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AN OVERVIEW OF SIX STROKE ENGINE

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Abstract

The increasing demand for low emission and low fuel consumption in modern combustion engines requires improved methods for combustion engine. The quest for an engine which having the same or more power with higher fuel efficiency than the existing ones has started before many years. There is at this day no wonder solution for replacement of internal combustion engine. Only improvements of current technology can help it progress within reasonable time and financial limit. Lots of research works are conducting on this topic nowadays and billions of explosion engine are working day and night worldwide. As a result of these researches a new engine concept is formed which is six stroke engine. Six stroke engines is a type of an internal combustion engine based on the four stroke engine but with the additional complexity indented to make it more efficient and reduce emission. This paper primarily concerns with review of Six Stroke Engines, its architecture, working along with its advantages.

Keywords - Engine, stroke, combustion, heat, efficiency.

1. INTRODUCTION

The majority of the actual internal combustion engines, operating on different cycles have one common feature, combustion occurring in the cylinder after each compression, resulting in gas expansion that acts directly on the piston (work) and limited to 180 degrees of crankshaft angel. According to its mechanical design, the six-stroke engine with external and internal combustion and double flow is similar to the actual internal reciprocating combustion engine. However, it differentiates itself entirely, due to its thermodynamic cycle and a modified cylinder head with two supplementary chambers: Combustion, does not occur within the cylinder but in the supplementary combustion chamber, does not act immediately on the piston, and it's duration is independent from the 180 degrees of crankshaft rotation that occurs during the expansion of the combustion gases (work). The six stroke engine has the same basic mechanism of transmitting power as the traditional Internal Combustion Engine i.e., by reciprocating motion of the piston which is converted into the rotary motion of the crankshaft. The six stroke engines are mostly preferred in heavy vehicles where the prime focus is on load carrying capacity rather than fuel economy. It consists of six strokes which are due to the radical hybridization of 2 strokes and 4 strokes engines, i.e. the piston in each stroke goes up and down six times for the injection of fuel. The six stroke engine consists of 2 chambers having internal combustion and external combustion wherein, the unused or waste heat from the 4 stroke Otto cycle is then

used to carry out further two strokes. These two additional strokes increase the work extracted per unit input of energy, and will include preferably a multiple of five non-uniform cylinders, and will have an energy efficiency of up to 30% higher than that of a 4-stroke internal combustion engine. Engine has greater thermal efficiency, greater performance and compatibility to various fuels. Further proposals are made for alternate fuels that can be used in the engine to increase its efficiency and reduce emissions

2. TWO APPROACHES IN SIX STROKE ENGINE

The term six stroke engine describes two different approaches in the internal combustion engine, developed since the 1990s which are as follows:
In the ***first approach***, the engine captures the waste heat from the four stroke Otto cycle or Diesel cycle and uses it to get an additional power and exhaust stroke of the piston in the same cylinder. Designs either use steam or air as the working fluid for the additional power stroke. As well as extracting power, the additional stroke cools the engine and removes the need for a cooling system making the engine lighter and giving 40% increased efficiency over the normal Otto or Diesel Cycle. The pistons in this six stroke engine go up and down six times for each injection of fuel. These six stroke engines have 2 power strokes: one by fuel, one by steam or air. The currently notable six stroke engine designs in this class are the Crower's six stroke engine, invented by Bruce Crower of the U.S.A; the Bajulaz engine by the Bajulaz S A Company, of Switzerland; and the Velozeta's Six-stroke engine built by the College of Engineering, at Trivandrum in India.

The ***second*** approach to the six stroke engine uses a second opposed piston in each cylinder which moves at half the cyclical rate of the main piston, thus giving six piston movements per cycle. Functionally, the second piston replaces the valve mechanism of a conventional engine and also it increases the compression ratio. The currently notable six stroke engine designs in this class include two designs developed independently: the Beare Head engine, invented by Australian farmer Malcolm Beare, and the German Charge pump, invented by Helmut Kottmann.

3. ARCHITECTURE OF SIX-STROKE ENGINE

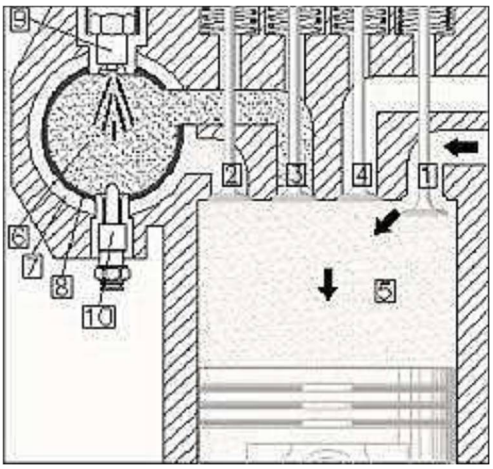


Fig 1: Components of Six Stroke Engine

Main Components of Six-Stroke Engine are as follows:
1. Intake Valve

2. Heating Chamber Valve
3. Combustion Chamber Valve
4. Exhaust Valve
5. Cylinder
6. Combustion Chamber
7. Air Heating Chamber
8. Wall of Combustion Chamber
9. Fuel Injector
10. Spark Ignition System

4. WORKING

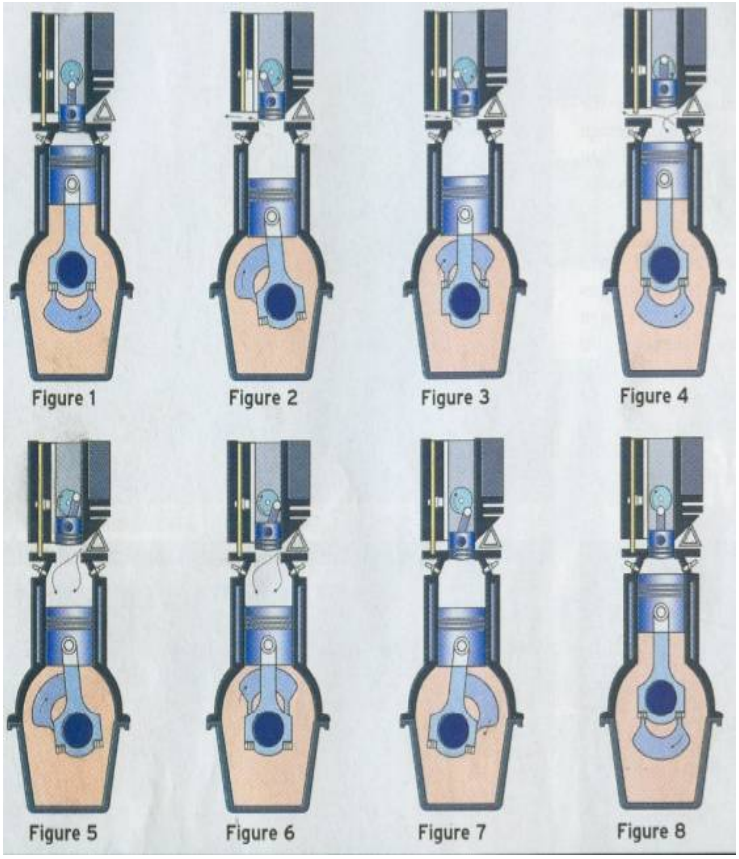


Fig2: Six stroke engine & their working function

Working principle of six stroke engine completed in six steps which are as follows:-
[1] FIRST STROKE (SUCTION STROKE)
During the first stroke the Inlet valves opens and air- fuel mixture from carburetor is sucked into the cylinder through the inlet valve and piston moves from TDC to BDC.
[2] SECOND STROKE (COMPRESSION STROKE)
During the second stroke, piston moves from BDC to TDC. Both the inlet valve and exhaust valves are closed and the air- fuel mixture is compressed.

[3] THIRD STROKE (FIRST POWER STROKE)
During the third stroke, power is obtained from the engine by igniting the compressed air- fuel mixture using a spark plug. Both valves remain closed. Piston moves from TDC to BDC.
[4] FOURTH STROKE (EXHAUST STROKE)
During the fourth stroke, the exhaust valve opens to remove the burned gases from the engine cylinder. Piston moves from BDC to TDC.
[5] FIFTH STROKE (SECOND POWER STROKE)
During the fifth stroke, the exhaust valves remains close and the water Inlet valves open. Fresh water from the water Inlet valves enters the cylinders through the secondary water Induction system. Piston moves from TDC to BDC.
[6] SIXTH STROKE (SECOND EXHAUST STROKE)
During the sixth stroke, the water exhaust valves remain open. The water sucked into the cylinder during the fifth stroke is removed to the atmosphere through the water exhaust valve. Piston moves from BDC to TDC and six stroke is completed.

5. ADVANTAGES

The main advantages of six stroke engine are as follows:
[1]Reduction in fuel consumption
[2]Dramatic reduction in pollution normally up to 65%
[3]Better scavenging and more extraction of work per cycle
[4]Lower engine temperature - so, easy to maintain the optimum engine temperature level for better performance
[5]Less friction – so, less wears and tears
[6]The six-stroke engine does not require any basic modification to the existing engines. All technological experience and production methods remain unaltered
[7]Higher overall efficiency

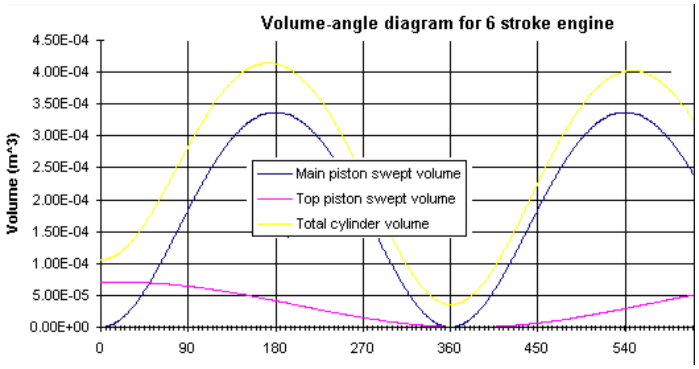
6. DISADVANTAGES

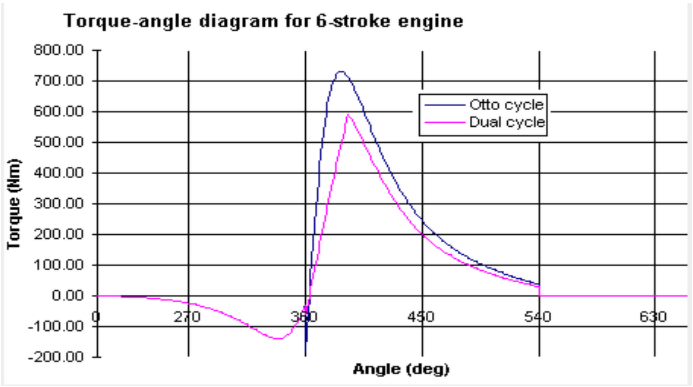
The main drawbacks of six stroke engine are as follows:
[1] Complex head design
[2]Complex cam design foe exhaust (due to 2 exhaust strokes)
[3]Heavier engine (due to combustion chamber)
[4]Thermodynamically the engine is stable, yet the designing of parts becomes more and more complex as the torque requirement increases
[5]High Initial cost Due to change in gear structure
[6] High Manufacturing cost in six stroke engine

7. APPLICATIONS

Applications of six stroke engine are as follows:
It is used in
[1]Motor boats
[2]Motor Pumps
[3]Generators
[4]Stationary Engines

8. GRAPHS FOR A SIX STROKE ENGINE





9. CONCLUSION

There is, at this day, no wonder solution for the replacement of the internal combustion engine. Only improvements of the current technology can help it progress within reasonable time and financial limits. The six-stroke engine fits perfectly into this view. Its adoption by the automobile industry would have a tremendous impact on the environment and world economy, assuming up to 40% reduction in fuel consumption and 60% to 90% in polluting emissions, depending on the type of the fuel being used. It is commercially obvious that the big market it for automobile, heavy goods, construction site and farm vehicle. This is a priority for the six stroke engine, reducing fuel consumption and pollution without any effect on performance will reassessed the concept of the automobile.

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