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Heat Recovery System in Automobile

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ABSTRACT

Nowadays the performance of the vehicles has been the trend of improvement, but the efficiency of the vehicles has not seen good improvement as engines efficiency is limited to 30-40% and other 60-70% of the fuel energy is being wasted to the environment through various factors such as heat, friction & engine coolant. Waste heat is the heat, which is generated in a process by a fuel combustion and released into the environment, though it can be used for economical, and some useful purpose. Some power of IC engine is used to run alternator, which reduces the mileage. We have used Thermoelectric Generator (TEG's) for utilizing the waste heat energy from the exhaust line through seebeck effect, which generates E.M.F with temperature difference; our motto is to supply this energy to the external accessories such as a portable mobile charger or auxiliary lights for various locations on the bike. The weight of the TEG setup is not as heavy as a reason it can be introduced to vehicles, the cost of the TEG is significantly affordable but the design, and construction of TEG is the challenging factor for us.

Keywords: Waste heat recovery, TEG, Thermo electric generator, Seebeck effect.

I. INTRODUCTION

In vehicle engines, enormous amount of heat is released to the environment. As a lot as 60-70% of the heat generated from combustion in an automotive fuel engine is dissipated to the environment through exhaust fuel and other losses which is recoverable at least partly.

In the case of high-performance engines the exhaust heat is used both for turbo-charging or supercharging. A turbocharger makes use of a turbine attached to the exhaust machine whereas a supercharger is connected immediately to the engine to run a compressor. A range of other heat recuperation techniques, generally conceptual, has been proposed to recover the waste heat of a vehicle engine.

Current ICEs are 20% to 45% environment friendly under typical using stipulations depending on the engine type and working conditions. The closing 55%–80% will be wasted as heat in each the coolant and the exhaust gases. A waste heat recovery system has the manageable to convert some of this waste heat into electrical energy and can be utilized to provide electricity to greater add-ons .TEGs may want to be used in conjunction for use in a waste heat restoration system. Their compact measurement and strong country layout make them perfect for automotive applications.

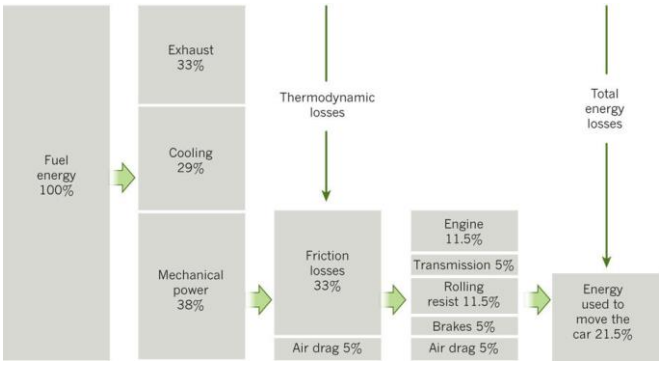

Fig.1. Heat lost chart

TEGs makes use of what is acknowledged as the Seebeck impact, which is explained in Fig. 2. A TEG is made up of many elements of N type and P type semiconductor materials, which are connected electrically in sequence however thermally in parallel. When one side of the TEG is heated and the different aspect cooled, a voltage is generated. The voltage generation capacity there is purposes for these TEGs to generate electricity the place temperature variations are present. Their efficiency is generally 5% [1] and they can generate energy from any temperature difference. Their efficiency is restrained by means of the Carnot efficiency. So greater the temperature difference, the more efficient they will be. A TEG operates at about 20% of the Carnot efficiency over an extensive temperature vary.

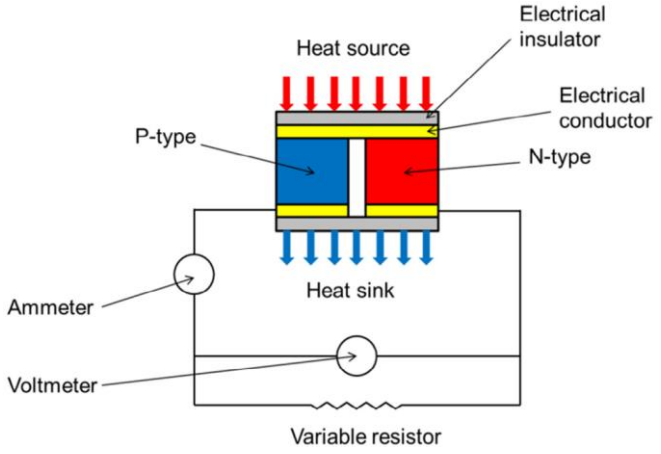

Fig. 2. Seebeck Effect

II. METHODS AND MATERIAL

Seebeck Effect

Seebeck effect is a phenomenon which uses Peltier device as a mode of energy conversion wherein the temperature difference created by the slab placed on silencer and the fins exposed to atmosphere generates a sufficient amount of E.M.F. which can drive a small capacity battery or any auxiliary devices such a portable charger etc. hence we have designed a model for the bike Access 125 from Suzuki where we have created single layered slab of single material with fins within which the TEG is embedded.

Materials

Table 1

Material	Mild Steel	Aluminum Alloy
Thermal Conductivity	32W/m2K	295 W/m2K
Usage Position	Before TEG	After TEG

Design

The design for heat recovery system is shown in fig. 3 with dimensions.

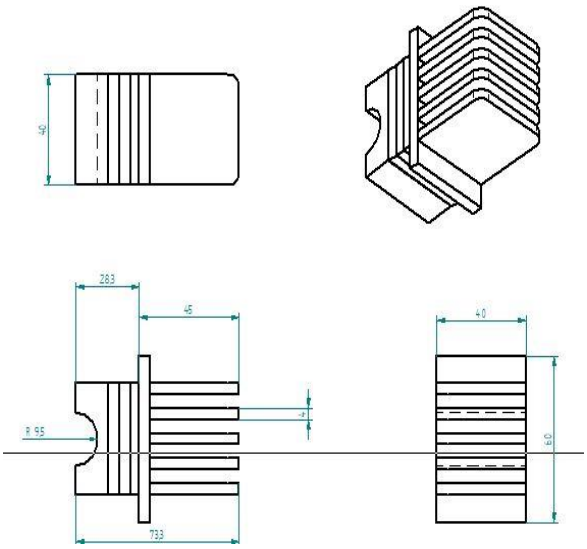

Fig.3. Dimensions of Heat Recovery system

III. RESULTS AND DISCUSSION

Analysis

The main issue with TEGs is that they have very low working temperature. For our experiment, we have selected TEC1-12706 whose working temperature is 150˚C. For that purpose, we have to design a slab such that temperature from 200˚C can be reduced to 150˚C. Analysis has been done in Ansys workbench V16 and result is shown in fig.4.

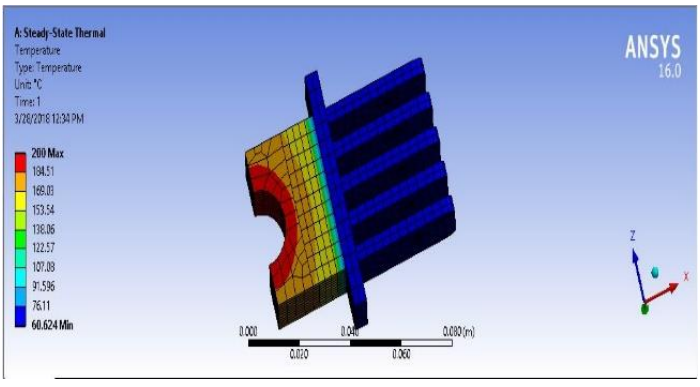

Fig.4. Analysis in Ansys V16

IV. CONCLUSION

As we have described our work on the vehicle using TEG we could find that a lot of improvement can take place if this field is dug properly with incorporation of electrical knowledge as the electrical circuits are much more effective than the mechanical circuits because they are more reliable and less prone to fail but the challenging factor we faced is the design and the construction of these modern bikes isn't simple and not same because of the emission norms restricted by the government for the less pollution emission from the vehicles which may help in degradation of global warming at significant level because number of vehicles on road keeps increasing day by day because of the advancement of the technology and innovation which has a significant attraction of our nation which increase the sales of automobiles.

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