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ANALYSIS OF A GREEN ENGINE

by

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Abstract
The green engine is one of the most interesting discoveries of the new millennium. It has got some unique features that were used for the first time in the making of engines. This engine is a pistonless one with features like sequential variable compression ratio, direct air intake, direct fuel injection, Multi-fuel usage etc. the efficiency of this engine is high when compared to the contemporary engines and also the exhaust emissions are near zero.

Key words: Analysis, green and engine

Introduction

The name Green engine reveals that this is well suited for the atmosphere and its pollution free. It has many unique features and it has high efficiency compared to the other type of engines. Pollution is the major problem nowadays which is eradicated by using the green engine. It is a 6 phase internal combustion engine, and it also has the important characteristic such as zero emission, noise free, lower cost etc.

Green Engine has six phases

Intake, Compression, Mixing, Combustion, Power and Exhaust

It has unique features like a direct air intake, without the strong swirling, it also has the features such as a sequential variable compression ratio, super Air Fuel Mixing, Lower surface to volume ratio, controllable combustion time, constant volume combustion, multi power pulses, high working temperature etc. it has the internal combustion Engine which gives a higher expansion ratio.

The background/history of the study

The Green Engine Company was a British Engine Manufacturer founded by Gustavus Green in Bexhill to produce engines of his design. It flourished especially as a designer of Aeroplane Engines during the first two decades of the 20th century. In 1915 the firm produced a range of water-cooled, mostly inline engines.
Green engines powered many pioneering British aircraft, including those of Alioto Vewon Roe (Avro founder) and Samuel Cody.

Statement of the problem

Today, the world is facing major problems regarding energy crisis. Along it, we are also facing major environmental troubles due to increase in harmful gases which are evolved from nowhere else but the combustion of these conventional energy sources. Statistics show that, the daily consumption of petroleum all over the world today is 40 million barrels of which about 50 percent is for automobile use. This is the reasons for the invention of Green Engine.

Aim/objective of the project

The major aim of the project is to reduce the level of pollution into the environment and also to save energy.

The scope of the project

This project covers the development of mechanical operating components which serves as a means of generating power to the automobiles and aircrafts engines. The engine can be modified to suit other requirement.

The significance/importance of the project
The significance/importance, of the green engines lies in the efficiency when the present world conditions of limited resources of energy are considered.

Literature review
Compared to conventional piston engines, operated on four phases the Green engine is an actual six (6) independent or separate working processes, intake, compress, mixing, combustion, power and exhaust, resulting in the high air charge rate, satisfactory air fuel mixing, complete burning high combustion efficiency and full expansion ratio. The most important characteristics is the expansion ratio being much bigger than the compression ratio. Therefore, an Engine having extremely high thermal efficiency near zero emissions,
Quietness, light and small, lower cost with capability of burning of various fuels has come into being.

Technical features of green engine

Direct air intake
Direct Air Intake means that there is no air inlet pipe, throttle and inlet valves on the air intake system. Air filter is directly connected to the intake part of the engine and together with the less heating effect of air intake process, benefited from lower temperature of independent intake chamber; a highest volumetric efficiency which makes engine produce a high torque of output on all speed range is achieved. The pump loss which consumes the part of engine power is eliminated. Also fuel measuring facilities are built in and parts are saved.

Direct fuel injection
Direct fuel injection can provide higher output and torque, while at the same time it also enhances the responses for acceleration.

Super air fuel mixing
Since the independent air-fuel mixing phase is having enough time for mixing air and fuel under strong swirling and hot situation, the engine is capable to burn any liquid or gas fuels without modifications. An ideal air fuel mixture could delete carbon-monoxide (Co) emission. Also centrifugal effect coming from both strong swirling and rotation of the burner makes the air fuel mixture denser near the spark plug. It benefits to cold starting and managing lean burning.

Lowest surface to volume ratio
The shape of combustion Chamber herein can be designed as global as possible. Thus, a lowest surface is obtained and the engine is having less heat losses and high combustion efficiency.

Controllable combustion time
Due to the independent combustion phase, compared to the conventional engine whose performances lack of efficient combustion time, resulting in heavy CO emission and low fuel usage rate, the Green Engine has a Sufficient Controllable combustion time match any fuel.

Constant volume combustion
The fuels can generate more energy while the combustion occurs on the constant volume. Also, the constant volume combustion technology can allow the engine to have a stable combustion when the lean burning is managed. Moreover, more water can be added in to make the much higher working pressure and drop down the combustion temperature, so power is added heat losses and Co emissions are decreased.

Multi-power pulses
The Green Engine operate on multi-power pulses with a small volume of working chamber contrasted to the conventional engine does on the single or pulse with a large working chamber. Obviously a small volume of chamber only needs little space resulting in compact structure and limited size, also a small amount of air fuel mixtures being ignited on each power pulse can greatly cut down exploration noise.

High working temperature
Because the burner, which is made of high heat resistance and low expansion rate material, such as ceramic, operates without cooling, a relatively high working temperature can eliminate the quenching zone which is the main solute of emission and can greatly reduce the heat losses on the combustion chamber.

High expansion ratio
High expansion ratio can make the burnt gases to release much more power. In other words, the waste gases while they run out of the engine are only brining much less energy with them. Therefore, the engines thermal efficiency is greatly raised and at the same time, the noise and temperature of the exhaust are tremendously dropped.

Vibration free
As major moving parts, vanes which are counted in little mass and operated symmetrically, the performance of the engine is very smooth. Hence, vibration is eliminated.

Advantages
As obvious from the technical features which include effective innovations, the advantages of the Green Engine over the contemporary piston engines are as follow.

Limited parts
There are only some dozens of parts easy to be manufactured in the engine structure.

High efficiency
Because many great innovations are being employed in the engine design such as; direct air intake, sequential variable compression ratio, super mixing process, constant volume combustion, controllable combustion time, high working temperature of the burner, high expansion ratio and self adopting sealing system etc.

Near-zero emissions
With perfect air-fuel mixture, complete combustion under lower peak temperature and free of quenching effect, the emission of Co, H2 and N_2 could be near-zero, thereby, a catalytic converter could not be required at all.

Smooth operation
Due to inherence of good dynamic and static balance the performance of the Green Engine is as smooth as an electric motor.

Fast accelerating response

Direct injection, little rotating inertial and deleted reciprocating motion can characterized the Green Engine with operating at a very fast accelerating response.

Working principle-six (6) phases of green engine

First phase: intake

Air arrives through the direct air intake port and moves through a duct which is provided on the sides of the vane and rotor. The duct is so shaped that when the air moves through, strong swirls generate when it gets compressed in the chamber.

Second phase: Compression

The rushing blades into the small chambers in the rotor where the compression is obtained.

Third phase: mixing

As soon as the chamber comes in front of the fuel injector, the injector sprays fuel into the compressed air and they mix properly, becoming very dense thereby allowing for lean-burning of charge when finally ignited by the spark plugs.

Fourth phase: Combustion

As the chamber rotates towards the "end" of its path, it is positioned before the spark plug which ignites the air-fuel mixture, then the burner rotates to position itself in front of the narrow exit.

Fifth phase: Power

The expanded gas rushes out of the chamber through the narrow opening, thereby pushing the vane in the process. The sudden increase in volume ensures that more power is released or in other words, the thermal energy is fully utilized.

Sixth phase: Exhaust

As the thermal energy is fully utilized, the exhaust gases bring along comparatively less heat energy.

Thus, increasing the engine's thermal efficiency and also because of the complete burning of the charge, poisonous gases like CO are absent in the exhaust emissions.

Summary and conclusion

The Green Engine is a six (6) phase internal combustion engine with much higher expansion ratio. The term "phase" is used instead of "stroke" because stroke is associated with the movement of the piston from bottom dead centre (B.D.C) to the top dead centre (T.D.C) or vice versa and since the Green Engine is pistonless, hence it works in phases as given below.

1. ***Direct Fuel Injection:*** Fuel is injected in compressed air directly.
2. ***Combustion***: In final chamber combustion is done.

3. ***Power:*** Power is achieved in the power stroke from expanding flue gases.
4. ***Exhaust:*** After power stroke, flue gases are expelled from engine through exhaust manifold.

With the evolution of these phases it can be compared with conventional engine based on the following criteria.

1. Emission, Noise and Vibration, Fuel feasibility, volumetric efficiency, Heat loss in exhaust gas, Torque and work output of engine.

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