International Journal of Progressive Research in Science and Engineering
Volume-1, Issue-3, June-2020
www.ijprse.com

Studies on Internal Combustion Engine Efficiency

Manjeet kumar[1], Rajesh Mattoo[1]

[1]*Student, Dronacharya College of Engineering, Gurgaon, Haryana, India.*

Corresponding Author: manjeetkumar15046307@gmail.com

Abstract: In this article was presented one idea of how to improve overall internal combustion engine efficiency. We try to make a brief description of most important and basic parts of a new internal combustion engine. Described engine have several advantages over conventional IC engine.

Key Words: - ***IC engine, motor vehicle, CAD..***

I. INTRODUCTION

Today, there are a very large number of successful constructions of internal combustion engines, which are applied to various fields of science and technology. In some areas IC engines are so dominant without concurrence of other types of engines. This fact suggest that today's internal combustion engines are at a high technical level. However, construction of piston stroke internal combustion engines that are now used is based on inefficient thermodynamic and mechanical concept. It can be said that the main characteristics of today's engine is very small amount of work in relation to used fuel, in other words, today's engines have a very low coefficient of efficiency. Realistically speaking Otto engines today use about 25% of input energy, while diesel construction about 30% (in some cases can be expected a little more). Approximately 35% of the petrol engine and 30% of heat in the diesel engines goes through exhaust and around 33% goes for cooling the engine in both versions, other 7% is attributed to friction and radiation [1]. For illustration can be taken into account combustion of one liter of fuel in the classical combustion engines. Combustion of this amount of fuel frees approximately 39 MJ of power, the engine output shaft is generated only around 13 MJ, while with other 26 MJ engine heated environment (through exhaust and cooling system). Conventional IC engines are based on a relatively simple solution to achieve a thermodynamic cycle while providing mechanical power.

II. CONVENTIONAL I.C. ENGINE

It is well known that ordinary IC engines are based on a slider-crank mechanism. This way of piston motion provides a relatively simple solution to achieve a thermodynamic cycle to produce mechanical power. As can be seen from theory, the most efficient thermodynamic cycle for IC engines is the Otto cycle, because the constant volume heat addition is essential for high efficiencies. Common to most reciprocating engines is a linkage known as a crank-slider mechanism. Slider-crank mechanism is one of several capable of producing the straight-line, backward-and-forward motion known as reciprocating. Fundamentally, the crank-slider converts rotational motion into linear motion, or vice-versa. With a piston as the slider moving inside a fixed cylinder, the mechanism provides the vital capability of a gas engine: the ability to compress and expand a gas. One of the major disadvantages of the conventional linkage is the fact that this setting produces very limited motion of piston (large changes of volume during combustion) and high mechanical losses due to the friction between piston and cylinder liner. Friction between piston and cylinder is the biggest source of friction in ordinary engine, more than half of all mechanical losses came from contact between parts like piston, rings and cylinder.

III. VARIABLE PISTON MOTION IC ENGINE

In the following section will be presented basic parts and shape of a new IC engine concept. Variable piston motion IC engine is presented on the fig. 1. Basic parts of the VPM engine are: 1engine block, 2-engine head, 3-toroidal piston, 4-intake manifold, 5-exhaust manifold, 6-camshaft, 7

valve, 8-valve spring, 9-housing, 10-flywheel, 11-noncircular gear, 12-noncircular gear, 13noncircular gear, 14-noncircular gear, 15-stepper motor, 16-stepper motor, 17-crankcase. As can be seen from the described illustration toroidal piston make a movement conditioned by the mechanism consisting of two pairs of non-circular gears. In this article will not be presented detailed description of this concept, since it is not the intention of the authors to propose a kinematic analysis of a new internal combustion engine design but only thermodynamic features and advantages over ordinary spark ignition engines.

VPM IC engine has a two pairs of non-circular gears (NCG). A NCG is a special gear design with special characteristics and purpose. While a regular gear is optimized to transmit torque to another engaged member with minimum noise and wear and with maximum efficiency, a non-circular gear's main objective might be ratio variations, axle displacement oscillations and more. In fact this feature of NCG is very important for synthesis of mechanism where is intermittent-motion required. This intermittent-motion mechanism combines circular gears with noncircular gears in a planetary arrangement. With such planetary differential gear it is possible to achieve very complex movement, where toroidal piston is able to provide motion with variable displacement and variable compression, also because of the characteristics of NCG, piston dwell at TDC and BDC is also feasible. Dwell time or dwell angle is important fact during combustion process. In conventional engine this dwell angle can be changed due to variations of ratio between connecting rod and crank radius. Piston dwell at TDC and at BDC are often mentioned, it should be noted that strictly, there is no dwell period in ordinary mechanism. The piston comes to rest at precisely the crank angle that the crank and rod are in line (TDC and BDC), and is moving at all other crank angles. At crank angles which are very close to the TDC and BDC angles, the piston is moving slowly. It is this slow movement in the vicinity of TDC and BDC that give rise to the term piston dwell. If the piston dwells longer near top dead center and ignition is initiated properly, there will actually be a longer period of time for the pressure created during combustion to press against the top of the piston. This process occurs within the engine and its part of the thermodynamic cycle of the device. In all IC engine useful work is generated from the hot, gaseous products of combustion acting directly on moving surfaces of the engine, such as the top of a piston. This moving boundary of combustion chamber is the focus of this paper. In generally moving of the piston is responsible for the volume changing during process of combustion. In this paper was presented IC engine where this boundary, i.e. top of the piston, actually not moving in a large portion of heat addition.

IV. ADVANTAGES

A major source of engine wear is the sideways force exerted on the piston through the connecting rod by the crankshaft, which typically wears the cylinder into an oval cross-section rather than circular, making it impossible for piston rings to correctly seal against the cylinder walls. Geometrically, it can be seen that longer connecting rods will reduce the amount of this sideways force, and therefore lead to longer engine life. However, for a given engine block, the sum of the length of the connecting rod plus the piston stroke is a fixed number, determined by the fixed distance between the crankshaft axis and the top of the cylinder block where the cylinder head fastens. Thus, for a given cylinder block longer stroke giving greater engine displacement and power, requires a shorter connecting rod (or a piston with smaller compression height), resulting in accelerated cylinder wear. Idea is to eliminate normal force at all, in this engine design it is possible to reduce mechanical losses with transfer normal force on cylinder wall into the force on gear teeth and force on piston disc which have hydrodynamic lubrication (very low friction). Also such engine design is able to provide such piston motion where heat addition can be done during smaller changes of volume when combustion occurs.

V. CONCLUSION

In this article was presented one approach for improvement of spark ignition engine efficiency. Described concept has several advantages over ordinary SI engines. All of these mentioned advantages show that the potential to increase the efficiency of the SI engine conditions is not yet exhausted. The engine used for most contemporary motor vehicles is the four-stroke SI internal combustion engine, in that sense in this paper is presented such engine. A novel Otto cycle engine concept in which intake and compression are carried out through unconventional piston mechanism is presented in this paper. With longer piston dwell near TDC and eliminating normal force on cylinder wall it can be expected that thermal efficiency and mechanical efficiency will be increased. It can be noted that this engine concept has lower number of parts than ordinary boxer engine. It is clear that the efficiency of modern IC engine cannot be much increased, which is also one of the reasons for the development of new propulsion systems. However, at the time in which every year world produces a large number of vehicles, where there is still no real alternative, a minimum improvement of any segment of today`s engines will certainly be felt on a global level.

REFERENCES

[1]. New Internal Combustion Engine Jovan Dorić Nebojša Nikolić.

[2]. Efficiency of A New IC Engine Concept with Variable Piston Motion Jovan Ž. DORIĆ, Ivan J. KLINAR.