A REVIEW PAPER ON SIX STROKE INTERNAL COMBUSTION ENGINE

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ABSTRACT

As it is known that four stroke engine have more efficiency than two stroke engine, and further to improve efficiency of four stroke engine and reduce environment pollution, a new concept come up with six stroke engines. Present four stork engine give approximate 30% fuel efficiency and it is expected to give 50% fuel efficiency by six stroke engine. Temperature of a diesel engine reaches to approximate 1400^{o}C which is the main reason of NO_x emission so to reduce this we use a secondary fuel below the combustion temperature.

In four strokes engine there is four strokes in which for tow revolution of crank shaft there is one power stroke and in six stroke engine there is two power strokes for three revolution of crank shaft. In which second power stroke is more fuel efficient and less pollution produce.

KEYWORDS*: Six stroke engines, combustion, efficiency, NO_x emission.*

INTRODUCTION

Six stroke engine is similar to four stroke engine consist same component as four stroke engine. Which use two kind of fuel in which primary fuel is generally diesel used.

Six stroke engine consist same four similar stroke as four stroke engine and last two stroke come up with addition of secondary fuel into the combustion chamber which use the heat remain of exhaust gases of fourth stroke of four stroke engine and give a power stroke to improve efficiency, reduce temperature of engine and make proper utilization of heat energy. Six stroke engines have been applied to IC engine to improve on two stroke and four stroke engine. These engines can be divide into two groups based on number of piston.

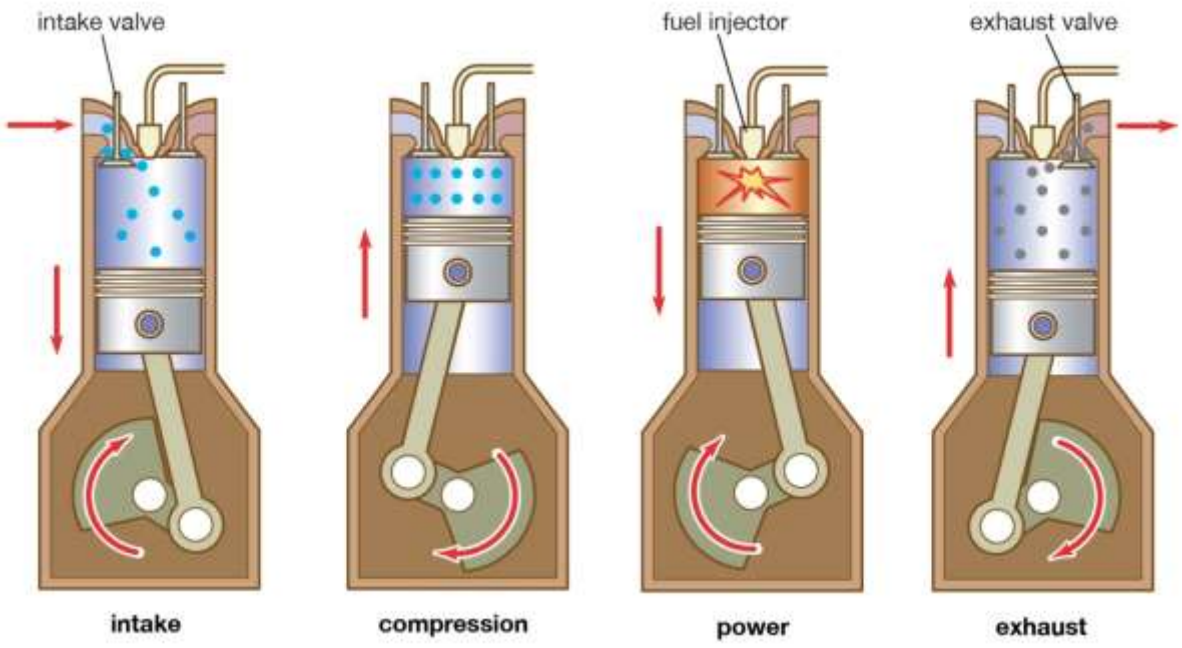
In the single-piston designs, the engine captures the heat lost from the four-stroke Otto cycle or Diesel cycle and uses it to drive an additional power and exhaust stroke of the piston in the same cylinder in an attempt to improve fuel-efficiency and/or assist with engine cooling. The pistons in this type of six-stroke engine go up and down three times for each injection of fuel. These designs use either steam or air as the working fluid for the additional power stroke.

The designs in which the six strokes are determined by the interactions between two pistons are more diverse. The pistons may be opposed in a single cylinder or may reside in separate cylinders. Usually one cylinder makes two strokes while the other makes four strokes giving six piston movements per cycle. The second piston may be used to replace the valve mechanism of a conventional engine, which may reduce mechanical complexity and enable an increased compression ratio by eliminating hotspots that would otherwise limit compression. The second piston may also be used to increase the expansion ratio, decoupling it from the compression ratio. Increasing the expansion ratio in this way can increase thermodynamic efficiency in a similar manner to the Miller or Atkinson cycle

Working

In four stroke SI engine there are four strokes

1. Intake: In this stroke fresh air-fuel mixture intake is take place from intake manifold. And piston move top dead centre to bottom dead centre.
2. Compression: In this stroke piston move from bottom dead centre to top dead centre and compress the air fuel mixture.
3. Power stroke: In this stroke ignition of air fuel mixture take place which apply a force to piston and this force move the piston from top dead centre to bottom dead centre and this stroke provide the sufficient power to run the engine.
4. Exhaust: this is the final stroke of a four stroke engine in which exhaust of residual gases take place.



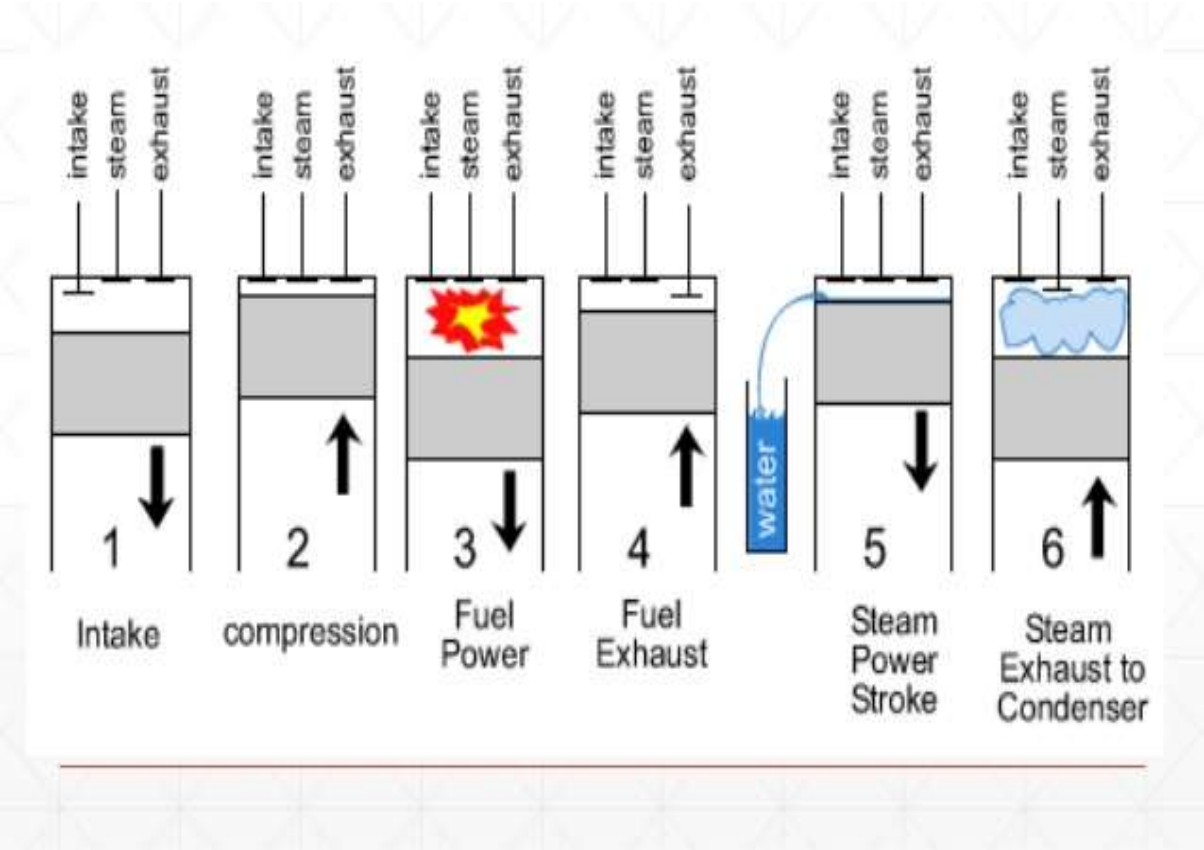
Working of four stroke engine

But in six stroke engine there is some modification take place. In six stroke engine we use an extra valve then four stroke engine on cylinder head to inlet and outlet of water and steam.

In four stroke engine crank shaft rotate twice for the single rotation of cam shaft but in six stroke engine crank shaft rotate thrice for the single rotation of crank shaft so gear ration of cam shaft to crank shaft should be 3:1 instead of 2:1.

Cam shaft modification is also required to open and close the extra valve of water inlet and steam outlet.

After the modification in the engine after the fourth stroke water is intake by the extra valve provide at the cylinder head. And due to the high temperature of the engine the water instantly convert into steam and reduce the temperature of engine and apply a force on piston which make this stroke as secondary power stroke and due to water intake it become more efficient less polluted power stroke and in sixth stroke exhaust of steam take place.



Working of six stroke engine

In diesel engine we can use ethanol as secondary fuel or we can use hot compressed air in the fifth stroke of the six stroke engine.

Advantages

1. More energy is extracted from the expansion stroke in six stroke engine. As it convert it heat losses in to useful work by providing extra power stroke.
2. As we get two power strokes for three revolution of crank shaft as compare to one power stroke for two revolution of crank shaft in four strokes engine we get Torque is increased by approximate 35% in six stroke engine.
3. As it reduces the temperature of cylinder directly so less No_x produce which lower air pollution.
4. It reduces engine temperature so extra cooling system is not required.
5. Increased fuel efficiency obtains.

Disadvantages

1. Initial cost of engine increase due to change in gear structure.
2. Manufacturing cost increase.
3. Size and complexity of engine increase due to two additional strokes.

Conclusion

As we all know that pollution is a very big problem in present time and IC engine are producing a large amount of air pollution due to a very large use of IC engines in transportation vehicle which is the basic need of every country. We are reducing the pollution of air by opting for alternative options of transportation and travelling. Where the six stroke engine contribute its part to reduce air pollution compare to traditional IC Engines by proper utilization of fuel which produce less exhaust gases and it also reduce the engine temperature which also

help to reduce the air pollution. As the fuel efficiency of this engine is also high so in result we get less use of fuel which makes it economy friendly.

We can assume that it reduce the fuel uses up to 40% and also reduce the air pollution from 50 to 90% which is depend upon type of fuel use. Its initial manufacturing cost is high but as it use less amount of fuel it is economy friendly too and it also reduce the air pollution.

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