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DESIGN OF THERMAL ELECTRIC GENERATOR

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ABSTRACT:

Electricity consumption over the period indicates how the country is developing. The industries consume electricity in huge amount. More the electricity consumed by the country means more production in industries. Electricity generation with various sources is always the appreciated by the researchers. Whenever any new way of generation is proposed it is always a helpful for any country. Another approach can be saving the energy and reducing waste of energy by various means of optimizing processes, working of machines and reducing losses. Authors have proposed generation of electricity through heat produced in automobile engine. This energy is useful for fuel saving or charging the battery of the vehicle.

KEYWORDS: Diesel engine, Heat Energy Recovery, Exhaust Bend of Diesel Engine, Electric Load, etc.

INTRODUCTION:

Electricity consumption of India has improved over last two decades by a huge amount. Electricity generated with any renewable form is appreciated and useful for any country. Many countries have taken the initiatives to promote electricity generation through renewable. The automobile consumes huge conventional fuel and produces very high heat. This heat is not utilized and wasted without any use.

Authors have proposed thermal electric generator to utilize the heat developed in vehicles. This will be useful for reduction in produced heat as well as generated electricity can be utilized for some applications such as lamps, horn and indicators of vehicle. Around 50% of energy in an automobile is lost during conversion from fuel to mechanical energy. Researchers have worked on conversion of heat to electricity since start of 18^{th} century after invention in this area by Thomas Johann See Beck. The major issue associated with this system is conversion rate to electricity as the heat collection is not so effective with present thermal modules.

The block diagram for the system is presented below to explain how electricity is generated from thermal generation.

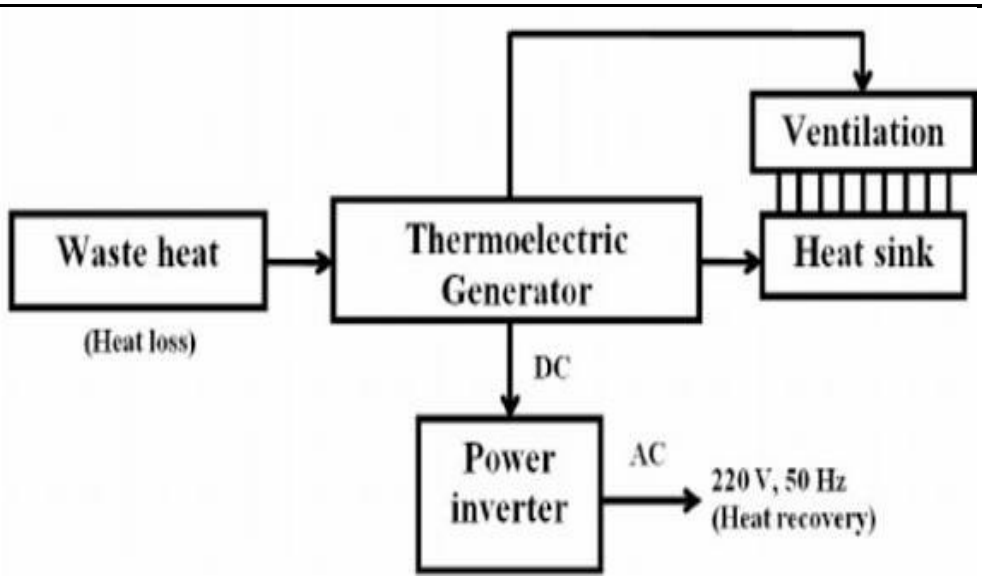


Fig.1: Block diagram for developed system.

OBJECTIVES OF WORK:

The work carried out with following objectives.

- Utilizing heat produces by diesel engine in automobile.
- Electricity generation with heat and charging of battery of vehicle.

SYSTEM REQUIREMENT:

Following table gives complete information about diesel engine to be used for system development.

Table.1: Specification of Diesel Engine Used

Sr. No.	Parameters	Range
1.	Type	AV1-Vertical,4-stroke, single acting totally.
2.	Displacement	2211cc
3.	Power	@1500 RPM-5HP @1800 RPM-6HP
4.	Torque	14.22 Nm @1500RPM
5.	Bore	80.0mm
6.	Stroke	110.0mm
7.	Lub oil capacity	3.7 litres
8.	Mode of starting	Hand start cum Electric start

SYSTEM DESIGN:

CAD model of developed system with different views is presented in figure below.

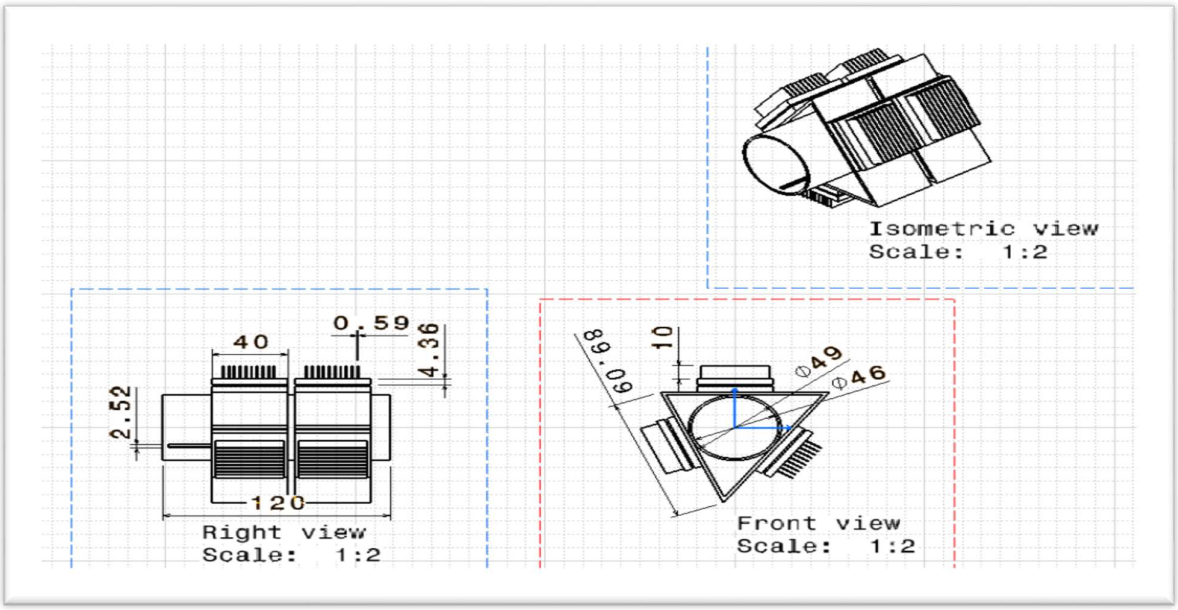
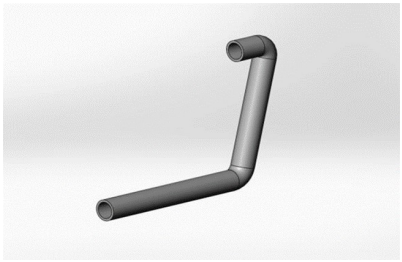
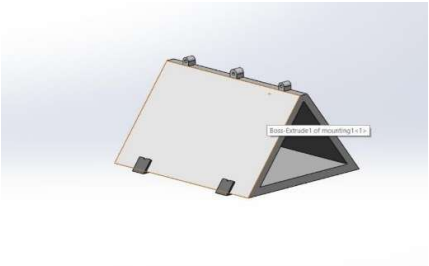


Fig.2: CAD model of views of the pipe.

Other components of the system are shown in table below.

Table.1: Specifications of main components

Sr. No.	Component Details	CAD Module Developed
1	**Exhaust Pipe** Chromium Ferritic Stainless Steel	
2	**Mounting** 200^{0}C, 36-54 *W*/m^{0}C.	

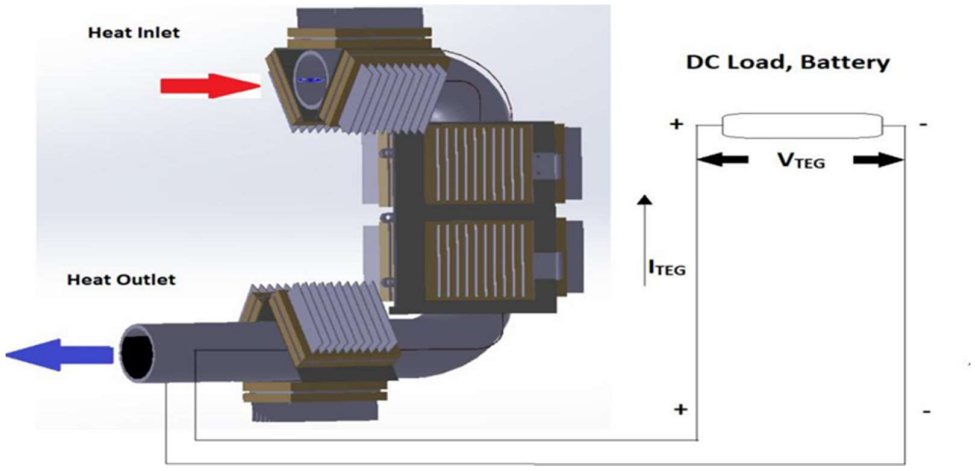


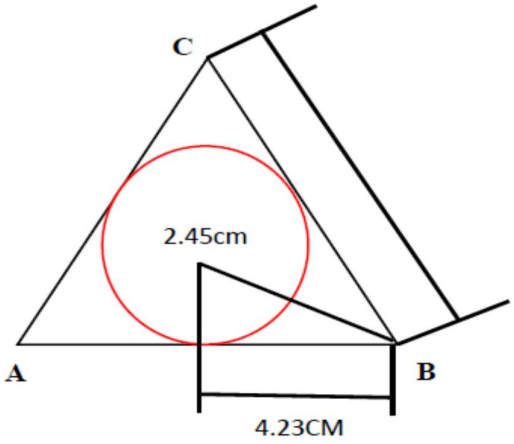
Fig.3: CAD model of TEG Assembly

Flow rate of a pipe

$$Q = \frac{\Pi d4\Delta T}{128}$$

Where,

Q= Flow rate
D= Pipe diameter
ΔT= Temperature of pipe
μ=Dynamic viscosity
Δx=Length of the pipe



Diameter = 4.9 cm
For equilateral Triangle Angle=60º
Tan (30) =2.45/x
X=4.24
Length (AB) = 8.48cm

FUTURE SCOPE:

In coming future work must be carried out to improve the efficiency of system. Mainly improving conversion of heat to electricity with higher rate of conversion is needed. A transducer which works with higher conversion rate is needed to be designed. The thermoelectric generation has huge scope for electricity generation as more than 60% of heat is wasted due to improper utilization. This system can be implemented to all heavy vehicles which are producing huge amount of heat. The analysis of performance of vehicles due to reduction in heat as it is converted to electrical form should also be included in future work to be carried out.

CONCLUSION:

Demand of electricity is improving exponentially worldwide as the industries are growing with increase in population. Conventional ways of electricity generation are creating hazards to environment and consuming fossil fuels. The renewable/green sources of electricity are contributing with good potential to electricity generation. The thermoelectric generator can convert waste heat to electricity which will be useful in improving performance parameters. The CAD design of generator to convert heat to electricity is presented in this paper. This design is proposed for low cost electricity generation from waste heat produced in heavy vehicles. Conversion rate enhancement from thermal to electrical is challenging and hence efficiency of the system is less.

REFERENCES:

1) Cao, Qimin, Weiling Luan, and Tongcai Wang. "Performance enhancement of heat pipes assisted thermoelectric generator for automobile exhaust heat recovery." *Applied Thermal Engineering* 130 (2018): 1472-1479.
2) Patil, Dipak S., Rachayya R. Arakerimath, and Pramod V. Walke. "Thermoelectric materials and heat exchangers for power generation–A review." *Renewable and Sustainable Energy Reviews* 95 (2018): 1-22
3) Elghool, Ali, et al. "A review on heat sink for thermo-electric power generation: Classifications and parameters affecting performance." *Energy conversion and management* 134 (2017): 260-277.
4) Lan, Song, et al. *The potential of thermoelectric generator in parallel hybrid vehicle applications*. No. 2017-01-0189. SAE Technical Paper, 2017.
5) Tran-Dinh, Thinh, et al. "Three-Phase Boost-Converter Based PMIC for Thermal Electric Generator Application." *2019 IEEE Asia Pacific Conference on Circuits and Systems (APCCAS)*. IEEE, 2019.
6) Kilinc, Enes, et al. "Steady-state thermal-electric analysis of a π-shaped 8-pair thermoelectric generator." *Materials Today: Proceedings* 8 (2019): 523-530.
7) Liu, Kang, et al. "Thermal–electric nanogenerator based on the electrokinetic effect in porous carbon film." *Advanced Energy Materials* 8.13 (2018): 1702481.