

# Comparison between free piston and conventional internal combustion engine: A REVIEW

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**Abstract:** Now a days an automotive world is moving towards the new researches trained regarding to the increase the efficiency of the engines to get more output . To achieve this motto there will be the introduction of free piston engine. This paper includes how the free piston engine concept is more efficient than traditional conventional engine in our day to day life. After in the mid of the 20 Th century the number of research work are going on the free piston engine. so there will be change in the conventional engine by changing the crank shaft system by another techniques like air compressed system, hydraulic system and cam system (in revetec engine ) etc. as this changes made there will be increase in the efficiency of the engine . Also going to discuss the various features of the free piston engine with the conventional engine. A goal of this paper is to show the effectness of the free piston engine over conventional engine.

**Key words:-** Free piston engine, Conventional internal combustion engine, efficiency of engine.

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## 1. INTRODUCTION:

In the upcoming era there will be the lots of competition between the speeds of the various automobile and also looking for getting more output by supplying limited or less input. So that to getting this there will be lots of experiments are going to full fill the needin the half of the 20th century. So one of the such experiment lead to the invention of the free piston engine. Which was the great achievement to the researcher that it will give more efficiency than the conventional engine? Introduction of cam in the revetec engine will increase 14% efficiency of the engine.[5] In the free piston engine there will be so many types of the engine but their motto is same and they overcome the drawback of the conventional engine like their weight , friction etc. almost all are mentioned in the topic . Under this topic we compare the thermodynamics and their relatives diagram to understand the basic difference. If we handle this topic more efficiently and skilfully then it will help to give new direction to the automobile world.

### 1.1 Conventional Internal Combustion Engine (basics):

Internal Combustion Engine this is the engine where the combustion of different fuel takes place to generate the power in presence of air (oxidizer). In the conventional internal combustion engine the combustion takes place within the combustion chamber made up of a cast iron or aluminium. This action is completed under the stokes of the piston. Piston move up and down with the action of the crankshaft and connecting rod connected to piston with the help of the gudgaon pin with this the piston moves up and down. As shown in the fig. the conventional

ICE engine. There was the different ICE engine, and they all work on to different cases like 2S and 4S cycle, in this some time to ignite the fuel the spark plug is used. The conventional engine consist of the piston, crank shaft, connecting rod, combustion chamber , exhaust and inlet port, spark plug and water cooling jacket this all this things are included in the conventional internal combustion engine. In this the fix compression ratio is used for the process .For 2S and 4S different compression ratios are used. And also in the conventional IC engine the efficiency is less than 50% due to the various losses occur in it.[4]

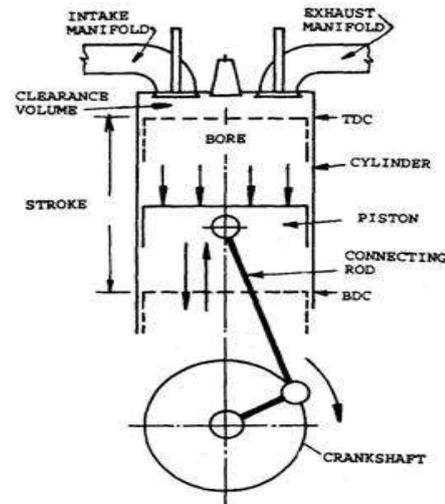


Fig.1.1 Conventional IC Engine [7]

### 1.2 Free Piston Engine basics:

This type of piston is basically different from the regular engine as there is no CRANKSHAFT is used in the

engine. As in the conventional engine the motion of piston is controlled by the mean of the rotating crankshaft, but in this motion is not controlled by the crankshaft i.e. free motion is available. The motion is controlled with the help of the action of the gases and other forces acting on the piston. Due to such feature there will be the reduction in the frictional losses of the engine and also give the chances to use the different compression ratio for the new operation regarding to the engine. And it will also give the variable stroke length for the different uses.

This engine gives the perfect control over the piston in the process of the ignition and compression of the fuel. And also restrict the excess pressure in the cylinder as there will be hitting of the piston head with the cylinder head. It gives a simple design having only few parts which reduces the vibration. It will give the chance of using more fuel in single cylinder. The free piston engine works on the principle of 2S engine because power stroke is required at every forward and backward motion of the piston.

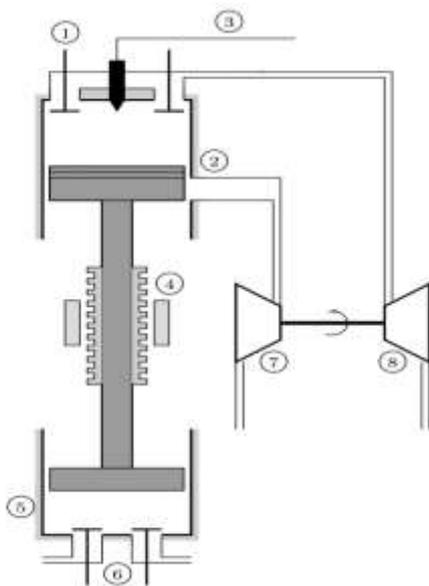


Fig.1.2 Free Piston Engine [1]

In the free piston engine the driving of the piston is main thing. So depending of the motion of the piston by the various forces the free piston engines are divided into the different categories which are as follow:

1.2.1 Single piston:

In this the piston is moved with the help of the hydraulic or pneumatic power. In this the simple design of the engine give us a high controllability in among all the free piston engines. As shown in the diagram the free piston engine is work here the hydraulic chamber support both the action i.e. loading and rebounding of the piston[1]

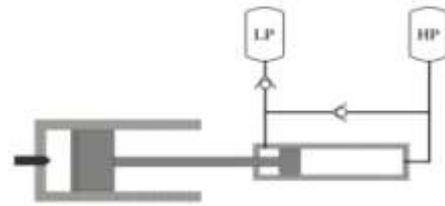


Fig.1.2.1 Single Piston Engine[1]

1.2.2 Opposed Piston:

This contains two pistons with the common combustion chamber. These designs are given the perfectly balanced engine and also the less vibration occurred in it. It reduces the other losses like heat losses due to the opposite head of the piston. The system is as shown in the fig

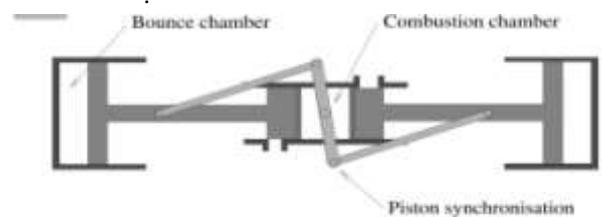


Fig. 1.2.2 Opposed piston[1]

1.2.3 Gas generator:

In this engine the load is act only for the supercharged the compressed air. And the o/p is taken purely from the power turbine as shown in the fig.

This can provide the high compression and pressure ratio. This engine is just work as the other engine but this will increase the concept of the free piston engine in various point of view.

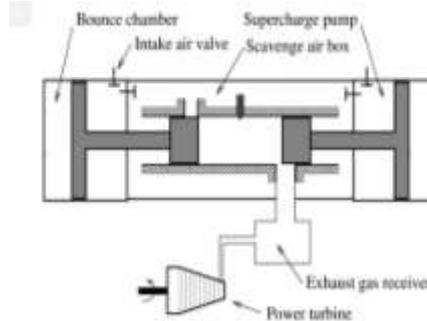


Fig.1.2.3 Gas Generator engine [1]

**2. THE ADVANTAGE OF FREE PISTON ENGINE OVER CONVENTIONAL INTERNAL COMBUSTION ENGINE:**

1 The construction of the free piston engine is simple and cheap compared to the conventional IC engine. [3]

2 The simple construction leads to removal of the crankshaft and the connecting rod as in the conventional engine which causes the reduced in the frictional losses of the engine. And also reduced the vibration in the engine. [2]

3 In case of the compression ratios in free piston engine as the maximum speed of the engine is achieve the compression ratio also capable to compute with the speed but in the conventional IC engine the compression ratio is fixed. so the free piston engine is give the various compression ratio as per the need. [2]

4 As in the free piston engine they work on the low temperature so there will be less heat losses in the engine as in the conventional internal combustion engine. [3]

5 As in the conventional internal combustion engine to start the engine we need to provide several rotations to the crankshaft to start but in the free piston engine we need to move the piston once forth and back rotation with the help of the hydro power or by the different forces mention above. [3]

6 The compactness of the engine provides the low weight and the size of the engine Compared to the conventional internal combustion engine. [1]

7 Due to the less no of parts and the low friction maintenance cost is low compared to the conventional engine. [3]

8 The various compression ratios available in the free piston engine provide the optimisation of the combustion process which is not allowed in the conventional engine. [3]

### 3. COMPARISON:

#### 3.1 According to the operation

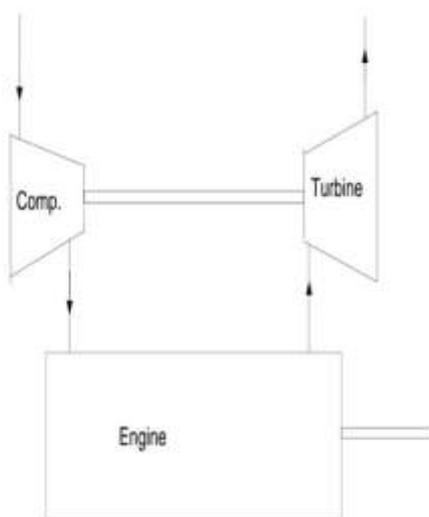


Fig.3.1.A Conventional engine [4]

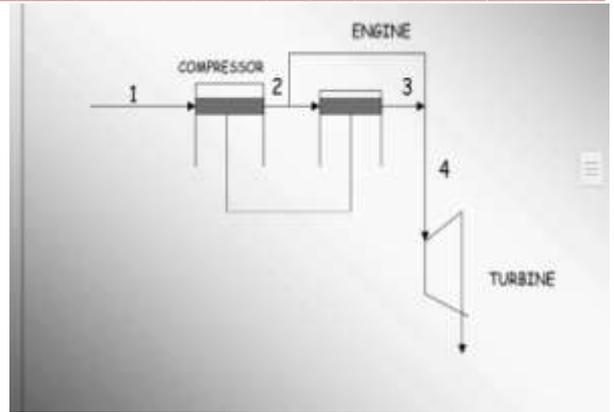


Fig. 3.1.B A Free Piston Engine [3]

#### 3.2 According to the T-S Diagram

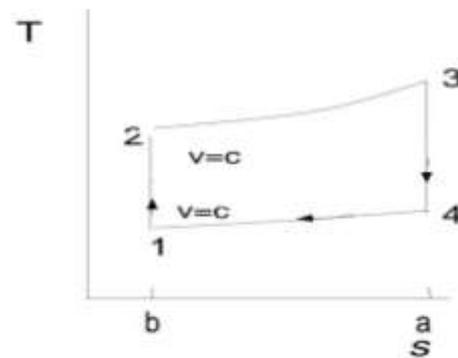


Fig.3.2.A T-S diagram of Conventional Engine [4]

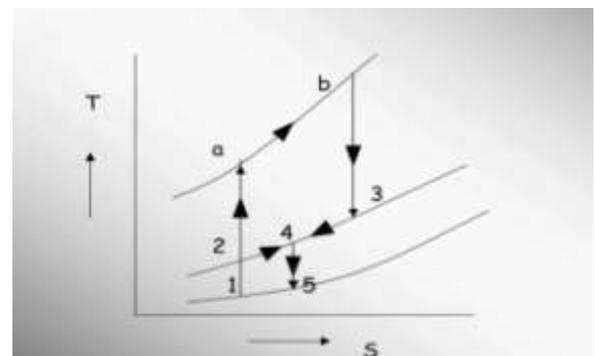


fig. 3.2.B T-S diagram of Free Piston Engine [3]

### 4. CONCLUSION:

As the basic comparison between the free piston engine and conventional IC engine is presented above so that it will give an clear idea about the both engine and how free piston engine is efficient than the conventional engine. And also give the idea about the user friendly nature of the free piston. From the above extract we can say that the free piston engine is more efficient and economical than the conventional one. And there will be the need of further research to make it more usable to implement the engine into the automobile to increase the efficiency of the automobile.

### 5 FUTURE SCOPES:

If we handle this technology very skillfully then it will help to improve the output of the cars. If we go through the available data then the cars available like MARUTI car in India it will give 68 kW power for the 6000 rpm and the BMW gives the 240 kW for 5500rpm. [7] But if you consider the energy output of the free piston engine it will give nearly 813 kW of power to only 613 rpm [6]. If we handle this topic softly then it will give a chance to increase the power of cars by implementing the engine into the cars. It will give the wide scope to the researcher to research to implement the engine into the car as Toyota stepping towards this invention. [8]

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