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Design and Manufacturing of Air Calorimeter to Enhance Engine Efficiencyand Reduce Pollution

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***Abstract*— The paper discusses The concept of increasing the fuel efficiency of a petrol engine in this project, is to pre-heat the intake air which is flowing through the carburettor. The humidity in the atmospheric air affects the petrol vaporization in the carburettor. Therefore, by pre-heating the inlet air to the carburettor for a considerable amount, the vaporization can be ease and in turn complete combustion is achieved. Moreover by reducing the water vapour to the engine, the steam formation in the engine can be reduced pitting of the engine cylinder, piston and exhaust pipe.**

The pre-heating of inlet air to the engine can be achieved by fixing a heat exchanger inside the exhaust pipe.

***Keywords*— Air Preheater , Engine Efficiency**

I.Introduction

In the Current System some amount of the energy is waste due to the Air Heating. Here silencer removes the exhaust hot air so the average of the vehicle is not getting good. Here we are going fabricate the calorimeter model of fuel efficiency increasing system by using air preheated system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from exhaust and converts it to air preheat

Here we fabricate the model of fuel efficiency increasing system by using air preheated system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from exhaust and converts it to air preheat. And also the atmospheric air inlet is fixed over the silencer to intake the hot air to carburetor.

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II. Literature Review

Present fuel resources are not going to be around forever and with the ever increasing consumption their extinction is nearly unavoidable.Also our fuel resources which are mostly made up of fossil fuels are not renewable in nature. Currently around the world the consumption of fossil fuels is 100,000 times faster than their natural production. According to an estimate the demand for these fuels will suddenly outstrip their availability in a matter of centuries-or less. Also the combustion of fossil fuels emits carbon dioxide.

Prof. Alpesh V. Mehta, Rajdevsinh K. Gohil (2)

Waste heat is that heat which is generated in a process by way of fuel combustion or chemical reaction, and then dumped into the environment even though it could still be reused for some useful and economic purpose. There exist today worldwide concerns about the best ways of using the deployable sources of energy, and of developing techniques to reduce pollution. This interest has encouraged research and development for re-use of the usually wasted forms of energy. There are many methods through which waste heat energy can be recovered and utilized. Sterling engines are mechanical devices working theoretically on the Sterling cycle. It uses air, hydrogen, helium, nitrogen or even vapors as working fluids. The Sterling engine offers possibility for having high efficiency engine with less exhaust emissions in comparison with the internal combustion engine. We had manufactured a gamma type sterling engine which operates at high temperature difference. Our ultimate aim is to develop Low Temperature Difference (LTD) Sterling engine and for that modification in existing design is going on.

Bipin Kumar Srivastava and Dr. S.P. Tewari (3)

When steel is welded, it is heated; the heated portion has a micro structure that is different from that of the base metal and is called the Heat Affected Zone (HAZ). During welding, rapid heating and cooling take place which produce severe thermal cycle near weld line region. Thermal cycle cause non uniform heating and Cooling in the material, thus generating harder heat affected zone, residual stress and cold cracking susceptibility in the weld metal and base metal. Detrimental residual stresses

commonly effect after the result display

 The project consists of an engine kit, silencer, carburetor, and a heat absorber. When the engine runs, the silencer gets heated up due to hot exhaust gas. At the time the intake air from the atmosphere gets heated when it passed over the silencer and the hot air send to the carburetor. By using this we get good fuel mixture and high efficiency.

Various elements of setup are:

- Angle frame
- Carburettor
- Fuel tank
- Engine
- Connecting tube
- Silencer with heat exchanger
-

Angle frame:

This is the element, forming the main structure of the machine. Frame is made from an angle.
The selection of angle depends upon the strength of angle and load which is carried on the angle should have good physical properties. The material of the angle is Mild Steel.
Angle selected for developing the frame is 140 105 35cm in size. Band Saw
machine was used to bring the angle plates in dimensions.
Arc welding process, gas cutting, etc. was employed for constructing this frame.

Carburettor

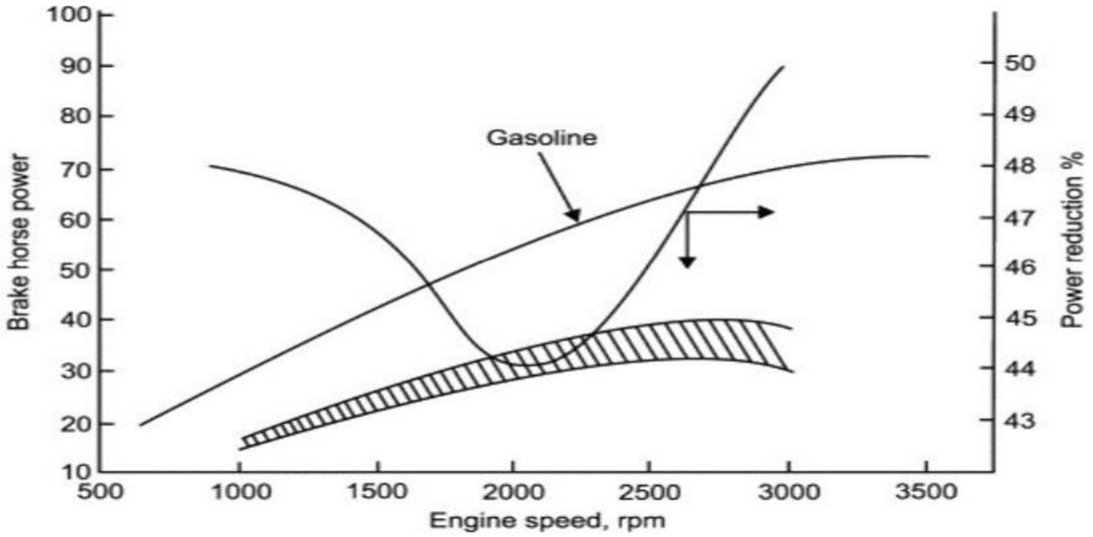
A carburetor basically consists of an open pipe through which the air passes into the inlet of the engine. The pipe is in the form of a venturi: it narrows in section and then widens again, causing the airflow to increase in speed in the narrowest part. Below the venturi is a butterfly valve called the throttle valve a rotating disc that can be turned end-on to the airflow, so as to hardly restrict the flow at all, or can be rotated so that it (almost) completely blocks the flow of air. This valve controls the flow of air through the carburetor throat and thus the quantity of air/fuel mixture the system will deliver, thereby regulating engine power and speed. The throttle is connected, usually through a cable or a mechanical linkage of rods and joints or rarely by pneumatic link, to the accelerator pedal on a car or the equivalent control on other vehicles or equipment.

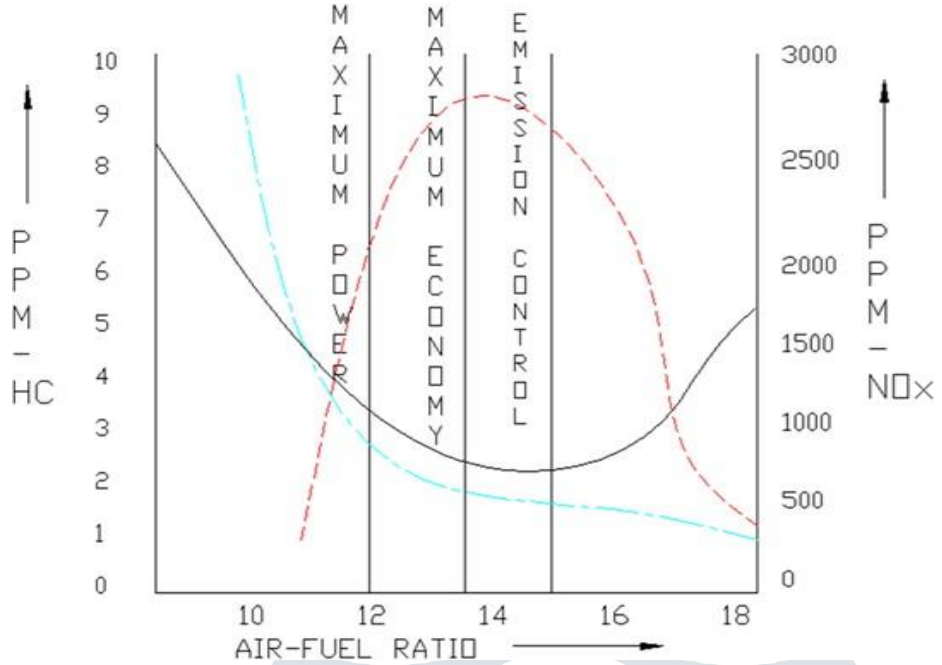
Fuel tank

Fuel tank (or petrol tank) is safe container for flammable fluids. Through any storage tank for fuel may be so called, the term is typically applied to part of an engine system in which the fuel is stored and propelled or released into an engine. Fuel tank range in size and complexity from the small plastic tank of a butane lighter to the multi-chambered cryogenic space shuttle external tank.
UL-142 is a national standard that covers most types of tanks for flammable and combustible liquids. It also applies to those tanks that are made from steel and located above ground. These standards apply for various shaped tanks including rectangular, round, or cylindrical. In our case it is cylindrical.

Heat Exchanger-

The original exhaust pipe of TVS 50XL 50cc bike is cut into three segments. The muffler and the stay plates are removed from the pipe. They are perfectly welded together without any leak. A spiral baffle plate is welded in between the two concentric pipes. Two 18mm M.S tubes of length 20mm are welded at the extreme ends of the outer pipe, in opposite direction for all inlet and outlet.
The whole setup is inserted on the muffler tube. The segments of the exhaust pipe are kept at their position and gas welded without any leak. The air inlet and outlet pipes are welded outside the exhaust pipe.





The heat exchanger is located in the engine exhaust pipe. The exhaust pipe consists of a muffler and stay plates etc. The heat exchanger is made up of 18 SWG M.S. plate. The inner tube is inserted tightly on the muffler tube. A spiral baffle plate arrangement is made in between the two concentric tubes so as to make a spiral path to the incoming air. So that the heat transfer to the air can be increased. Moreover the air is flowing in counter direction to the exhaust gas; thereby effective heat transfer can be achieved.

The heat exchanger inlet is fitted with a pre-filter. The outlet is connected to a by-pass mechanism through a hose pipe. The by-pass mechanism is connected to the carburetor intake. The temperature of the air entering to the carburetor can be maintained constant for a particular degree centigrade. When the temperature of air is increased above the predetermined valve the thermal relay opens the butterfly valve (4- wheeler Application) and allows the atmospheric air to mix with the heater air from the heat exchanger. So the hot air is diluted with atmospheric air and reducing the temperature.
Thereby the temperature of the hot air to the carburettor can be maintained at a particular level an adjustable screw which is used to pre-test the thermal relay for the required temperature

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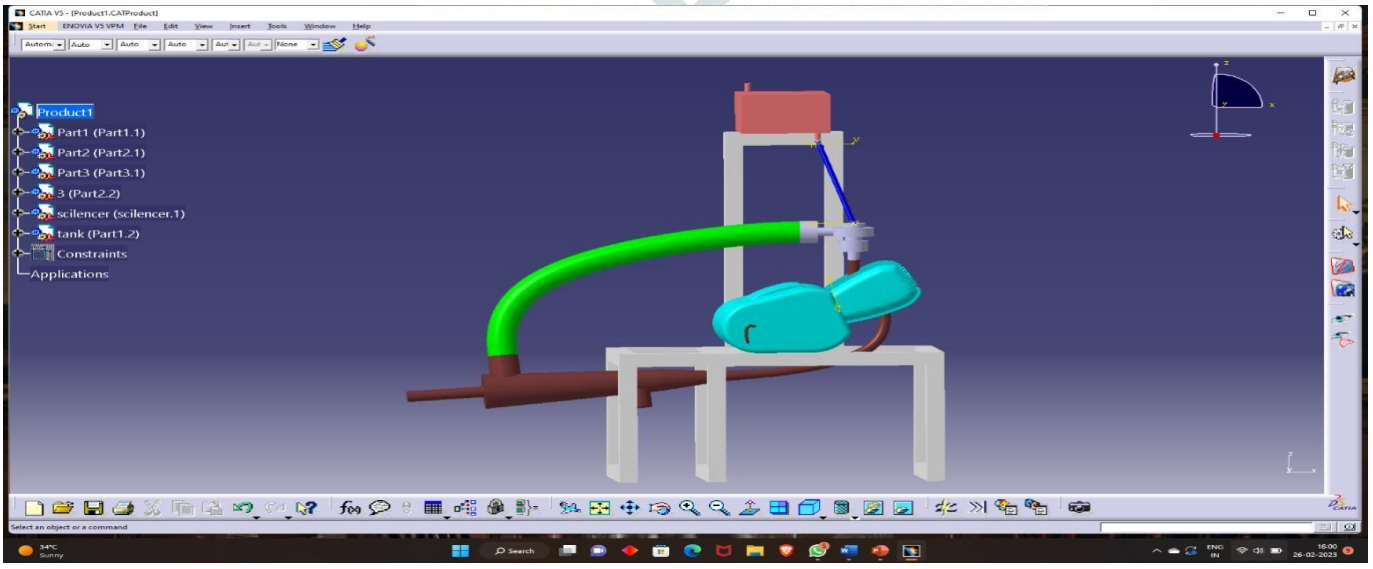

. Calculate Fuel Consumption

1. Check the fuel level.
2. Fuel level should be 50ml.
3. Open the way cock so that fuel flows to engine tank.
4. Start the engine.
5. Maintain RPM at constant speed by using speedometer and note it.
6. Note the temperature of air at inlet of caburettor in ºC at varios speed of engine.
7. Initially the test is made without the preheater setup then the engine is made to run at various rpm for the fuel of 50ml then timing is noted, the rpm noted here is crank shaft rpm and the results are being noted.
8. The second test for its actual fuel consumption (with air pre-heater connection): Then the test is being conducted with the preheating setup being attached along with the carburetor the hot air from the air preheating setup is being transferred with the help of a hose pipe in which one end is being attached to the air preheating setup and the other end is being attached to the carburetor thus when the air enters in the carburetor is preheated by exhaust gas heat recovery setup, thus hot air enters into the carburetor and the engine is made to run at different rpm for the same amount of fuel 50ml and the time for which the engine is running is noted.
9. Operate the throttle valve so that engine pickup speed to required level 300rpm.
10. Repeat step 4 for different speeds. 11. Repeat step 1-4 for condition- without air-preheater and with air-preheater**Experimental Results**

Engine speed = 5000 rpm
Torque = 43 N-m
Area of fuel tank = 0.1361 m^2
Density of fuel (petrol) = 740 kg/m^3

BREAK POWER = $2\pi NT/60*1000$
$=2*\pi*5000*43/60*1000$
= 22.51 kW

Calculation for Reading

Time for reading = 5 min

Case 1:- without preheating system –

Initial petrol level in fuel tank = 0.120 m
Final petrol level in fuel tank = 0.09 m
Difference between initial level and final level (L) =0.03m

Mass of fuel (mf):-
mf = ρ*Area*L/Time
mf=740*0.01272*0.03/5
mf= 0.0564 Kg/min

Thermal efficiency (ŋ):-
η= B.P./mf*C.V.
η=22.51*60/0.0564*42000
η=59.94%

Case 2:- with preheating system –

Initial petrol level in fuel tank = 0.120 m
Final petrol level in fuel tank =0.095 m
Difference between initial level and final level (L) =0.025 m

Mass of fuel (mf):-
mf = ρ*Area*L/Time

mf = 740*0.01272*0.025/5
mf = 0.0470 kg/min

Thermal efficiency (ŋ):-
η= B.P./mf*C.V.
η=22.51*60/0.0470*42000
η= 68.32%

Result and Observation of Emission test

Emission test Results

Condition	CO (%)	HC (ppm)	CO2 (%)
Without Air Preheater	2.3	464	3.2
With Air Preheater	1.8	470	2.8

As observation table the CO2 and CO volume percentage in exhaust gas reduced as increase in temperature of inlet air of carburetor. HC matters in exhaust gas slightly increases when temperature carburattor inlet air temperature increases.

CONCLUSIONS

This project is an attempt to reduce our dependency on foreign oil and reduce the tail pipe emission from automobiles and this was an attempt to design and implement this new technology that will drive us into the future.

Use of production pre heating will reduce smog-forming pollutants over the current national average. The first hybrid on the market will cut emissions of global-warming pollutants by a third to a half and later modes may cut emissions by even more.

The preheating of charge is beneficial in many ways. It is expected to increase power output of the engine by 11-15% due to the extreme homogeneity of the air-fuel mixture present in the cylinder during power stroke. This leads to maximum utilization of the specific heat of the fuel (C.V.=42000KJ/Kg) which results in an improved the thermal efficiency of the engine.

REFERENCES

1. Prof. Alpesh V. Mehta, Rajdevsinh K. Gohil, Jaydeepkumar P. Bavarian, Biren J. Saradava. “Waste Heat Recovery Using SterlingEngine” International Journal of Advanced Engineering Technology E-ISSN 0976-3945.
2. Bipin Kumar Srivastsva. “A review on the effect of preheating and/or post welds heat treatment (pith) on the mechanical behaviorof ferrous metals”. ET. al. / International Journal of Engineering Science and Technology Vol. 2(4), 2010, 625-631.
3. Simonson C.J. Besant R.W. “Heat and Moisture Transfer in Energy Wheels during Sorption, Condensation, And FrostingConditions” From the journal of heat transfer. AUGUST 1998.
4. Arjun Shanmukam, Karthik S. Kumar. Pre-heating Fuel for Charge Homogeneity to Improve Combustion”. Volume-2, issue-1,2013.
5. R K Rajput ” Applied Thermodynamics”, – pp 473 [14]
6. ELSEVIER Gasoline engine exhaust gas recirculation – A review Haiqiao Wei, Tianyu Zhu, Gequn Shu ⇑ , Linlin Tan, YuesenWangZ. Sahin et al. / Fuel 115 (2014) 884–895
7. PERMAGON Using exhaust gas recirculation in internal combustion engines: a review G.H. Abd-Alla * Al-Ain Technical School, P.O. Box 17835, Al-Ain, the United Arab Emirates Received 17 January 2001; accepted 25 April 2001EnergyConversionand Management 43 (2002) 1027–1042