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GREEN ENGINE

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ABSTRACT

Innovative thinking leads to development of new technologies. Today, the world is facing serious pollution crisis due to the exhaust gases from vehicles using petroleum-based fuel. The pollutants like HC, NO_x occurs due to the incomplete combustion of fuel. These pollutants are very harmful to human being causing various diseases. Also the fuel recourses are depleting rapidly.

This paper includes introduction to Green Engine, technical features, working and comparison with the conventional internal combustion. Engine, also its Pros and Cons with future applications.

This is six phase I.C. engine in which the priority is given to the proper mixing of fuel with the air thereby causing its complete combustion. Due to six phases of working, air-fuel mixing process and constant volume combustion with controllable time is achieved. So the Green Engine becomes the only real multi-fuel engine on our planet that is any liquid or gaseous fuel can be used. Therefore this also helps to overcome fuel-crisis.

"GREEN ENGINE" will bring new revolution in the field of engine technology.

I. INTRODUCTION

Every day, radios, newspapers, televisions and the internet warn us of energy exhaustion, atmospheric pollution and climate warming. After few hundred years of industrial development, we are facing these globality problems while at the same time we maintain a high standard of living. The most important problem we are faced with is whether we should continuous "developing" or "die".

Statistics show that, the daily consumption of petroleum all over the world today is 40 million barrels, of which about 50 per cent is used in communications and transportation. In this sort of consumption, about 70-80 per cent is for automobile use. That is to say, auto petroleum constitutes about 35 per cent of the whole petroleum consumption. In accordance with this calculation, daily consumption of petroleum by automobiles all over the world is over two million tones. At the same time as these fuels are burnt, poisonous materials such as 500 million tones of carbon monoxides (CO), 100 million tones of hydra carbons (HC), 550 million tones of carbon(C), 50 million tonnes of nitrogen oxides (NOx) are emitted into the atmosphere every year, severely polluting the atmosphere. At the same time, large quantities of carbon dioxide (CO_2) gases, resulting from burning, have also taken the major responsibility for the "green house effect". However, it is estimated that petroleum reserve in the globe will last for only 38 years. The situation is really very grim.

To counter this problem, the concept of green engine is introduced. This is six phase I.C. engine in which the priority is given to the complete mixing of fuel with the air thereby causing its complete burning. It is a multifuel engine; therefore the fuel crisis can also be overcome.

Compared to conventional piston engine operated on four phases, the Green Engine is an actual **six-phase internal combustion** engine with much higher expansion ratio. The six phases are **INTAKE, COMPRESSION, MIXING, COMBUSTION, POWER AND EXAUST.**

The main features of this engine are

- High air charge rate
- Satisfactory air-fuel mixing
- Complete burning
- High combustion efficiency
- Full expansion

The most important characteristic is the expansion ratio being much bigger than the compression ratio. Also the other main features are

- The Sequential Variable Compression Ratio,
- Constant Volume Combustion
- Self-adapting Sealing System.

Because of these revolutionary inventions the engine has some advantages like The thermal efficiency of the engine is increased. The engine is free of the harmful emissions. As more power is obtained in a less space, the engine is more compact and light. Also the reciprocating parts are eliminated, so the engine is vibration free.

2.1 The Various Technical Features of the Green Engine

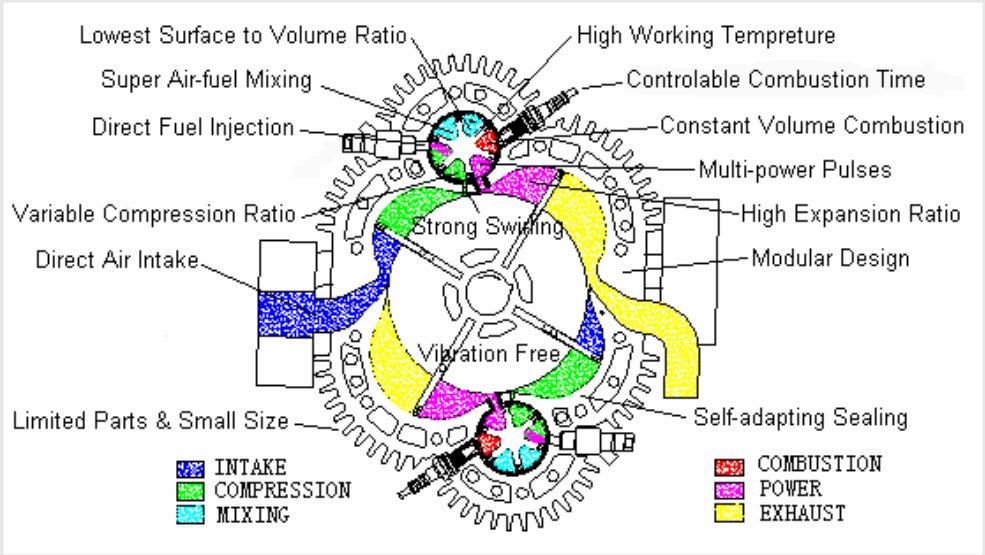


Fig.2 Technical Features of Green Engine

III. 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, therefore highest volumetric efficiency which makes engine produce a high torque of output on all speed range is achieved, and the pump loss which consumes the part of engine power is eliminated.

3.1 Strong Swirling

As a tangential air duck is between combustion chamber and compression chamber, a very strong swirling of air is achieved. Consequently, the air-fuel mixing and the combustion process can have a satisfying working condition.

3.2 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

3.3 Direct Fuel Injection

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

3.4 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 came from both strong swirling and rotation of the burner makes the air-fuel mixture denser near the spark plug, it benefits to cold engine starting and managing lean-burning, and allowing the engine use of mass control for output.

3.5 Lowest Surface to Volume Ratio

The shape of combustion chamber is parabolloidal. Thus a lowest surface-to-volume ratio is obtained, and the engine is having less heat losses and high combustion efficiency.

3.6 Controllable Combustion Time

Due to the independent combustion phase, compared to the conventional engine which 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 to match any fuels.

3.7 Constant Volume Combustion

The fuels can generate more energy while the combustion is occurred 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 so the heat losses and NOx emissions are decreased.

3.8 Multi-power Pulses

The Green Engine operates on the multi-power pulses with a small volume of working chamber, 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 explosion noise.

3.9 High Working Temperature

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

3.10 High Expansion Ratio

High expansion ratio can make the burned gases to release much more power, in other words, the waste gases while they run out the engine are only bringing much less energy with them, therefore the engine's thermal efficiency is greatly raised, and at the same time, the noise and temperature of the exhaust are tremendously dropped.

3.11 Self-adapting Sealing System

This is another greatly revolutionary innovation applied in the Green Engine; it can eliminate a number of seal plates or strips to achieve gapless seal and to provide most efficient and reliable seal system with less friction.

3.12 Vibration Free

As major moving parts, vanes, which are counted in little mass and operated symmetrically, the performance of the engine is very smooth got away from vibration.

IV. WORKING OF THE GREEN ENGINE

The Green Engine has six phases which occur in the following sequence.

- Intake
- Compression
- Mixing
- Combustion
- Power
- Exhaust

1) Intake

The air is admitted directly inside the compression chamber. The air does not undergo any treatment before entry. The air filter is directly connected to the entry of the intake pipe. The amount of the air intake can be varied as per the fuel used.

2) **Compression**

The air admitted in, then enters into the compression chamber. The compression chamber has variable area. The central disc having arms pushes the air in the compression chamber.

The compression chamber is connected to the combustion chamber by a small diameter duct which is tangent to the combustion chamber. So as arm pushes the air in the compression chamber the pressurized air is forced to flow through this duct. As the air flow through it, the air is swirled very fast. The air thus enters the combustion chamber.

3) **Direct Fuel Injection**

One more facility is provided in the green engine is that of direct fuel injection. The fuel injected is also variable. The amount of fuel injected is varied as per the mode of the vehicle.

4) **Super Mixing**

The combustion chamber is also rotating. This centrifugal force from the rotation along with the strong swirling causes the fuel to mix with air. The mixing assures the complete burning of the fuel. The super mixed charge is forced by the arm towards the spark plug.

5) **Combustion**

The charge is ignited by the spark plug. The combustion time can be varied to burn different grade of fuels. The controlled combustion time gives the complete burning of the charge. The emissions are greatly reduced.

6) **Power**

The burned products of the combustion are expelled out of the combustion chamber. The high pressure gases push the arm of the compression chamber causing work output. The power is obtained in the form of the power pulses. These pulses reduce the area of the engine. The power pulses also reduce the explosion noise.

7) **Exhaust**

The burned gases are expelled out. The gases are first expanded in the expansion zone. The expansion ratio is more which ensures the maximum work output. Also the maximum energy is gained from the gases. The temperature also reduces and hence an optimum utilization of the burned gases is achieved. The burned gases after expansion are pushed into the exhaust pipe and released into the atmosphere.

Thus the six-phase cycle is completed.

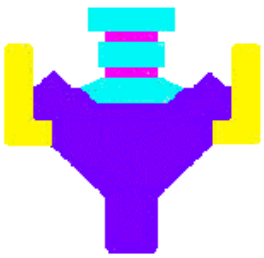
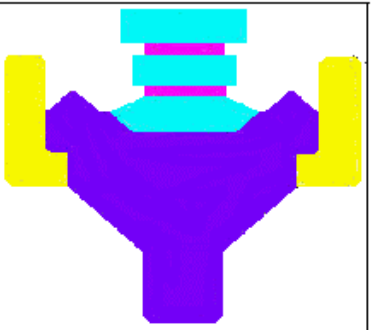
OUTLINE			
ITEM	GREEN ENGINE	STANDARD PISTON ENGINE	DIESEL ENGINE
	THT-C1B	Volvo Penta 230 S	Hercules 3400 DT
POWER	120 hp	120 hp	120 hp
WEIGHT	60 lbs	400 lbs	935 lbs
VOLUME	1 Cubic ft	11.2 Cubic ft	20 Cubic ft
SIZE	15"Diameter x 8"L	25"W x 24"H x 32"L	- - - - - - - -

Fig 3. Comparison of Green Engine with conventional I. C. engines

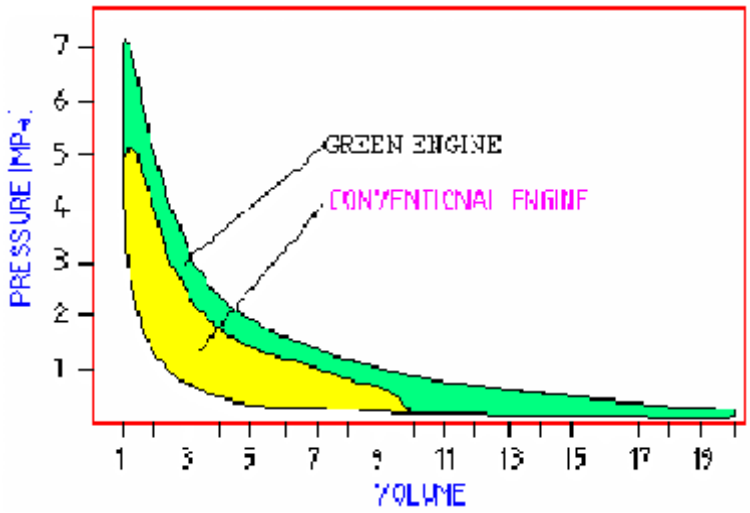


Fig 4. Graph of work and power output

4.1 ADVANTAGE

1) As Green Engine is very compact with multi-power pulses, the Size and Weight could be only 1/5 to 1/10 of the conventional piston engines on same output.
2) The Thermal Efficiency of the Green Engine could be potentially as high as 65%, even more if water add-in technology is to be considered.
3) Due to Six Phases of Working Principle, Super Air-fuel Mixing Process and Constant Volume Combustion with Controllable Time the Green Engine becomes the only real Multi-Fuels Engine on our planet; any liquid or gas fuels can be burned well.
4) With perfectly air-fuel mixture, complete combustion under lower peak temperature and free of quenching effect, the Emissions of CO, HC and NOx could be near zero, thereby a catalytic converter could be not required at all.
5) Due to inherence of good dynamic and static balance the performance of the Green Engine is as smooth.
6) Limited parts, small in size, light in weight and depended upon current mature materials and manufacture technologies, it means that it would be to being done on the much **Lower Cost** on manufacture, transportation, installing to other devices, and maintenance.

4.2 Distadvantage

1. Variation of HC emission.
2. Variation in smoke opacity.

V. APPLICATIONS

The Green Engines could be used as the ideal power plants on a very wide range of applications in transportation, communication, farm, mine, engineering, military uses, such as automobiles, aircrafts, boats, ships, hovers, tractors, locomotives, generators, snowmobiles, chainsaws, helicopters, tanks, torpedoes, submarines etc.

VI. CONCLUSION

The environmental problems can be effectively overcome by the use of Green engine. It can use almost any type of fuel available. It is superior to the conventional I.C. engine in terms of smooth operation, efficiency and cost. Compared to conventional piston engine operated on four phases, the Green Engine is an actual six-phase internal combustion engine with much higher expansion ratio.

Already it is being used in some of the application like aircrafts, ships and locomotives. Research is going on for its effective use in wider range of transport vehicles.

REFERENCE

[1]. T. Pushpara, & S. Ramabalan, "Green fuel design for diesel engine, combustion, performance and emission analysis" International Conference on design and manufacturing, IConDM 2013.

[2]. T. Bohl & G. Tian "Optical investigation on diesel engine fuelled by vegetable oils" The 6th International Conference on Applied Energy – ICAE2014.

[3]. I Wayan Surata et al., "Simple Conversion Method from Gasoline to Biogas Fueled Small Engine to Powered Electric Generator" International Conference on Alternative Energy in Developing Countries and Emerging Economies 2013.

[4]. M. Mofijur, M.G. Rasul, J. Hyde "Recent Developments on Internal Combustion Engine Performance and Emissions Fuelled With Biodiesel-Diesel-Ethanol Blends"6th BSME International Conference on Thermal Engineering (ICTE 2014).

[5]. Internal combustion engine- Mathur & Sharma. pp.1213 to1250.