

Study And Analysis Of Six Stroke Engine

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Abstract:

One of the most difficult challenge in engine is that to increase the thermal efficiency of the engine and it is very essential to increase the thermal efficiency of the engine. four stroke diesel engine and otto cycle engine have very low thermal efficiency due to high amount of energy is lost in exhaust and also cooling of the engine. it is estimated about 35 percent of fuel energy is lost in exhaust of engine and 30 percent in cooling of engine. out of the remaining 35 percent of energy of the fuel about 50% of energy gets converted into the work. two extra additional stroke have to be added to increase the thermal efficiency and from the addition of the two additional stroke engine, we can avoid from the big problem.

Keywords: Six-Stroke engine, water injection system.

Introduction:

The term six stroke engine describes two different approaches in internal combustion engine developed since the early 1880s, to improve its efficiency and reduce emission. we can increase the brake thermal efficiency of the engine. also the dramatic reduction in pollution and better scavenging occurs. these six stroke engines have two power strokes - one by fuel, one by steam or air. the currently notable six stroke engine design in this class are the Crower 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 six stroke engine built by the college of engineering at Trivendrum in India. The efficiency of internal combustion engine is very low due to loss of energy in exhaust, cooling of an engine. The difficult challenges in engine technology are the urgent need of increase in engine thermal efficiency.

There are many losses in the internal combustion engine as below:

1. Time loss(6%)
2. Heat loss(12%)

3. Blow Down loss(2%)

Heat loss is the Big loss in the internal combustion engine which is very difficult to eliminate. So there are three Major losses Which would affect the thermal efficiency of the engine. Six stroke is one of the Best Solution for this problem.

In the First Approach, The Engine captures the Heat Loss from the four stroke otto cycle or Diesel cycle and uses its to power an additional power and exhaust stroke of the piston in same cylinder. The piston in this type of six stroke engine go up and Down six times to complete one cycle in a combustion engine. Fresh water which Injected into the cylinder after the exhaust stroke is quickly turned to superheated steam, And second power stroke would be performed in the cylinder after the exhaust. Which causes the water to expand to 1600 times its volume and force piston Down for an additional stroke and can reduce the temperature of the engine.

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.

The Six Stroke Engine Has the following Advantages and Disadvantages:

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. Two expansion (work) through six stroke.
5. Direct Injection and optimal fuel combustion at every engine speed.
6. We can eliminate the radiator.
7. We would get the better scavenging in fifth stroke.

Disadvantages:

1. High Initial cost Due to change in gear structure.
2. High Manufacturing cost in six stroke engine.
3. engine size Increases Due to additional stroke in engine, fifth stroke and sixth stroke.

Working of six stroke engine:

First stroke (suction stroke):

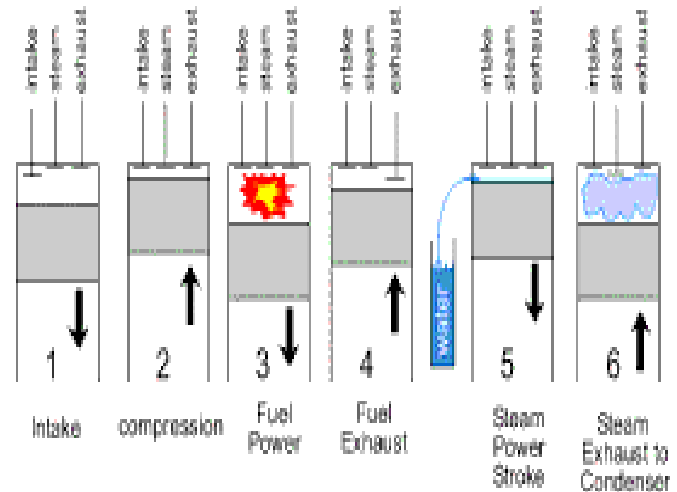
During the first stroke the Inlet valves opens and air- fuel mixture from carburator is sucked into the cylinder through the inlet valve and piston moves from TDC to BDC.

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.

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.



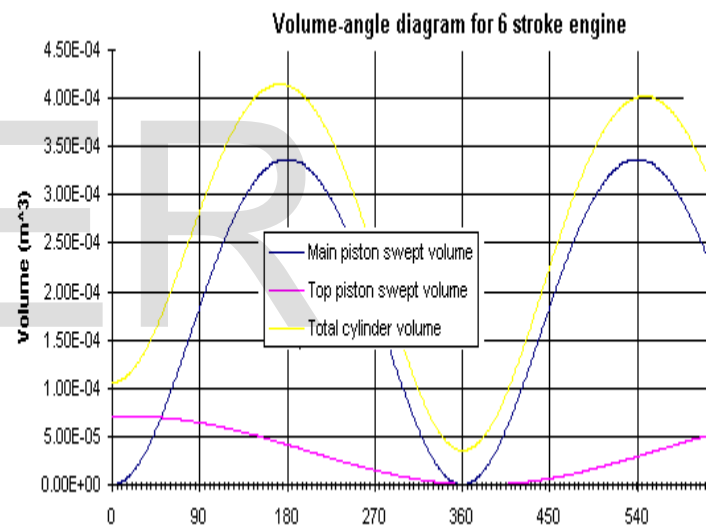
Fourth stroke (exhaust stroke):

During the fourth stroke, the exhaust valve open to remove the burned gases from the engine cylinder. Piston moves from BDC to TDC.

Fifth stroke (second power stroke):

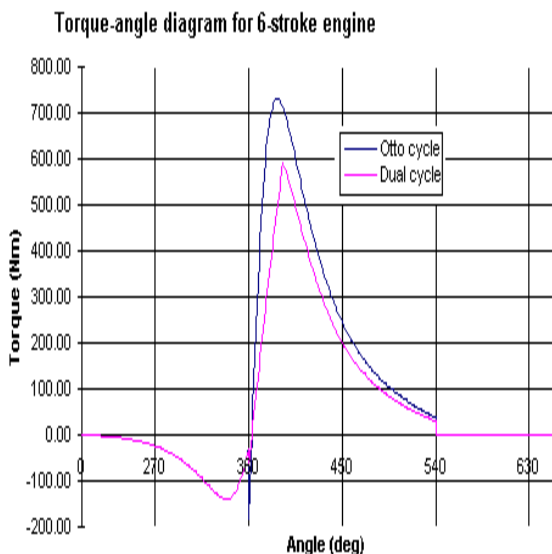
During the fifth stroke, the exhaust valves remains close and the water Inlet valves open. Fresh water from the water Inlet valves enters the cylinders through the secondary water Induction system. Piston moves from TDC to BDC.

Graphs for six stroke engine:



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.



Modification in six stroke engine:

Modification are done to specific parts of conventional four stroke engine so that the new engine with six stroke engine works successfully. these modification are:

1. crankshaft to camshaft ratio

Modification:

in conventional four stroke engine, the gear at crankshaft must rotates 720. while the camshaft rotates 360 to complete on cycle for six stroke engine, the gear at the crankshaft must rotates 1080 to rotates the camshaft 360 and complete one cycle. Hence their corresponding gear ratio 3:1.

2. Camshaft Modification:

in the six stroke engine the 360 degree of the cam has been divided into 60 degree among the six stroke . the exhaust cam has 2 lobes to open the exhaust valve at fourth stroke (first exhaust stroke) and at the sixth stroke to push out the steam.

3. Cam follower Modification:

the bottom of shape of regular follower has the flat pattern, which is suitable with the normal camshaft for four stroke engine. when reducing the Duration of valve opening from 9000 to only 6000 the shape of the follower must be changed from flat to roller or spherical shape.

Percentage Increase in Efficiency:

the mileage of a normal car is 11.76 kmpl. i.e. it covers 100 km. in 8.55 liters of gasoline on average.

if a six stroke engine is coupled instead of four stroke engine then practically it is observed that the fuel requirement is Decreased by 25% though the manufacture claim it to be 40% so eventually the combo car covers 100 km in 2.94 liters i.e. at an average of 34 kmpl.

Results:

There are comparison Between four stroke and six stroke engine based on otto cycle and dual cycle as Below:

COMPARISON BETWEEN 4-STROKE AND 6-STROKE

	Based on Otto Cycle			Based on Dual Cycle		
			Total Torque			Total Torque
4 stroke			49.82			39.36
6 stroke	Main	Top	61.38	Main	Top	42.87
	56.78	4.61			38.66	
	Increase in torque		23.20%	Increase in torque		8.93%

Conclusion:

This is the big challenge of the automobile Industry, to Increase the thermal efficiency of the engine and reduction in fuel consumption. As well as to avoid the polluting emission. As we all know that the big problem our country faces is that fuel rate is increasing day by day. The cost of fuel is very costly now a days. The big problem has to be solved from the six stroke engine. Fuel consumption is very less comparison to the other engines. The fuel efficiency of the engine can be Increased and also the valve timing can be effectively arranged to extract more work per cycle. Better scavenging is possible as air intake occurs During fifth stroke and exhaust During the sixth stroke. Its adoption by the automobile Industry would have a tremendous Impact on the environment and world economy, assuming up to 40% reduction in the fuel consumption and 60% to 90% in polluting emission

Depending on the type of fuel being used.

References:

1. tajas kumar U. kothari, devranjan kumar, k.d. tandel, Design and analysis of six stroke engine, vol-2, issue:03,2014, ISSN:2321-0613.
2. prof. v.k. manglik, Development of high efficiency engine by combining I.C. engine and E.C. engine. e-IISN:2278-1684, p-IISN:2320-334X.
3. Akash Alkhaniya, Aakash Kotiyal, Concept of Six Stroke engine, IISN:2348-7593.
4. V. Ganesan, Internal Combustion Engine.
5. Kapil N. Kariya, Mayur M. Raje, velozeta six stroke engine, IISN:2319-507X.

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