

Engine Cooling & Pre Heating of Fuel using Peltier Element

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Abstract— Cooling system is a very integral part of a vehicle. It is a must thing to maintain the maximum power output and better fuel economy of any vehicle. In earlier days only air-cooling was used in almost all vehicles but the rolled out days changed the fate of vehicles by introducing the water-cooling system. The pre heating of fuel will help to increase the performance of an engine. We will take a look on that in our following project. Our project puts forward the idea of Engine Cooling and Pre Heating of Fuel using Peltier Element. This system is not an existing system and is completely a very new concept in the field of engine cooling. With the help of the law proposed by Peltier. We made this a successful system and increased the cooling efficiency of an engine.

Key words: Engine Cooling, Pre Heating of Fuel

I. INTRODUCTION

Our project is totally dependent on PELTIER ELEMENT. It is a small electrical device used for cooling various systems. This element has a special property that, when the power supply is given to this device, one side of the element is cooled while the other side gets heated. The reason for this is explained in the following pages. The cold side of the device is faced towards the cylinder block, while the hot side away from the cylinder.

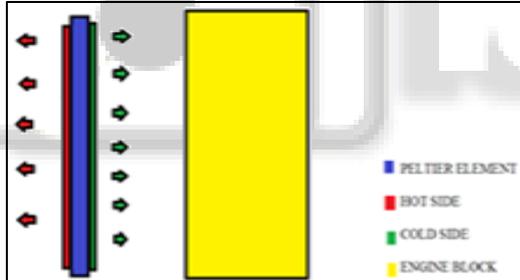


Fig. 1: Normal View of Peltier Element

Impellers or blowers are fixed in both sides of the element to take away the cold and heat created in the surfaces of the element. The cold air from the blower is converged towards the engine block while the hot air is taken to the atmosphere in-order to avoid the damage to device because of the heat. The hot air from the second blower can be sent to the intake manifold in-order to pre heat the fuel. The working of device is based on Peltier effect, which is derived from See back effect.

II. ELEMENT DESCRIPTION

Thermoelectric coolers are operated by the Peltier effect. The device has two sides, and when DC current flows through the device, it brings heat from one side to the other, so that one side gets cooler while the other gets hotter. The "hot" side is attached to a heat sink so that it remains at ambient temperature, while the cool side goes below room temperature. In some applications, multiple coolers can be cascaded together for lower temperature.

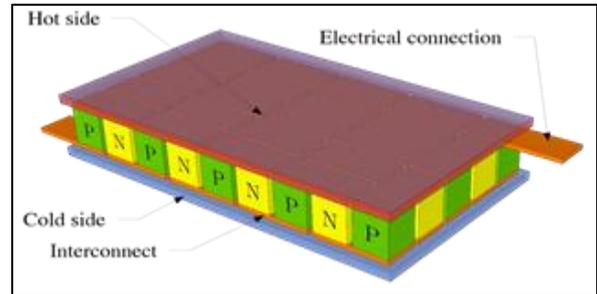


Fig. 2: Detailed View of Peltier Element

III. CONSTRUCTION OF ELEMENT

Two unique semi-conductors, one n-type and one p-type, are used because they need to have different electron densities. The semi-conductors are placed thermally in parallel to each other and electrically in series and then joined with a thermally conducting plate on each side. When a voltage is applied to the free ends of the two semiconductors there is a flow of DC current across the junction of the semi-conductors causing a temperature difference. The side with the cooling plate absorbs heat, which is then moved to the other side end of the device where the heat sink is. TECs are typically connected side-by-side and sandwiched between two ceramic plates. The cooling ability of the total unit is then proportional to the number of TEC in it.

A. Specification of the Peltier Element

MARKET NAME	Thermo Electric Cooler (TEC)
OPERATING VOLTAGE	6V-12V
SOCKET REQUIREMENTS	2 Pin Socket
WORKING TEMPERATURE	-20 degree to +70 degree Celsius
AVAILABLE SIZE	50 * 50 *4 mm
SPEED OF THE BLOWERS	90-110 rpm (Approx.)

Table. 1: Specification of the Element

IV. COMPONENTS & DESCRIPTION

A. Peltier Element

It is used as the cooling source for the engine. It can make a temperature difference of about 90 degree Celsius. So it is used mostly for the purpose of temporary refrigeration and for CPU cooling in long use computers.

B. Heat Sink

One side of the element gets heat it may cause damage to the element so this heat has to be dissipated very efficiently. This is done by the heat sink. A heat sink is nothing but a blower fan. It continuously runs in-order to dissipate the heat generated. This is a very must part because without this element would burn out.

C. Blower

It is as similar as a heat sink, which is used to transfer the cold air from the cool side of the element to the engine block. A duct like thing can also be used along with the blower for increased efficiency.

D. Temperature Sensor

It is a very common device in the car. It is used to continuously monitor the heat of the engine block. As the working temperature of the element extends to -20 degree it is very essential to have a sensor and control the working of Peltier element.

E. Control Unit

It is used to receive the input signals from the sensors, analyse the same to generate the appropriate command and to change the actuators for proper working. It can be linked or integrated with the ECU.

V. WORKING PRINCIPLE

This working principle of this system is explained by assuming it to be used to cool a two-wheeler engine. The element is placed in such a way that the cold side of the element is facing the fins of the air-cooled engine. For better and efficient cooling the air in the cold side of the element is converged with the help of a funnel and focused towards the fins via duct.

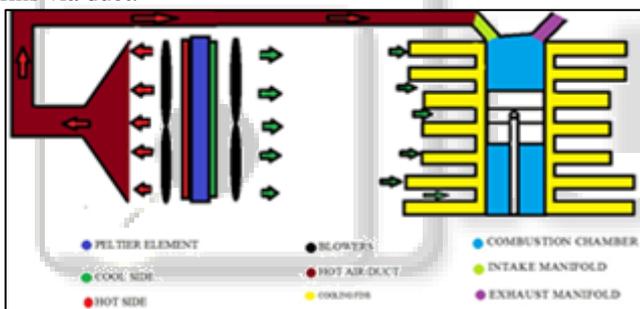


Fig. 3: 2D View of Project

The hot air flowing in other side is either let to the atmosphere or converged and sent to the carburetor for pre heating of the fuel, which may ease the combustion process and reduces the emission of HC and increases the fuel efficiency slightly. The power supply for the Peltier element is given by taking the power from the battery of the vehicle. Controlling the ON/OFF of the Peltier element should be very correct, else the engine would over cool, causing lack of temperature for the ignition of fuel which will lead to frequent shutting of the vehicle. The sensors and the control unit prevent this. The sensor senses the exact temperature at the engine block and correspondingly sends these to the ECU as electric signals. The ECU then controls the temperature by varying the voltage of the current given as input (6V-13V) to the device.

VI. CONCLUSION

Engine cooling being an integral part of the engine has been modified a lot but not has been changed so far successfully. But this type helps us to additional way to cool the engine. So, we hope that the above-mentioned system would have shown a clear way of an alternate, efficient and cheap system

for the cooling of automobile engine. We hope that this system would be in all the tomorrow's vehicles with better cooling efficiency and a good engine performance for the enhanced life of humans. Hence the preheating of fuel helps to increase the mileage and efficiency of an engine.

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