International Journal For Technological Research In Engineering
Volume 7, Issue 8, April-2020 *ISSN (Online): 2347 - 4718*

SIX STROKE ENGINE

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ABSTRACT: One of the most difficult challenges in engine technology today is the severe need to increase engine thermal efficiency. Higher efficiencies mean less fuel consumption and lower atmospheric emissions per unit of work produced by the engine. In 1862 a Frenchman Lamphouse Beau de Roches gives his theory regarding the ideal cycle of the internal combustion engine. This theory is applied by a German engineer named Nikolaus A. Otto, who firstly built a successful four-stroke SI engine in 1876. The four- stroke combustion cycle later became known as the "Otto cycle". In four stroke engines, the piston executes four complete strokes within the cylinder, and the crankshaft completes two revolutions for each thermodynamic cycle. The disadvantage of the four-stroke cycle is that only half as many power strokes are 2 completed per revolution of the crankshaft. The capacity of the four strokes would be 340cc only. Less torque is generated during the process. Pollution is more in four stroke engines. In six strokes the engine captures the exhausted heat from the four-stroke cycle and uses it to get an additional power and exhaust stroke of the piston in the same cylinder. This heat is used to generate the steam from the water which is further used as a working fluid for the additional power stroke. This steam will force the piston down. As well as extracting power, the additional stroke cools the engine by water and removes the need for a cooling system making the engine lighter and giving 40% increased efficiency over the normal Otto 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.

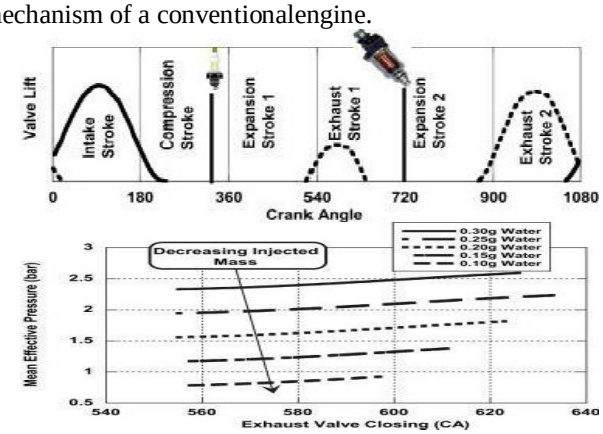
Keyword: six stroke engine, water injection, piston cam follower, Otto cycle, cylinder, and crankshaft.

I. INTRODUCTION

Firstly, in four stroke engine the inlet valve opens [I.V.O] and the fresh charge of fuel and air mixture is drawn into the cylinder.

Then the intake and exhaust valves are closed, and the piston is at its lowest position [B.D.C]. During the compression stroke, the piston moves upward compressing the air-fuel mixture. But before the piston reaches its highest position [T.D.C], the spark plug injected the air-fuel mixture and the mixture ignites, increasing the pressure and temperature of the cylinder. The high-pressure gases force the piston down, which in turn forces the crankshaft to rotate, producing a useful work output during the expansion or power stroke. At the end of this stroke, the piston is at its lowest position, and the cylinder is filled with the combustion products. Next the piston moves upward again, purging the exhaust gases through the exhaust valve and down a second time, drawing in fresh air-fuel mixture through the intake valve. Thus, the piston completes four stroke which gives two complete revolutions to the crankshaft. But in six strokes engine the exhausted gases which are left after combustion is further used. Then water is injected in super heated cylinder. Through hot gases the water changes its phase into steam as the temperature of the hot gases is high. This steam will work as a working fluid which will forces the piston down. This movement will give an additional two stroke for the same cycle. In this cycle, there is no need of external cooling system as the water will cools the system.

Less fuel is needed and also increases its power. It reduces the weight and complexity of the engines head by as much as 50%. Torque is increased by 35% and also increases its efficiency. The four-stroke block, pistons and crankshaft remain same. This combination of two stroke and four stroke technology is named as “six stroke engines” (2 + 4 = 6). Functionally, the second piston replaces the valve mechanism of a conventionalengine.



Mean effective pressure due to second expansion with water injection

II. ENGINE MODIFICATION

Tomakeaconventionalsixstrokeengine,afewmodificationscan be done so that it can be easily run. Below the cylinder head gasket, everything is conventional, so one advantage is that this modification can be transferred in the existing engines without changing the bottomend.

2.1 Crankshaft

In four stroke engines, the crankshaft rotates about 720 degree while the camshaft rotates 360 degree to complete one cycle. But in six stroke engine the crankshaft must rotate 1080 degree to rotate the camshaft 360 degree to complete one cycle. Thus, the gear ratio of six strokes will be 3:1 instead 2:1 which is of four stroke engines.

Theteethofgearincrankshaftwillbe18andincamshaftthegear teeth will be 54. The gear used in this is helical type gear

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which gives high speed and high-speedrotation.

OLD NEW

CRANKSHAFT AND CAMSHAFT

2.2 Camshaft

When camshaft rotates 360 degree in six stroke engines, the cam has been divided into 60 degree among the six-strokes. There are two exhaust strokes, one will be at the time of fourth stroke through which hot gases or burnt gases are left out and thesecond one is at the six stroke which pushes the steamout.

OLD

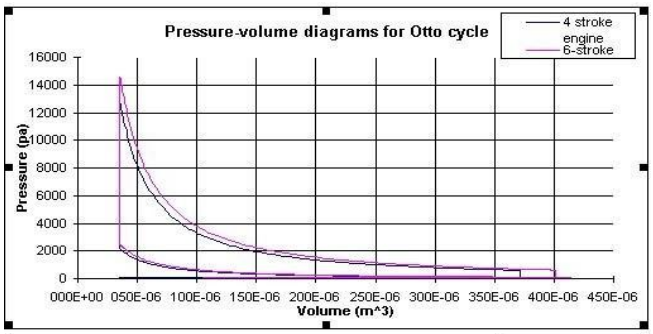
NEW

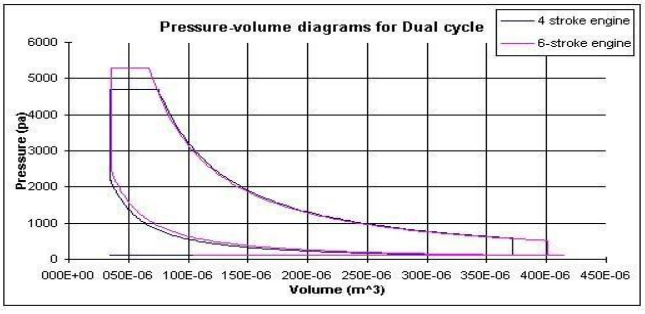
Cams and Camshaft

2.3 CamFollower

The shape of follower which is used in four stroke engines is flat from the bottom. But when reducing the duration of opening the valve from 900 degree to 600 degree only then the shape of the follower must be changed from flat to 01

Comparison of Six Stroke Engine with Four Stroke Engine





III. ADVANTAGES OF SIX STROKEENGINE

1. In six stroke engine the change in volume during the compression stroke is slightly higher than four stroke engines after the ports areclosed.
2. The expansion stroke is also much greater in six strokesthan four strokes, both from T.D.C. to B.D.C. and from T.D.C. till the exhaust port isopen.
3. More energy is extracted from the expansion stroke in six strokes.
4. Torque is increased by 35% in six strokeengines.
5. Efficiency is also increased in six strokeengines.
6. Reduction inpollution.
7. Reduction in fuelconsumption.
8. Lower engine temperature so no need of extra cooling system.

IV. CONCLUSION

This article elaborately discusses about how to convert a four-stroke conventional engine into a six-stroke engine with some modification. The modifications are the gear ratio between the crankshaft and the camshaft and also of the camshaft. The efforts done in six stroke engines previously were done by solenoid valves and DC-motortostarttheengine.Inthisresearch it is proven that the six-stroke engine can work by same conventional mechanical valve and the conventional engine starter. Higher mean efficiency means lower fuel consumption and lower atmosphericemission. Due to water injection, the cooling system is improved. It enables lower engine temperature and therefore increases its overall efficiency. This is the main advantage of six stroke engine. Using this technology by the automobile industry would have a tremendous impact on the environment and world economy, assuming upto 40% reduction in the fuel consumption and 60% to 90% in pollutingemissions.

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Biography:

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