To Study of Dual Sparkplug In Two Stroke IC Engine

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ABSTRACT

This paper describes some results of the research in the area of multiple spark ignition engines. Dual spark ignition system has proved their potential in improving the performance of the engines. On applying the dual spark plug in two stoke gasoline engine the combustion could be made proper and the specific fuel consumption could be made to decrease. In this two Stroke gasoline engine the scavenging process will also be improved which is poor in the present single spark plug. The present two-stroke twin spark plug gasoline engine can be made to operate either with single or dual spark plug as per the user's requirement. Two stroke spark ignition engines have high exhaust emissions and low brake thermal efficiency due to the short circuiting losses and incomplete combustion, which occur during idling and at part load operating conditions. An effort is been made to improve the engine parameters i.e. specific fuel consumption and Thermal Efficiency of the engine. This is achieved by using dual spark plug in two stroke gasoline also its effect on the engine parameter is analyzed. A spark-ignition (SI) engine cycle model was used to study the effects of spark plug location on a four spark plug SI engine performance.

Keyword: *-Dual Spark plug, 2-Stroke Gasoline Engine.*

1. INTRODUCTION

A two-stroke, or two-cycle, engine is a type of internal combustion engine which completes a power cycle with two strokes (up and down movements) of the piston during only one crankshaft revolution. This is in contrast to a "four-stroke engine", which requires four strokes of the piston to complete a power cycle. In a two-stroke engine, the end of the combustion stroke and the beginning of the compression stroke happen simultaneously, with the intake and exhaust (or scavenging) functions occurring at the same time. Multiple ignition system is one of the techniques to achieve rapid combustion. Multiple spark plug engines often use the initiation of flame propagation at two or more number of points in the combustion chamber depending on the number of spark plugs employed. If two plugs are employed the flame front travels from two points in the cylinder and the effective distance to be travelled by each flame is reduced. The concept of dual plug spark ignition is under consideration for more than last three decades. Several experimental studies were made in the area of dual ignition engines regarding optimization of spark plug location and to prove their efficient operation at part loads, extended EGR tolerance, extended lean misfire limit and relatively clean burning compared with single spark ignition systems.

Spark plugs may also be used for other purposes; in Saab Direct Ignition when they are not firing, spark plugs are used to measure ionization in the cylinders – this ionic current measurement is used to replace the ordinary cam phase sensor, knock sensor and misfire measurement function. Spark plugs may also be used in other applications such as furnaces wherein a combustible fuel/air mixture must be ignited. In this case, they are sometimes referred to as flame igniters.

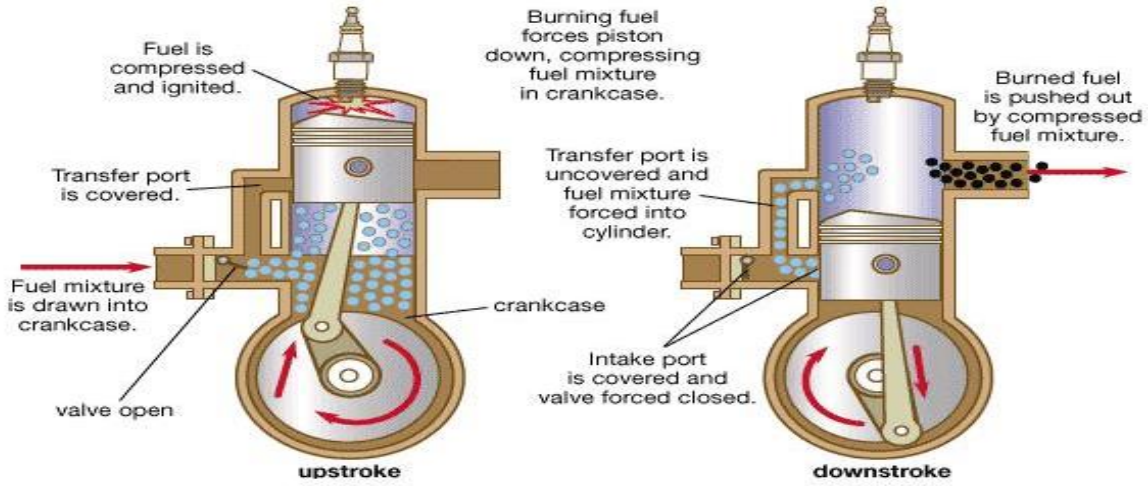

Fig-1: Two Stroke Engine

Gasoline (spark ignition) versions are particularly useful in lightweight or portable applications such as chainsaws and motorcycles. However, when weight and size are not an issue, the cycles potential for high thermodynamic efficiency makes it ideal for diesel compression ignition engines operating in large, weight-insensitive applications, such as marine propulsion, railway locomotives and electricity generation. In a two-stroke engine, the heat transfer from the engine to the cooling system is less than in a four-stroke, which means that two-stroke engines can be more efficient. However, crankcase-compression two-stroke engines, such as the common small gasoline-powered engines, create more exhaust emissions than four-stroke engines because their petroil lubrication mixture is also burned in the engine, due to the engine's total-loss oiling system.

2. LITERATURE REVIEW

In Dual Spark ignition engine has two Spark plugs located at opposite ends of the combustion chamber and hence fast and efficient combustion is obtains. The benefits of this combustion process can be felt in terms of better fuel efficiency and lower emissions. Dual Sparkplugs used for faster and better combustion. Currently one spark plug at one end of the combustion chamber is the conventional practice. The flame front created by the spark takes some time to reach the farthest portion of the combustion chamber. This leads to slower burning of the Air-fuel mixture and creates limitations in optimizing the combustion chamber characteristics. 2 spark plugs at either ends of the combustion chamber help in faster and better combustion.

Hardik A. Patel [1] used two stroke spark ignition engines which have high exhaust emissions and low brake thermal efficiency due to the short circuiting losses and incomplete combustion occur during idling and at part load operating conditions. An effort is been made to improve the engine parameters i.e. specific fuel consumption and Thermal Efficiency of the engine. This is achieved by using dual spark plug in two stroke gasoline also its effect on the engine parameter is analyzed. A spark-ignition (SI) engine cycle model was used to study the effects of spark plug location on a four spark plug SI engine performance. Constructed simulation can be used for either single- or four-spark plug configuration. For the tetra-spark arrangement, spark plugs were considered to be located diametrically opposite to each other on cylinder head axsymmetrically.

Arpit Dubey [2] has been introduced a new type engine which uses triple spark plugs at different location, controlled by an advanced electronic control unit. This advanced electronic control unit uses three different ignition timings with variable spark plug number. Experiments were conducted at different load conditions and different types of engines has proved that dual spark plug ignition engines are surely better than a single spark plug engine ,but triple spark ignition engines has proved their potential. The current paper investigates the effect of multiple spark plugs to single spark plug on the basis of engine performance and their respective emissive characteristics. The result has shown that there is a considerable performance improvement in power output, increase in thermal efficiency and reduced maintenance due to lower emission of BSFC, HC and CO emission in triple spark plug mode of operation as compared to single and dual spark plug mode of operation.

Karthik Dhayakar [3] used two spark ignition engine to improve the engine parameters i.e. specific fuel consumption and Thermal Efficiency of the engine. This is achieved by using dual spark plug in two stroke gasoline also its effect on the engine parameter is analyzed. On applying the dual spark plug in two stoke gasoline engine the combustion could be made proper and the specific fuel consumption could be made to decrease. In this two Stroke gasoline engine the scavenging process will also be improved which is poor in the present single spark plug. The present two-stroke twin spark plug gasoline engine can be made to operate either with single or dual spark plug as per the user's requirement. The engine is fitted with both the options. This two stroke gasoline engine is also has the luxury of a condenser which will enhance its sparking capability. Overall this engine is a far more technically improved engine than that of single spark plug.

Narasimha Bailkeri [4] developed a new dual ignition engine by introducing two spark plugs at suitable locations. Experiments were conducted at different load conditions and three different ignition timings. The results have shown that performance of dual plug engine is comparatively better than the conventional single plug ignition engine under all three ignition timings. The results have shown considerable performance improvement in power output and thermal efficiency, as well as reduction in BSFC, HC, and CO emission in dual plug mode of operation.

3. WORKING PRINCIPLE

The two-stroke petrol (gasoline) engine was very popular throughout the 20th century in motorcycles and small-engine devices, such as chainsaws and outboard motors. They were also used in some cars such as the Saab 93 and Trabant, a few tractors and many ships. Part of their appeal was their simple design (and resulting low cost) and often high power-to-weight ratio. The lower cost to rebuild and maintain made the two stroke engine very popular, until for the USA their EPA mandated more stringent emission controls in 1978 (taking effect in 1980) and in 2004 (taking effect in 2005 and 2010). The industry largely responded by switching to four-stroke petrol engines, which emit less pollution. Most small designs use petroil (two-stroke oil)) lubrication, with the oil being burned in the combustion chamber, causing "blue smoke" and other types of exhaust pollution. Dual Ignition is a system for spark-ignition engines, whereby critical ignition components, such as spark plugs and magnetos, are duplicated. Dual ignition is most commonly employed on aero engines, and is sometimes found on cars and motorcycles.

In 1860 Étienne Lenoir used an electric spark plug in his gas engine, the first internal combustion piston engine and is generally credited with the invention of the spark plug. A spark plug (sometimes, in British English, a sparking plug, and, colloquially, a plug) is a device for delivering electric current from an ignition system to the combustion chamber of a spark-ignition engine to ignite the compressed fuel/air mixture by an electric spark, while containing combustion pressure within the engine. A spark plug has a metal threaded shell, electrically isolated from a central electrode by a porcelain insulator. The central electrode, which may contain a resistor, is connected by a heavily insulated wire to the output terminal of an ignition coil or magneto. The spark plugs metal shell is screwed into the engine's cylinder head and thus electrically grounded. The central electrode protrudes through the porcelain insulator into the combustion chamber, forming one or more spark gaps between the inner end of the central electrode and usually one or more protuberances or structures attached to the inner end of the threaded shell and designated the side, earth, or ground electrode(s).

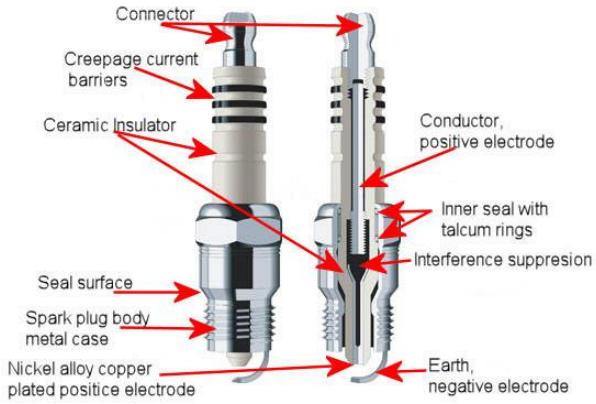

Fig -2: Spark plug

The plug is connected to the high voltage generated by an ignition coil or magneto. As the electrons flow from the coil, a voltage develops between the central and side electrodes. No current can flow because the fuel and air in the gap is an insulator, but as the voltage rises further, it begins to change the structure of the gases between the electrodes. Once the voltage exceeds the dielectric strength of the gases, the gases become ionized. The ionized gas becomes a conductor and allows electrons to flow across the gap. Spark plugs usually require voltage of 12,000–25,000 volts or more to "fire" properly, although it can go up to 45,000 volts. They supply higher current during the discharge process, resulting in a hotter and longer-duration spark.

The heat and pressure force the gases to react with each other, and at the end of the spark event there should be a small ball of fire in the spark gap as the gases burn on their own. The size of this fireball, or kernel, depends on the exact composition of the mixture between the electrodes and the level of combustion chamber turbulence at the time of the spark. A small kernel will make the engine run as though the ignition timing was retarded, and a large one as though the timing was advanced.

4. CONCLUSIONS

The experimental study confirms that:
1) Two stroke engines have a good potential if dual spark plug technology is employed.
2) Applying the dual spark plug in two stroke gasoline engine combustion process have improved hence efficiency of the engine is improved.
3) Less fresh charge will move out in the scavenging process by applying the dual spark plug. It means scavenging process have been improved.
4) On applying the dual spark plug in two Stroke Gasoline engine the problem of fuel economy will also be improved due to proper combustion inside the cylinder.
5) More power can be generated from the same size engine by employing dual spark plug its mean improvement in power without changing the fuel input.

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6. REFERENCES

[1]. Hardik A. Patel and J. J. Goswami "Performance and Emission Analysis of Two Stroke Dual and Triple Spark plug Single Cylinder SI Engine with Gasoline fuel" IJSRD - International Journal for Scientific Research & Development| Vol. 1, Issue 12, 2014 | ISSN (online): 2321-0613

[2]. Arpit Dubey, Akshay Pareta and Pawan Sharma "Study of Multiple Spark Ignition Engines with Single Spark Ignition Engines on the Basis of Engine Efficiency and Emission Characteristics Size" International Journal of Current Engineering and Technology ISSN 2277 - 4106 Special Issue-3, (April 2014)

[3]. Karthik Dhayakar, G. Vijay, J. Gowtham Kumar, T. Kamalahar and C. Preetham "Effect of Twin Sparkplug in Two Stroke IC Engine" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Volume 4 Issue 2, February 2015

[4]. Narasimha Bailkeri, Krishna Prasad S and Shrinivasa Rao B.R "Performance Study on Twin Plug Spark Ignition Engine at Different Ignition Timings" International Journal of Science and Research (IJSR), India Online ISSN: 2319-7064 Volume 2 Issue 8, August 2013

BIOGRAPHIES

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