

Design of Quadruple Naturally Aspirated Spark Ignition V4 Engine

ThombareShreyashShripad

S.E. mechanical engineering, APCOER, Pune, SavitribaiPhule Pune University, India

ABSTRACT

Internal Combustion Engines, which are use for daily transportation of various types of goods as well as transportation of Human being, are typically known for their massive Power with their Fuel Efficiency during travel. Nowadays, more efficient & reliable Automobile Engines which means that Internal Combustion Engines are running on streets, but this is study about to design such a powerful Four Stroke Automobile Engine which also gives great fuel efficiency during performance. For achieving the aim as described early in content this research introduce Quadruple Naturally Aspirated V4 Spark Ignition Engine for Bikes.

Quadruple Naturally Aspirated Spark Ignition is the new technology which is use in newly designed Four Stroke bike Engine for obtaining Massive Power with great fuel efficiency during operation. This future technology also helps to the newly designed V4 engine for performing better on Exhaust Pollution Control unit, which is very much important in today's era.

Keywords: Quadruple Ignition System, V4 Engine, Spark Ignition Engine

INTRODUCTION

Aim for this paper is to introduce the Naturally Aspirated Spark Ignition Engine which gives Massive Power with maintaining Fuel Efficiency as well for heavy duty bikes. This future engine performs better on both the main categories which give idea about engine strength, because of the Quadruple Spark Ignition system which is used in this Naturally Aspirated Spark Ignition Engine. Due to this Quadruple Spark Ignition this engine utilized maximum air-fuel mixture that displaced in engine cylinder and gives:

1. More Brake Power.
2. More Fuel Efficiency.
3. Less Exhaust Pollution.

More power: Engine gives more power (Brake Horse Power) to the crankshaft because of total Four Spark Plugs produces sparks for single cylinder. Due to multiple amount of spark produced inside the engine cylinder, time required for flame propagation is reduced and engine delivered more Power to the wheel.

More Fuel Efficiency: Engine gives better fuel efficiency because of Quadruple Spark Ignition system. Due to more sparks generated inside the engine cylinder, engine uses maximum amount of air-fuel mixture which is present inside the cylinder volume during combustion process and engine performs better in Efficiency category.

Less Exhaust pollution: Engine also improved in Exhaust Pollution category because of this Quadruple Spark Ignition system that is used in this newly designed engine. Due to more fuel burnt during combustion process, amount of exhaust gases reduced.

From various theoretical calculations this engine gives good results in above main three categories which are very much important in Engine performance.

LITERATURE SURVEY

1. Performance And Emission Analysis Of Two Stroke Four Spark Plug Single Cylinder SI Engine With Gasoline Fuel by Hardik A. Patel, J. J. Goswami:

Professor Hardik Patel and J. Goswami present their analysis for improving engine performance by using four spark plugs to the single cylinder two stroke SI engine. They conclude that using four spark plugs to the two stroke engine, performance of engine get improved in:

1. Unburned Hydro Carbon emission gets lower.
2. Brake Thermal Efficiency increased.
3. Brake Specific Fuel Consumption reduced.
4. More Power generated.

2. Performance Study on Twin Plug Spark Ignition Engine at Different Ignition Timings by NarasimhaBailkeri, Krishna Prasad, ShrinivasaRao B.

Sir NarasimhaBailkery, Sir Krishna Prasad and Sir ShrinivasaRao B. conclude in their research that when Twin Spark Plugs are in Engine at different ignition timing engine performs better than single Spark Ignition Engines. Also Twin Spark Plugs gives more sparks at different ignition timing as compared to Single Spark Ignition engines. They conclude following results in their research as:

1. Brake Power of engine increases at different ignition timings.
2. Exhaust is significantly reduced.

ENGINE SPECIFICATIONS

Engine Diameter	70 mm
Stroke Length	80 mm
Displacement of Engine	1231504.3 mm ³
Total Cylinders	04
Strokes/Cycle	04
Valves/Cylinder	04
Cooling System	Water Cooled
Lubrication System	Dry Sump Lubrication

Mathematical analysis of Engine Performance

Technical Measurements:

Maximum Power	171.58 kw
Maximum Torque	129.15 Nm

Engine Fuel Consumption Calculations:

Fuel Used	Petrol
Calorific Value of Fuel	44000 KJ/Kg
Specific Gravity of Fuel	0.75
Fuel Consumption/Hour	40.11 Kg/Hour

Engine Air Consumption Calculations:

Air Consumption/Hour	601.65 Kg/Hour
----------------------	----------------

Engine Efficiency Related to Various Factors:

Mechanical Efficiency	85.5%
Air Standard Efficiency	63.59%
Relative Efficiency	47.17%
Volumetric Efficiency	74.75%
Indicated Thermal Efficiency	40.93%
Brake Thermal Efficiency	35%

IGNITION SYSTEM

To obtaining Higher Output Voltage **Quadruple Spark Ignition System (QSI System)** is used in this V4 Spark Ignition Engine. In this system Four Spark Plugs are used for Single Cylinder of V4 engine to obtain multi sparks at same time. Two of them act as **Boss Spark Plugs** which produces spark at the Crank Position is at TDC and remaining two of them act as **Employee Spark Plugs** which produces spark just after Crank Position is quite below to TDC.

Location of Spark Plugs:

1. Boss Spark Plugs located middle of the Combustion Chamber.
2. Employee Spark Plugs located corner of the Combustion Chamber with Inclined to Boss Spark Plugs at 45⁰ and also opposite to each other.

This Spark Ignition System better perform with **Electronic Control Unit** because due to ECU System each Spark Plug has able to maintain their required Voltage. ECU System passes required amount of Voltage to the Spark Plugs for smooth performance hence Quadruple Spark Ignition System having some advantages as:

1. Reduce Ignition system maintenance.
2. Reduce wear of the Components.
3. Increased Reliability.
4. Extended Spark Plug Life.
5. Improved ignition of Lean Mixture.
6. More Combustion takes place during operation.
7. Reduce Exhaust Pollution.
8. Obtain more Power for Engine.

CONCLUSION

Based on above mathematical data, this Quadruple Spark Ignition V4 Engine gives better numbers in the manner of efficiencies as well as power developed.

After several mathematical calculations following conclusions are made:

1. Multipoint sparks helps to improve in total combustion of fuel hence engine gives more power due to maximum amount of air-fuel mixture used during operation.
2. This engine gives maximum fuel efficiency because of more amount of air-fuel mixture can burn inside the cylinder during one cycle.
3. Multiple sparks also reduced Carbon- dioxide percentage which coming from exhaust.
4. Unburned Hydro Cabin emission is significantly reduced in this V4 engine.

REFERENCES

1. Performance And Emission Analysis Of Two Stroke Four Spark Plug Single Cylinder SI Engine With Gasoline Fuel by Hardik A. Patel and J. J. Goswami M. E. Automobile Associate Professor, GEC Bhuj
2. NarasimhaBaikeri, Krishna Prasad, ShrinivasaRao B. Performance Study on Twin Plug Spark Ignition Engine at Different Ignition Timings International Journal of Science and Research (IJSR), India Online ISSN: 23197064 Volume 2 Issue 8, August 2013.