

Six Stroke CI Engine - A Review

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Abstract— The modern four stroke internal combustion engine has been widely applied due to excellent power to weight ratio and reliability. However, the major downside of the even most efficient modern 4 stroke engine is the production of significant amounts of excess heat energy, dissipated though the cylinder walls of the engine and expelled as waste energy during the exhaust stroke of the cycle. The development of a more efficient six stroke internal combustion engine for increasing the efficiency of four stroke engine for that the final two strokes designed to use of exhaust and convert it into power stroke and finally six stroke working as exhaust stroke and also better scavenging. Some of basic modifications are done in four stroke engine and made a six stroke engine we can increase the brake thermal efficiency of the engine.

Key words: 2-Cylinder 6-Stroke Engine, efficiency, ratio

I. INTRODUCTION

The six-stroke engine is a type of internal combustion engine is petrol or diesel engine with advance feature of more power generation some complexity intended to make it more efficient and utilize the fuel. These engines almost consist of similar components as that of the four stroke engine with addition of two more valves. The working concept is similar to the actual internal reciprocating combustion engine as a reciprocal movement which is converted into a rotating movement by means of a connecting rod and of a crankshaft.

The six-stroke engine has a second compression and combustion processes before exhaust process. The basic characteristics of this engine have been numerically predicted by using the thermodynamic model and a phenomenal model. Further combustion phenomenon had been observed by using a rapid compression-expansion machine (RCEM).

Since the fuel in one cycle was divided into two combustion processes and the EGR effect appeared in the second combustion process, the decreased maximum cylinder temperature reduced NO concentration in exhaust gases. It was further confirmed that soot formed in first combustion process was oxidized in second combustion process. Therefore 6-stroke DI diesel engine has significant possibilities to improve combustion process because of its more controllable factors relative to a conventional four-stroke engine.

II. ABOUT SIX STROKE ENGINE

To further the study of six stroke engine in short-term, unconventional solutions, a one cylinder, four- cycle, 16-horsepower, internal combustion engine has been modified with the goal of higher efficiency.

The combustion converts chemical energy into usable power, and likewise, the vaporization of water converts waste heat energy into usable power. By harnessing waste heat, the added strokes effectively reduce fuel

consumption, and therefore emissions, without significantly compromising on power. The big advantages is that, we have got in six stroke engine, the waste of heat created the power in fifth stroke, and power has to be generated in the fifth stroke Due to the waste of heat. The heat is used to generate the steam from the water which is further used as a 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.

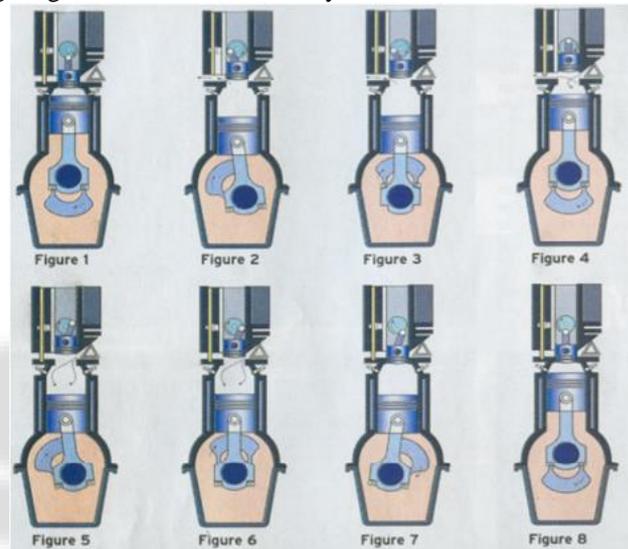


Fig. 1: Six stroke engine & their working function

III. WORKING OF SIX STROKE ENGINE

Six Strokes engine has consist of the six processes in a complete cycle such as four stroke engine consist only four process in a complete cycle. These six processes are as:-

A. First Stroke (Suction Stroke):

During the first stroke the Inlet valves opens and air- fuel mixture from carburettor is sucked into the cylinder through the inlet valve and piston moves from TDC to BDC.

B. 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.

C. 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

D. 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.

E. 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.

F. 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. These are the process that may be repeated again & again and the engine start working with the high amount of power and torque production with less fuel consumption. The six stroke engine may be further work in the otto and duel cycle. In a six stroke engine the energy absorption is less because of slower acceleration of reciprocating parts The piston speed of the upper piston is about a quarter of the main piston; therefore its service life should be at least twice that of the main piston.

IV. LITERATURE REVIEW

Prashant Haridas Pande [1], In mechanical design, six stroke engine is in double flow similar to the actual internal reciprocating combustion engine. The velozeta is one of the type of six stroke engine. In Velozeta engine, fresh air is injected into the cylinder during exhaust stroke, which expand by heat and therefore forces the piston down for an additional stroke. The six stroke engine is thermodynamically more efficient. Thus the engine seems to show 40% reduction in fuel consumption dramatic reduction in air pollution, adaptability to multi fuel operation. That improves the thermal efficiency reaching up to 50% and 30% for actual internal combustion. 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. Better fuel economy and cleaner burning. Longer service intervals and considerably reduced tooling costs when compared with a conventional OHC four-stroke design torque is increased by 35% and efficiency increased by the same.

Tejaskumar U Kothari et al., [2] The new advancement of six stroke internal combustion engine, the fifth stroke or the second power stroke uses the heat evolved in the exhaust stroke as heat required for the sudden expansion of the secondary fuel which pushes the piston downwards for the second power stroke thereby the rotating the crankshaft for another half cycle. As heat evolved in the fourth stroke is not wasted, the requirement for a cooling system is eliminated. Here fuel is injected once in every 3 complete cycles of the crankshaft which is any time better than a 4 stroke ICE where fuel is injected once in 2 complete cycles of the crankshaft. It should be noted that efficiency of the 6 stroke ICE is more than the existing 4 stroke ICE. Major type of secondary fuels used in the 5th stroke is air and water. The fuel efficiency of the engine can be increased and also the valve timing can be effectively arranged to extract more work per cycle. The brake thermal efficiency of four stroke two cylinder diesel engine can increases by modified its some component and convert into six stroke engine. Better scavenging is possible because exhaust of first cylinder

exhaust is become an inlet of second cylinder during the fifth stroke and its work as second power stroke the exhaust during the sixth stroke.

V. ADVANTAGES

- 1) Thermal efficiency reaching 50% (30% for the actual internal combustion Engine)
- 2) Fuel consumption reduced by more than 40%
- 3) Reduction of chemical, noise and thermal pollution
- 4) Higher efficiency

VI. CONCLUSION

From the above data of six stroke engine is better than two or four stroke engine. Reducing fuel consumption and pollution without any effect on performance will reassessed the concept of automobile. 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 good impact on the environment and world economy.

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