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A performance analysis of green engine

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Abstract
This paper describes about the green engine, which is one of the most interesting discoveries of the new millennium. It has got some unique features when compared to other contemporary engines. This engine is one of the pistonless with features like high expansion ratio, strong swirling, sequential variable compression ratio, direct intake etc. The efficiency of this engine is very high and also the exhaust emissions are near zero. The significance of the engine lies in the efficiency when the present world is facing some serious problems regarding energy crisis. Various researches on this engine is being carried out and yet to find the demerits of this engine. Generators have been produced by using green engine. Hence the GREEN ENGINE is the ENGINE OF FUTURE. There are many disadvantages of conventional engine one of which pollution The efficiency of this engine is high when compared to the contemporary engine and also the exhaust emission are near zero. The significance of the engine lies in the efficiency when the present word condition of limited resource of energy are considered. Prototypeof the engine has been developed.

Keywords: engine, prototype, compression ratio

1. Introduction
A green engine is any power source or "engine" from which the fuel or energy source is a green resource or zero emission energy source such as wind, solar or wave energy. 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 piston less 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. The significance of the engine lies in the efficiency when the present world conditions of limited resources of energy are considered. Prototypes of the engine have been developed. Generators have been produced with the green engine. A green engine is any power source or "engine" from which the fuel or energy source is a green resource or zero emission energy source such as wind, solar or wave energy. Examples include a electric motor driven by battery power derived from solar panels or motors running from power generated on a wind turbine farm.
Associated with green engines is "Green Engineering" which refers to engineering design and technology of process plants, power generation and other industrial processes that is targeted at reducing carbon emissions and pollutants to atmosphere or any engineering carried out to protect the planets environment.
Examples include wet scrubbing and gas scrubbing technology designed and installed on sulfuric acid plant discharge gases and combined cycle power plants to recover heat energy and maximize recovery of energy from fossil fueled power plants such as natural gas and coal plants. Any engineering and technology which increases efficiency of industrial plant and processes could be deemed "green engineering".
Green engineering could also fall into the category of renewable energy engineering technology such as solar power farms where engineering solutions are based on sustainable sources such as wind and solar energy. The subject is extensive however the above would give you a flavor for the scope that green engineering covers.

2. Technical Features
Compared to conventional piston engines, operated on four phases, the Green engine is an actual six phase internal combustion engine with much higher expansion ratio. Thus it has six independent or separate working processes: intake, compression, mixing, combustion, power and exhaust, resulting in the high air charge rate. Satisfactory air-fuel mixing, complete burning, high combustion efficiency and full expansion. The most important characteristic 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.

2.1 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 port 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.

2.2 Super Air-Fuel Mixing
Direct fuel injection can provide higher output and torque, while at the same time it also enhances the response for acceleration.

2.3 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 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.

2.4 Strong Swirling
As a tangential air duct in between combustion chamber and compression chamber, a very swirling which could lost until gas port is opened, can be formed while air is pumped into the combustion chamber. Consequently, the air-fuel mixing and the combustion process can have a satisfying working condition.

2.5 Sequential Variable Compression Ratio
This greatly revolutionary innovation can provide the most suitable compression ratio for the engine whatever operation mode it works on with burning variety of fuels. Therefore, an excellent combustion performance is attained.

2.6 Multi-Power Pulses
The green engine operates on multi-power pulses with a small volume of working chamber contrasted to the conventional engine dose on the single power pulse with a large working chamber. Obviously, a small volume of chamber only needs little space, resulting in compact structure and limited size.

2.7 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 NOx emissions are decreased

3. Construction of the green engine
As earlier mentioned, the Green engine is a six phase, internal combustion engine with much higher expansion ratio. The term “phase” is used instead of “stroke” because stroke is actually associated to the movement of the piston. The traveling of the piston from bottom dead centre to the top dead centre or vice versa is termed a stroke. But, in this engine pistons are absent and hence, the term “phase” is used. The six phases are: intake, compression, mixing, combustion, power and exhaust. Even though the engine is of symmetric shape, the vanes traverse an unsymmetrical or uneven boundary. This shape cannot be compromised as this a result of the path taken by the intake and exhaust air. This uneven boundary is covered by the vanes in a very unique fashion.

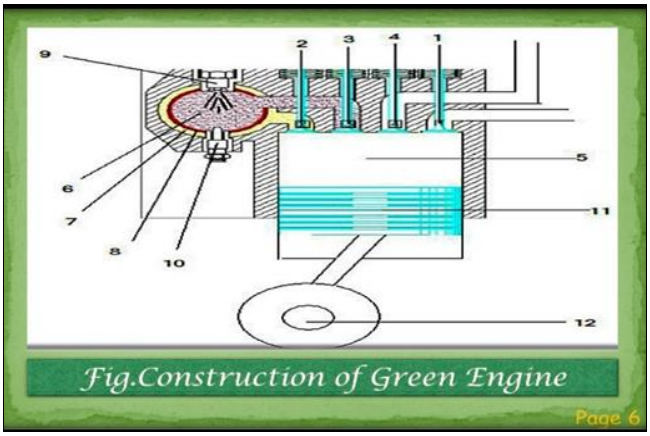

Fig 1: Construction of the Green Engine

4. Working of the green engine

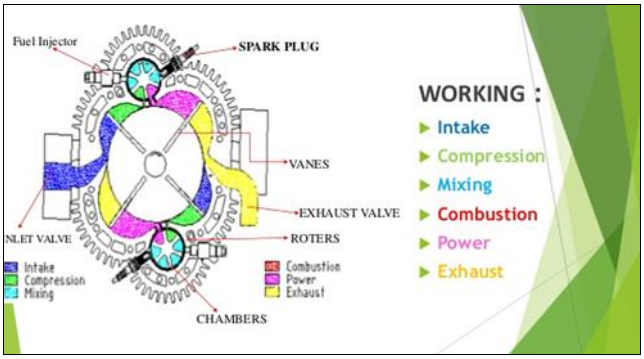

Fig 2: Green Engine

- **Intake**

The air arrives to the engine through the direct air intake port in the absence of an air inlet pipe, throttle and inlet valves on the air intake system. A duct 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. The air pushes the vane blades which in turn impart a proportionate rotation in the small rotor which houses the chambers. The inlet air duct ends with a very narrow opening to the chamber.

- **Compression**

The rushing air from the duct is pushed by the blades into the small chambers in the rotor. The volume of these chambers is comparatively very small. Naturally, the compression obtained by such a procedure is very satisfactory. As earlier mentioned, the compressed air is in a swirling state, ready to be mixed with the fuel which will be injected into the chamber when it will be place before the injector by the already rotating rotor.

- **Mixing**

As soon as the chamber comes in front of the fuel injector, the injector sprays fuel into the compressed air. Because of the shape of the chamber, the fuel mixes well with the compressed air. The importance of ideal mixing leads to deletion of CO emission. And also because of the strong swirling, a centrifugal effect is exerted in the air-fuel mixture. Moreover, the rotation of the burner, makes this

centrifugal effect all the more effective. Mixing phase has enough time to produce an ideal air-fuel mixture as the spark plug is positioned towards the other end of the rotor or burner.

- **Combustion**

As the chamber rotates towards the "end" of its path, it is positioned before the spark plug. A spark flies from the plug into the air-fuel mixture. Because of the mixing phase, the air-fuel mixture is denser near the spark plug, thereby, enabling lean-burning of the charge and also a uniform flame front. As soon as the whole charge is ignited, the burner rotates to position itself in front of the narrow exit.

- **Power**

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

- **Exhaust**

As the thermal energy is fully utilized, the exhaust gases bring along comparatively less heat energy. This mainly helps in the thermal efficiency of the engine. It raises 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.

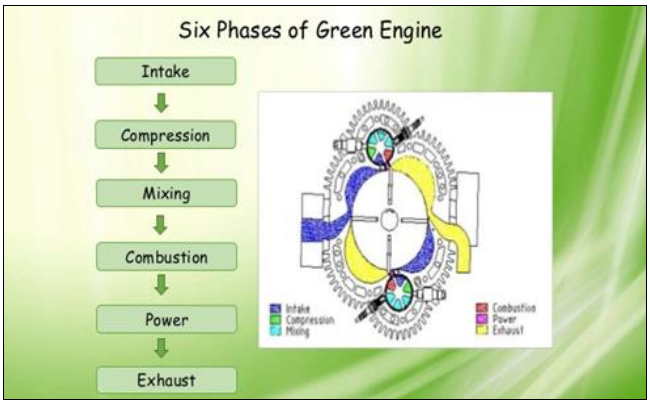

Fig 3: 6 Phases of Green Engine

5. Advantages

1. Small Size and Light Weight
2. High Efficiency
3. Smooth Operation
4. Quietness and Low Exhaust Temperature
5. Limited Parts
6. Multi-fuels
7. Low Cost

6. Disadvantages

1. Choking of flow during combustion due high-pressure difference and small clearance area.
2. Friction and wear.
3. Efficiency gets reduced due to leakage.

7. Applications

1. Like normal engine green engine can be employed in automobile and in aircrafts too.
2. Engineering application.
3. Military use.
4. Electrical generators.
5. Ships and submarines
6. Mines

Conclusion

As we have discussed there are lots of advantages of green engine over traditional IC engine. This study shows that GREEN ENGINE is beneficial and good efficiency over 2 Stroke and 4 Stroke. Hence it will be accepted and useful for some unique features.

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