EXPERIMENTAL INVESTIGATION OF SINGLE CYLINDER S.I ENGINE BY TEG AIR PEHEATING

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Abstract

The aim of our project is to reduce the engine exhaust gas emissions and improve the fuel economy by preheating the inlet air temperature to the engine using Thermo electric generator. By which better vapourization of fuel can be achieved resulting in the better combustion process. Due to which pollutant can be controlled. Thus improving better combustion process and reducing exhaust gas emission of an four stroke Spark Ignition engine. And experimental result have been taken will show the significant reduction in exhaust gas emission. Such as carbon monoxide and Hydrocarbon reduce by this method..

Keywords – *Emission, Inlet Air, TEG.*

I. INTRODUCTION

In current situation there is a rapid increase worldwide problem regarding fast economy development and subsequent short in energy, greenhouse effect has been increased recently to very high level within a short period of time thus leading to damage of ozone layer which might take several million years to recover. Out of the total heat supplied to the engine in the form of fuel, approximately, 30 to 40% is converted in to useful mechanical work; the remaining heat is expelled to the environmental pollution, so it is required to utilize waste heat in to useful work. The recovery of waste heat not only conserves fuel but also reduces greenhouse effect. The concept of increasing the fuel efficiency of petrol engine by preheating the intake air of the engine through carburettor. The humidity in the air affects the petrol vaporization in the carburettor. Therefore by preheating air to the carburettor to a considerable amount evaporation can be made easy and in turn complete combustion is being achieved. Thus a preheating system is being used which recover the heat from the exhaust gases through heat exchanger which recovers the heat, in order to improve the heat of the intake air an additional preheating element is being added to the setup which is being powered by the battery.

II. RELATED WORK

Chirtravelan et al.[1], have experimentally prove that the effect of preheated air on standard diesel fuel engine indicated a good result on emission control. NOx and CO emissions at intake air temperature of 55°C were less when compared at intake air temperature of 32°C. Result are proved from this experiments like that Higher inlet air temperature will be affect some factors (a) lower ignition delay (b) lower NOx formation. (c) Uniform or better combustion (d) lower engine noise (e) Easy vaporization (f) better mixing of air and fuel occur due to warm up of inlet air (g) lower CO emission.

D. Tamilvendhan [2] have performed that the Performance and Emission and Combustion Investigation on Hot Air by using the pre –heater in single cylinder, air cooled, vertical and direct injection diesel engine. The inlet side of the engine consists of anti-pulsating drum, air heater and air temperature measuring device. The amount of preheat required for the intake air is depends upon the load condition of the engine. Basically the engine requires more preheat when the starting condition and the idling condition and at lower loads but it requires less preheat when higher loads and peak loads are requires. The result from this paper is below when increasing temperature. 1. The brake thermal efficiency increases with increase in intake temperature, reaches a maximum condition and thereafter decreases considerably at all loads. 2. Reduces ignition delay and advances the occurrence of peak pressure. 3. Volumetric efficiency decreasing. 4. Decreases air density.

Chirtravelan. M et al,[3] worked on design and fabrication of air pre-heater for diesel engine. The effect of preheated air on standard diesel fuel engine indicated a good result on emission control. NOx and CO emissions at intake air temperature of 55°C were less when compared at intake air temperature of 32°C. Higher inlet air temperature causes lower ignition delay, which is responsible for lower NOx formation. Uniform or better combustion is occurred due to pre-heating of inlet air, which also causes lower engine noise. Easy vaporization and better mixing of air and fuel occur due to warm up of inlet air, which causes lower CO emission. From the test it is clear that the fuel consumption reduces and brake thermal efficiency increase with increase intake air temperature.

Manoj R et.al [4] Thus in this process as the fuel air mixture is being preheated before it is being fed in to the carburetor the air fuel mixture is expanded, complete combustion takes place inside the engine during power stroke. Because of complete combustion there is no unburned hydrocarbon while exhaust stroke, hence the hydrocarbon is completely burned this reduces the presence of hydrocarbon in flue gas. Thus emission of the hydrocarbon to a great extent. The ratio of expansion can be controlled by controlling the ratio of increase in temperature in the expansion chamber.

Kunik Lee et.al [5] Bismuth telluride is one of the promising materials for room temperature thermoelectric applications. In this study, solvo thermal synthesis successfully produced low-dimensional nano crystals of bismuth telluride. Bi2Te3 grains covered by Au or Ag metallic nano particles demonstrated both a higher Power Factor and Figure of Merit than pure Bi2Te3. The nano particle/matrix interface on grain geometry serves as a thermal energy retarder for phonons while allowing electrons to move across the interfaces effectively. The advanced TE material that was developed shows material properties with low thermal conductivity, high electrical conductivity, and high Seebeck coefficient which are very favorable for TE applications.

III. OBJECTIVES

1. Toimprove the fuel economy of the engine.
2. To reduce unburnt exhaust emission.
3. To reduce knocking inside the engine.
4. To maximize usage of heat supplied to the engine.
5. To increase the overall life of the engine.

IV. WORKING PRINCIPLE

Peltier air preheater works on the principle of “peltier effect”. Peltier effect states that “when a potential difference is applied between to two electrodes connected to the dissimilar semiconductors heat is transferred from one side of the thermo electric module to other side.This can be used to transfer heat from one side to other side”.We are using the hot junction of the thermo electric module to preheat the intake air of engine heat from the peltier element is transferred to the intake with the help of the radiator type heat sinks consist of copper tubes filled with siliconegel with fins and a fan to force the hot air through the fins. The fan used is 12 volt 0.4 amps fan which is being powered by the battery, while the cold side is left unused since we are using it for heating purpose but for the high life of the peltier element ordinary aluminium heat sink is being placed and fan is also used on the cold side too of same rating.

V. DIAGRAM

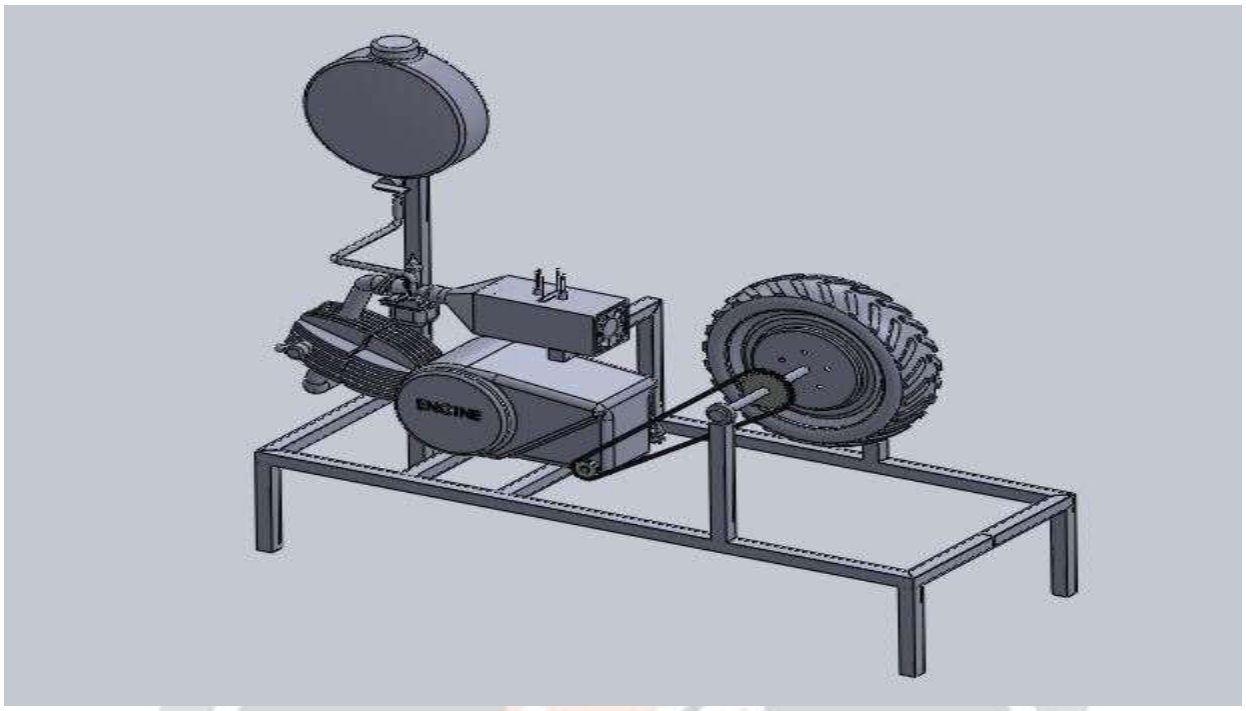

Figure 1. 3D Diagram

VI. DESIGN CALCULATION

THERMO ELECTRIC GENERATOR UNIT:

The total surface of area of the TEG Unit as,
H= Height of the TEG
L= Length of the TEG
W= Width of the TEG
H=10cm L=20cm W=10cm
Surface Area of cube = 6a2 = 6*10*10 = 600cm²
SA= 2(10+20+10) = 80cm²
Surface Area of Stocked Value = 600+80-20
= 660cm²
TEG plate size = 8*8cm² (for square plate)

THERMO ELECTRIC GENERATOR MASS FLOW RATE;

The flow of air inside the TEG box as,
Density of Air = 1.225kg/m³
Velocity of Air = 12.5m/sec
Area of Cuboid = 0.1*0.1 = 0.01m²
Mass flow rate of Air = ρAV
= 1.225*12.5*0.01
= 0.1531kg/sec

MANIFOLD MASS FLOW RATE;

The flow of air Inlet Manifold as,
Density of Air = 1.225kg/m³

Velocity of Air = 75m/sec
Area of Pipe = $\pi/4*0.03^2 = 0.000706m^2$
Mass flow rate of Air = ρAV

$= 1.225*75*0.000706$
$= 0.0649kg/sec$

VII. AFTER MODIFICATIONS

Fig 2 After Modification Engine

VIII. CONCLUSION

The use of inlet air preheating using Thermo Electric Generator unit in the combustion process of internal combustion Spark Ignition engine. Can be part of solution to the problem of pollution control and improving fuel economy. Using Thermo Electric Generator air Preheating Carbon Monoxide and Hydrocarbon can be effectively reduced in the engine. The mechanism of fuel vapourization is understood from the theoretical view to probable extend. The exhaust emission reduction using Thermo Electric Generator unit have been verified experimentally.

Experimentation investigation confirmed that the preheating of air reduces Carbon Monoxide and Hydrocarbon emission. The available result show that the significant reduction in Carbon monoxide and Hydrocarbon have been observed.

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