.com

Rotary Engine

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Abstract: A Rotary engine is an internal combustion engine, but it works during a completely different way than the traditional piston engine. Like a piston engine, the rotary engine uses the pressure created when a mixture of air and fuel is burnt. In a piston engine, that pressure is contained within the cylinders and forces pistons to maneuver back and forth. The rod and crankshaft convert the reciprocating motion of the pistons into rotational motion which will be wont to produce power. In a rotary engine, the pressure of combustion is contained during a chamber formed by a part of the housing and sealed in by one face of the triangular rotor, which is what the engine uses rather than pistons.
Keywords: Reuleaux Rotor,4-stroke engine,triangular piston,spark plugs

I. INTRODUCTION

The rotary engine is a type of internal combustion engine which uses a rotor a convert pressure into a rotating motion instead of using reciprocating pistons. Its four stroke cycle is typically generated during an area between the within of an oval like epitrochoid -shaped housing and a roughly triangular rotor. This design delivers soft high rpm power from a compact, lightweight engine.

The engine was made-up by German engineer Felix Wankel. He began its development within the early 1950s at NSU Motorenwerke AG before completing a working, running prototype in 1957. NSU then subsequently licensed the concept to other companies across the world, who added more efforts and enhancements within the 1950s and 1960s.

Because of its compressed, lightweight design, Wankel rotary engines are installed throughout a category of vehicles and devices like automobiles and racing cars, aircraft, go karts, personal Water crafts and auxiliary power units.

In a piston engine, the same volume of space alternately does four different jobs-intake, compression, combustion and exhaust. A rotary engine does these same four jobs, but all happens in its own a part of the housing. It's kind of like having a committed cylinder for each of the four jobs, with the piston moving continuously from on to the next. The rotary engine is sometimes called a wankel engine.

II. CONSTRUCTION AND WORKING

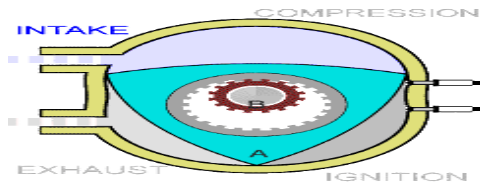

Fig2:-Working of Rotary Engine

The Wankel KKM motor cycle. The "A" characters one of the three apexes of the rotor. The "B" characters the eccentric shaft and the white portion is the lobe of the eccentric shaft. The shaft turns three times for each revolution of the rotor about the globe and once for each orbital revolution around the eccentric shaft.

In the Wankel engine, the four strokes of a typical Otto cycle occur in the space between a three-sided symmetric rotor and the indoors of housing. In each rotor of the Wankel engine, the oval-like epitrochoid-shaped housing situation a rotor which is triangular with bow-shaped flank (often confused with a Reuleaux triangle, a three-pointed curve of constant width, but with the bulge in the middle point of each side a bit more flattened. The academic shape of the rotor between the fixed corners is the result of a minimization of the volume of the geometric combustion chamber and a maximization of the compression ratio, respectively. The symmetric curve connecting two reasonable apexes of the rotor is maximize in the direction of the inner housing shape with the restriction that it not touch the housing at any angle of rotating (an arc is not a solution of this optimization problem).

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The middle drive shaft, called the eccentric shaft or E-shaft, passes through the center of the rotor and is support by fixed bearings. The rotors traverse on eccentrics (analogous to crankpins) integral to the eccentric shaft (analogous to a crankshaft). The rotors both rotate around the eccentrics and create orbital revolutions around the eccentric shaft. Seals at the corners of the rotor seal against the fringe of the housing, dividing it into three moving combustion chambers. The rotation of each rotor on its own axis is caused and controlled by a pair of synchronize gears. A fixed gear mounted on one side of the rotor housing engage a ring gear close to the rotor and ensures the rotor moves exactly 1/3 turn for each turn of the eccentric shaft. The power output of a engine is not transmitted through the synchronizing gears. The force of gas pressure on the rotor (to a first approximation) go directly to the center of the eccentric, part of the output shaft.

The easiest way to imagine the action of the engine in the animation at left is to look not at the rotor itself, but the cavity created between it and the housing. The Wankel engine is really a variable-volume progressing-cavity system. Thus there are 3 cavities per housing, all repeat the same cycle. Note as well that points A and B on the rotor and e-shaft turn at different speed—Point B circles 3 times as often as point A does, so that one full path of the rotor equates to 3 turns of the e-shaft.

As the rotor rotates and orbitals revolves, each side of the rotor is brought closer to and then away from the wall of the housing, compressing and expanding the combustion chamber like the stroke of a piston in a reciprocating engine. The power vector of the combustion stage goes through the hub of the offset lobe.

whereas a four-stroke piston engine makes one combustion stroke for each cylinder for every two rotations of the crankshaft (that is, one-half power stroke per crankshaft rotation per cylinder), every combustion chamber in the Wankel generate one combustion stroke per driveshaft revolution, i.e. one power stroke per rotor orbital revolution and three power strokes per rotor rotary motion. Thus, power output of a Wankel engine is generally superior than that of a four-stroke piston engine of similar engine displacement in a comparable state of tune; and higher than that of a four-stroke piston engine of similar physical sizes and weight.

Wankel engines generally have a much superior redline than reciprocating engines of similar power output. This is due to the softness inherent in circular motion, and because there are no highly stressed parts such as crankshafts, camshafts or connecting rods. Eccentric shafts do not have the stress related contour of crankshafts. The redline of a rotary engine is incomplete by tooth load on the synchronizing gear.tough steel gears are used for extended operation above 7000 or 8000 rpm. Mazda Wankel engines in auto race are operated above 10,000 rpm. In aircraft they are used conventionally, up to 6500 or 7500 rpm. However, as gas pressure participates in seal efficiency, race a Wankel engine at high rpm under no load conditions can obliterate the engine.

National agencies that tax automobiles consistent with displacement and authoritarian bodies in automobile racing variously consider the Wankel engine to be almost like to a four-stroke internal-combustion engine of 1.5 to 2 times the displacement some racing series ban it in general.

A. Intake

the intake phase of the cycle starts when the tilt of the rotor passes the intake port. At the moment when the intake port is exposed to the chamber, the volume of the chamber expand, drawing air/fuel mixture into the chamber. When the crest of the rotor passes the intake port the chamber is sealed off and compression begins.

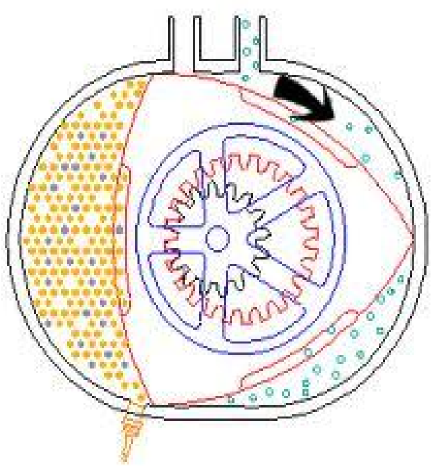

Fig2.1: - Intake Stage

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
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B. Compression

As the rotor continue motion around the housing, the volume of the chamber gets lesser and the air/fuel mixture gets compressed. By the time the face of the rotor has made it around to the spark plugs, the volume of the chamber is again closet.

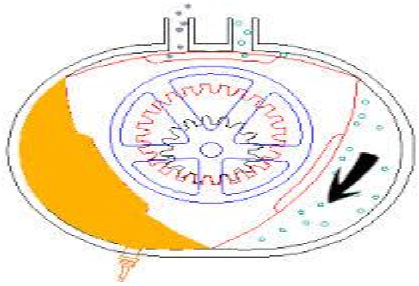

Fig2.2:-compression stage

C. Combustion

Mostly rotary engines have two spark plugs. The combustion chamber is extensive, is the flame would increase too slowly if there were only one plug. When the spark plugs fire the air/fuel mixture, pressure rapidly builds, forcing to move. The pressure of combustion forces the rotor to move into the direction that makes the chamber flow in capacity. The combustion gases continue to expand, moving the rotor and creating power until the peak of the rotor pass the exhaust port.

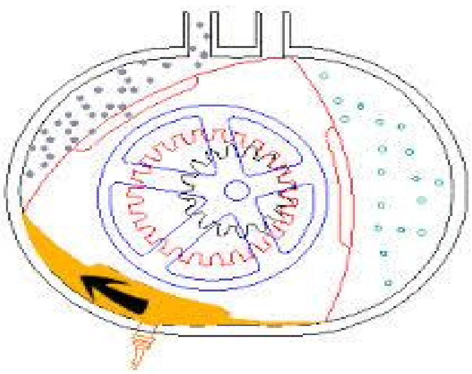

Fig2.3: - Combustion Stage

D. Exhaust

Once the peak of the rotor passes the exhaust port, the high pressure combustion gases are free to flow out the exhaust. As the rotor continues to move, the chamber starts to contract, forcing the left over exhaust out of the port. By the moment the volume of the chamber is approaching its minimum, the peak of the rotor passes the intake port and the whole cycle starts again. The near thing about the rotary engine is that each of the three faces of the rotor is always working on one part off tube cycling one complete revolution of the rotor there will be three combustion strokes. But keep in mind, the output shaft spins three times for every whole revolution of the rotor, which means that there is one combustion stroke for each revolution of the shaft.

Fig2.4: - Exhaust Stage

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III. ADVANTAGES AND DISADVANTAGES

A. Advantages

1) A far high power to weight ratio than a piston engine.
2) It is approximately one third of the size of a piston engine of equivalent power output.
3) No reciprocating parts.
4) Able to achieve higher revolutions per minute than a piston engine.
5) Operates with almost no vibration.
6) Not prone to engine-knock.

B. Disadvantages

Slow combustion. The combustion is slow because the combustion chamber is long, thin, and moving. The trailing side of the combustion chamber naturally produces a "squeeze stream" that prevents the flame from reaching the chamber trailing edge. Fuel injection during which fuel is injected towards the vanguard of the combustion chamber can minimize the quantity of unburnt fuel within the exhaust. Kawasaki proposed a triangular tail expansion of the plug hole, pointing to the combustion chamber trailing side to solve this.

IV. CONCLUSIONS

Application adiabatic engine technology to the rotary engine is highly dependent upon the materials used for the basic engine components.Fundamental work on increasing the permissible operating temperature of the apex seal/ rotor covering tribological system is required before the adiabatic technology can be successfully applied to a complete engine.

REFERENCES

[1] A.K.N. Gerami, M.S. Shadloo, M. Ghasempourand A. kimiaeifar"Analysis of the Forces Acting on Apex Seal of A WankelEngine" Australian Journal of Basic and Applied Sciences, 4(9): 4205
[2] B. Lienhardt, E. Hughes, C. Bes, and D. HolI, "Failure-Finding Frequency for a Repairable System Subject to Hidden Failures," Journal of Aircraft, vol. 45, 2008
[3] M. Grill, M. Chiodi. H. Berner, M. Bargende, Calculating the thermodynamic properties of burnt gas and vapor fuel for user-defined fuels, MTZ 05 (2007) 398
[4] R. Craven, J. Cox, J. Smith, S. Ford, Mechanism analysis of a cam driven rotary engine, SAE Technical Paper No. 880659, 1988
[5] R. Saidur, M.Rezaei, W.K.Muzammil, M.H.Hassan, S.Paria, M.Hasanuzzaman, "Technologies to recover exhaust heat from internal combustion engines." Renewable and Sustainable Energy Reviews. vol. 16, 2012, pp. 5649-5659.

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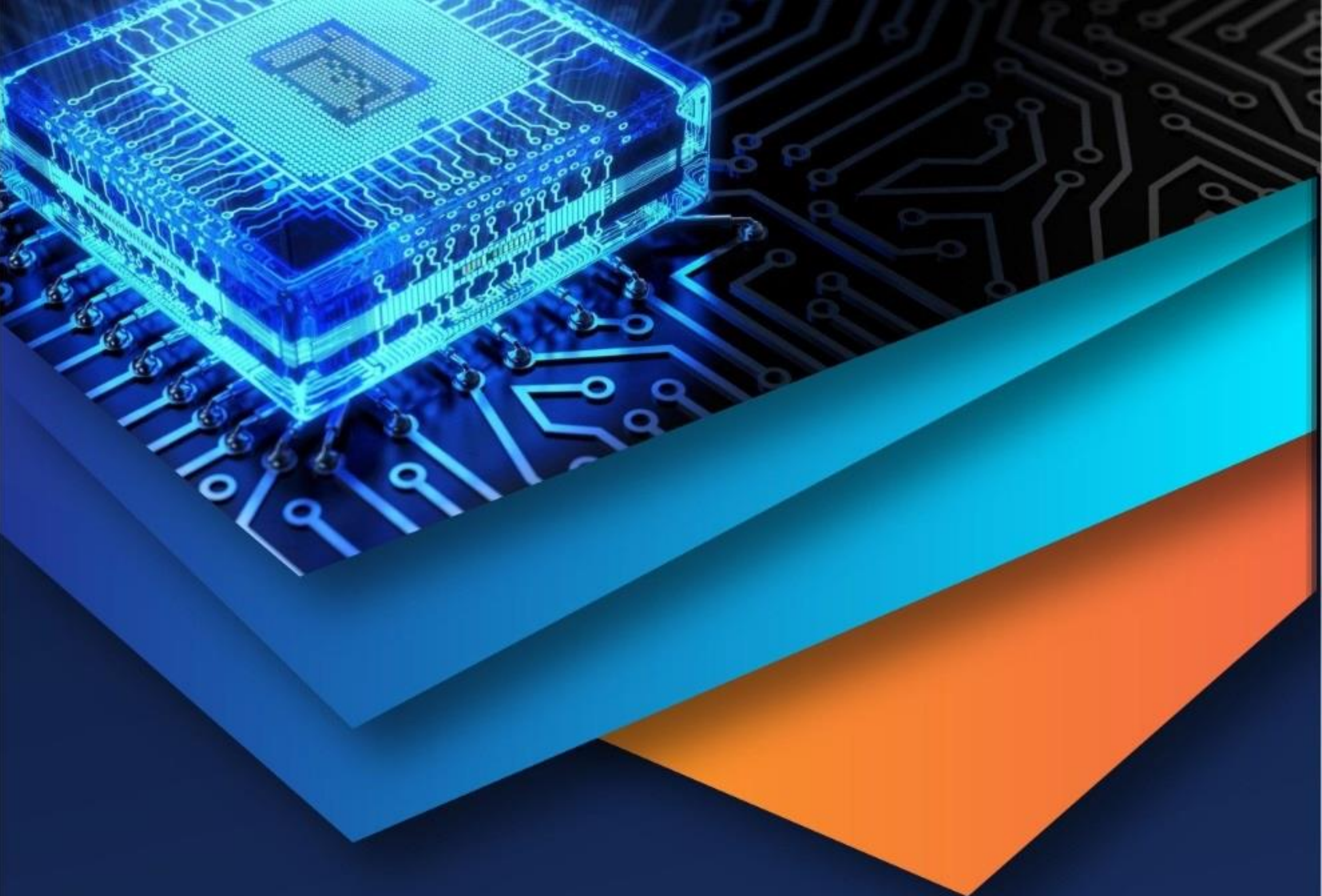

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