

Air Conditioning Using Exhaust of a Vehicle

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Various irreversible procedures in as far as possible its ability to accomplish an exceptionally adjusted effectiveness. The fast extension of gases inside the barrel creates high temperature contrasts, violent smooth movements and substantial warmth exchanges from the liquid to the cylinder crown and chamber dividers. These quick progressions of occasions occurring in the chamber make growing fumes gases with weights that surpass the barometrical dimension, and they should be discharged while the gases are as yet extending to set up the barrel for the accompanying procedures. Thus, the warmed gases created from the burning procedure can be effectively directed to the fumes valves & complex. A substantial measured vitality from flood of depleted gases can conceivably be utilized for wasted warmth vitality recuperation to create control. Different techniques to outfit the waste warmth to deliver control successfully had wound up futile. This paper consists of wasted thermoelectric warmth vital for health advantage for inner ignition motor cars, including vehicles of gas half and half electric vehicles. The main goal is to make a change in the field over the surface heat usage from exhaust of car into electrical usage with the help of TEG (thermoelectric generator), after which it is directed to a DC converter in order to charge battery that can be used afterwards. Consequently, the power (electrical) storing in battery may be boosted. Trial result show that suggested framework can function admirably in various working conditions, & would be useful in various industries.

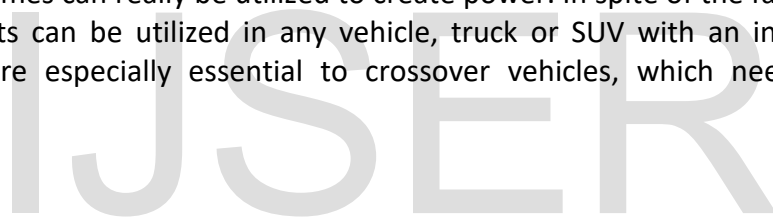
Introduction

Indeed, a profoundly productive ignition motor proselytes just around 33% of vitality to convert fuel energy into useful power in order to run a vehicle. Rest is imparted by warmth released in environment otherwise, just, carry out by vehicle in form of "squander heat". Unmistakably, it leads to an extraordinary advantage in decrease of CO₂ discharges. As of late the logical and open mindfulness on ecological and vitality issues has acquired real interests to the examination of cutting edge innovations especially in exceptionally effective inside ignition motors. Survey from the financial point of view, as the dimension of vitality utilization is straightforwardly corresponding to the monetary advancement and all out present populace in nation. Developing rate populace in the world in present era demonstrates that vitality request could be probably going to increment. Substantial warm vitality is accessible from the fumes gas in current car motors. 66% of the vitality from burning in a vehicle is lost to surrounding and related components, where 40% is hot fumes gas.

The most recent improvements and advancements on waste warmth recuperation of fumes gas from (ICE) inner ignition motors which incorporate thermoelectric generators (TEG), Organic Rankine cycle (ORC), and much more advancements in innovation of turbocharger. Being the best gadgets in a car squander in heat recuperation is (TEG) thermoelectric generator that will end up a standout amongst the most vital and remarkable gadgets later on. Thermoelectric power generators are strong gadget in a state which results vitality change from warm source (heat) due to inclination in temperature into electrical source dependent on "Seebeck effect".

One potential arrangement is the use of the fumes squander warmth of burning motors. This is conceivable by the waste warmth recuperation utilizing thermoelectric generator. A thermoelectric generator changes over the temperature angle into helpful voltage that can utilized for giving capacity to assistant frameworks, for example, forced air system and minor vehicle hardware. Indeed, even it can lessen the span of the alternator that devours shaft control. In the event that roughly 6% of fumes warmth could be changed over into electrical power, it will spare around same amount of driving vitality. It will be conceivable to decrease fuel utilization around 10 %; henceforth AETEG frameworks can be productive in the car business.

A vehicle's fumes can really be utilized to create power. In spite of the fact that these advancements can be utilized in any vehicle, truck or SUV with an inside ignition motor, they're especially essential to crossover vehicles, which need to create greatest fuel.



Principle of Working

✧ Basic Principle

It works on the principle based on "*Seebeck Effect*" that leads to change in temperature contrasts straightforwardly in power. It would be a great example of (emf) electromotive power & figures out quantifiable flows and voltages in a same manner as of other electromotive power. It admits Ohm's law by which it produces flows even when voltage difference is absent (or the other way around); the nearby present thickness is defined as,

$$j = \sigma (-\Delta v + E_{emf})$$

Here, v is local voltage, σ is local conductivity. Generally, the Seebeck impact is defined locally due electromotive field's creation.

$$E_{emf} = -S \cdot \Delta T$$

Where S is coefficient of Seebeck effect, a local material property of which it is built & ΔT is temperature gradient 'T'.

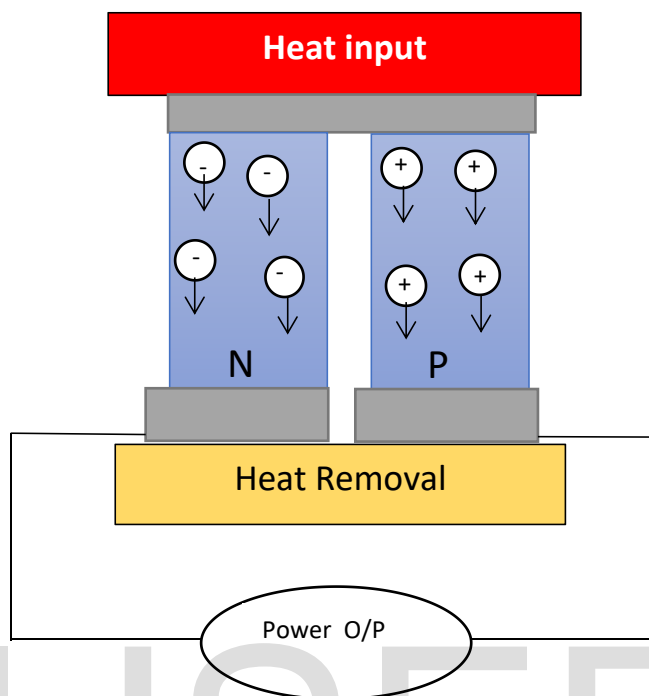


Figure - 1: Seebeck Effect

✧ Thermo electric Principle of Operation

Thermo electric principle of operation means the necessary change of warmth in source of electricity. As per Joule's law, current carrying conductor generates heat at rate related to a result of opposition [R] of conductor & square of current [I]. This sort of circuit is known as thermocouple; various thermocouple associated in arrangement are known as thermopile.

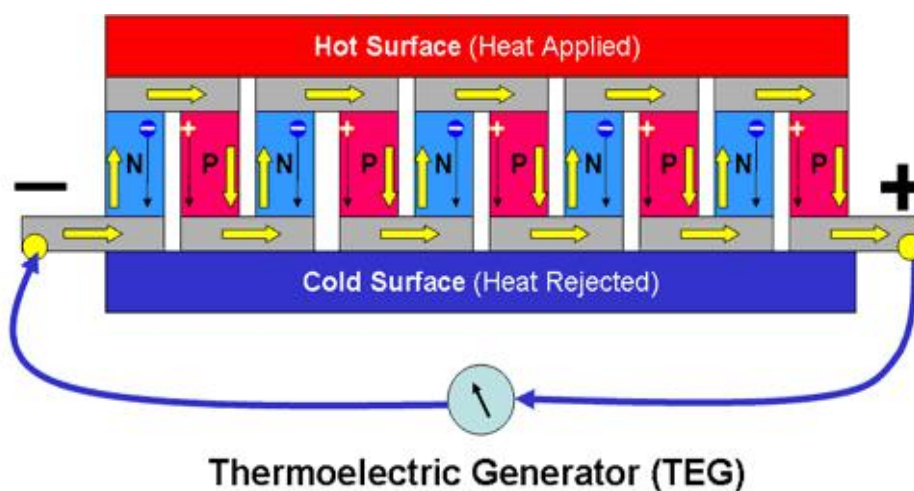
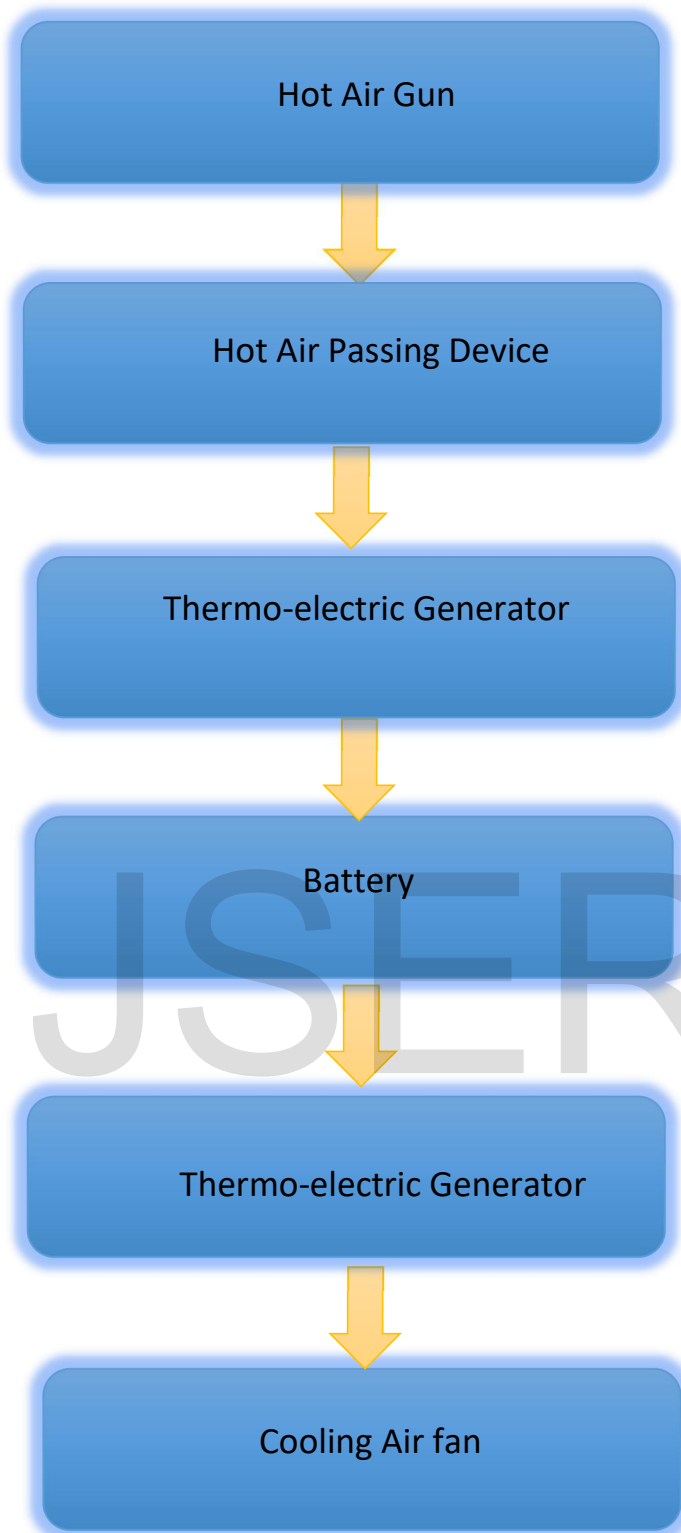


Figure - 2: Thermo-electric Generator Principle



*Block Architecture for
Component flow of working
model*

COMPONENTS USED

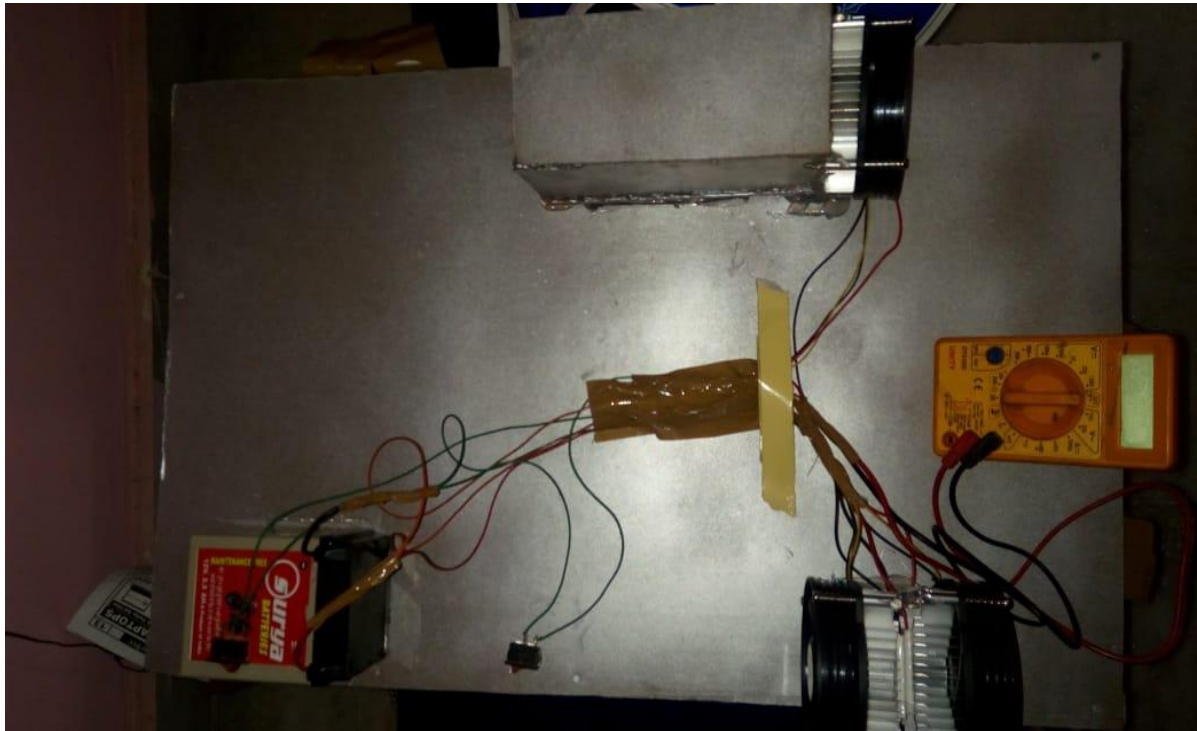


Figure - 3: Working Model

✧ Heat Exchanger

Outlet temperature & channel on both side of warmth (cold & hot side) exchanger may be utilized for a structure of warmth exchanger. Fundamental conditions required for warmth exchanger configuration is as follows:-

$$Q = U_o.A.F. [LMTD]$$

Here,

Q is Heat transfer rate,

U_o is transfer coefficient of heat (Overall)

A is transfer area of Heat

$LMTD$ is Logarithmic mean temperature difference

F is Correction factor

Span of warmth exchanger is estimated by methods for number of exchange units (NTU),

Where,

$$NTU=A.U/C$$

U is Local heat transfer (overall) coefficient

A is Heat transfer area

C is multiplication of coefficient of specific heat and mass flow rate

Without stage change, the NTU of a warmth exchanger decides the execution as far as E i.e. effectiveness. Viability is defined as proportion of real warmth exchange rate to the most extreme warmth exchange rate.

Where,

$$E= Q/Q_{max}.$$

Q is Actual rate of heat transfer

Q_{Max} is heat transfer rate (Maximum)

✧ Peltier Module

A thermoelectric (TE) module, additionally known as thermoelectric cooler, is based on electronic segment of semiconductor that has a capacity of few hot siphon. After apply of lesser amount of DC voltage capacity to this module; warmth will pass from one side to other of a module. One face of this module will be cooler than the contrary side of face which is at same time warmed.

P –type & n-type both of Bi₂Te₃ (Bismuth Telluride) materials (thermoelectric) is utilized in thermoelectric cooler.

✧ Dynamo

It is generator well known as electrical generator. This dynamo delivers DC by a utilization of commutator. They were the primary generator fit for the power industries. They have turning wires joined in a form of curls & fields attractive in nature in order to obtain electric flow by mechanical revolution. It has a stationary part, known as stator; provides steady attractive field. It also consists of pivot windings known as armature which moves inside this field.

Commutator expects to give DC. At some stage where a circular turn wire gets a motion in the above mentioned field, it instigated the potential in it after each half motion, and hence creates substituting current. Some usage of power like, , used DC ,

electroplating, etc. Commutator has many contacts fitted on poles of machine, which changes combination of windings for outer circuit when there is a switch in potential, which is opposite to substituting current, which results in a delivery of direct current.

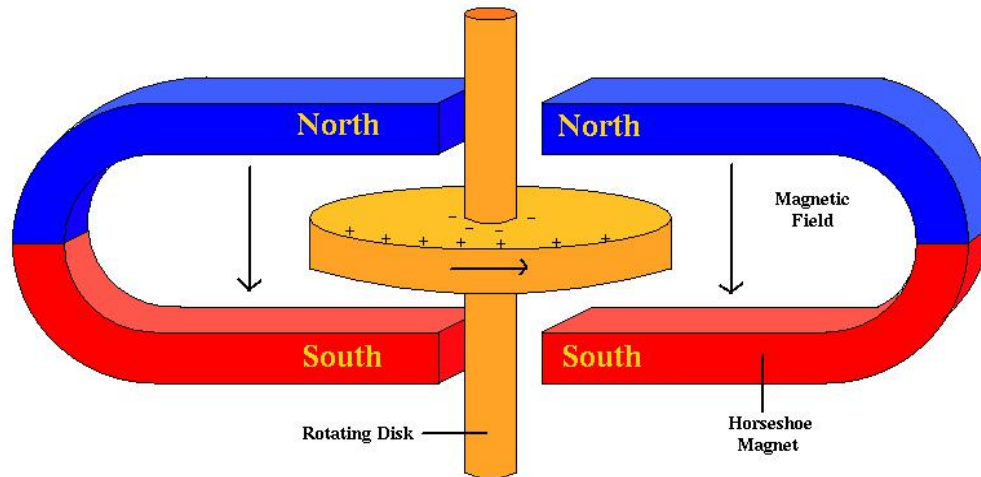


Figure - 4 : Dynamo

✧ Battery

Here, we are utilizing auxiliary sort battery. It is battery-powered sort. A battery is at least one electrochemical cells, which store concoction vitality and make it accessible as electric flow. There are two kinds of batteries, essential (expendable) and optional (battery-powered), the two of which convert compound vitality to electrical vitality.

✧ Multimeter

Also known as multitester, or called as (volt-ohm-milliammeter) VOM. It is an electron instrument which join a small number of estimation works in single unit. An average multimeter quantifies, and obstruction, current, voltage.

✧ Small A.C.

Air Conditioner is a way towards carrying out dampness & warmth from a space which is consumed, in order to get a better solace for inhabitants.

Working Procedure

When vehicle starts & acceleration is needed to give, such that amount of heat coming from exhaust will increased. Due to the heat, exhaust pipe's surface & silencer would be heated to high range of temperatures. These surfaces try to

liberate this heat into atmosphere, which will be acting like a Heat Sink. Since atmosphere is less than temperature of silencer, a difference in temperature is created & hence surface tries to attain equilibrium state by heat transformation procedure. But it will be a longer procedure. Hence to get high heat transfer rate, thermal Grease is used. This Grease will be coated on silencer's hot surface & on the surfaces of fins (inner surface) that is present in part on upper side. Fins are utilized to increase rate of heat transfer. As soon as the vehicle comes into motion, air flow would take place among fins & it acts as sink.

As silencer's surface will be more and more heated the heat transfer rate will increase due to the increase in difference of temperature. Peltier module is placed between the Heat Sink (atmosphere) & Heat Source (Hot Silencer Surface) & fins that are placed above module. This module consists of materials made up of semiconductors. Hence using effect of SEEBECK, the difference in temperature can directly converted into voltage with the use of some type of thermoelectric material. Based on that effect, when heat from surface of silencer is given into atmosphere, the holes & electrons of semiconductor would try to move in junction & let electric current to flow.

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Calculations

✧ Calculations for Voltage Generated

From seebeck effect's equation,

$$V = \alpha \cdot (T_h - T_c)$$

Where,

V is generated voltage (Volts),

α is Seebeck Coeff. ($\mu\text{V}/\text{K}$),

T_h is hot surface temperature (kelvin),

T_c is cold surface temperature (kelvin) (I.e., Atmospheric Temp. - 298K),

For our module/prototype,

S.no.	Nomenclature	Value	Unit
1.	α	120	$\mu\text{V/K}$
2.	T_h	573-673	K
3.	T_c	298	K

1. for $T_h=573\text{K}$,

Voltage generated $V= \alpha(T_h-T_c)$;

Therefore, $V= 120 * 10^{-6} [573-298]$;

$$= 120 * 10^{-6} [275];$$

$$= 0.033 \text{ Volts}$$

2. for $T_h=673\text{K}$,

Voltage generated $V= \alpha(T_h-T_c)$;

Therefore, $V= 120 * 10^{-6} [673-298]$;

$$= 120 * 10^{-6} [375];$$

$$= 0.045 \text{ Volts}$$

Similarly,

S.No.	T_h (Hot Air Temp.)[K]	T_c (Air Temp.)[K]	V (Voltage Generated)
1.	573	298	0.033
2.	593	298	0.035
3.	613	298	0.037
4.	633	298	0.040
5.	653	298	0.042

6.	673	298	0.045
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ADVANTAGE

- ✧ Productivity strategy for charging the battery.
- ✧ Power is put away in a battery; we need to utilize other application like lighting, and so on...

DISADVANTAGE

- ✧ Extra expense is required.
- ✧ Extra space is required to introduce this course of action in vehicles.

CONCLUSION

In this paper we have effectively created a fumes gas heat recuperation control generator. Consequently economical usable age of force strategy may actually use for business & local areas at an expense of reasonable rate. The motor's effectiveness would not be effected in light; a fact that silencer's heat is pulled out. Fundamental goal of the paper is to reuse surface heat to evade mishaps brought about by silencers that are overheated, and in order to change the warmth to helpful electrical usability. This particular goal is effectively practiced in this paper. The voltage generated could be increased by combining various TEGs in proper arrangement. The voltage or electricity created by this technique is used by AC and can be put away for different plunges too.

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