Power Generated from Exhaust Gas On petrol Engine

Jerome Ignatius S[1], Assistant .Professor, Gnanamani College of technology Tamilnadu, India
Sanjay Gandhi B[2,] Principal**,** Gnanamani College of technology Tamilnadu, India
Senthilkumar R[3], **Soundhar A[4]Thiyagarajan P[5], Vijayakumar K[6]**
UG Scholar Gnanamani College of technology Tamilnadu, India

Abstract-Here we are modifying an automobile for producing power using vehicle exhaust. Nowadays in automobile field many new innovating concepts are being developed. We are using the power from vehicle exhaust to generate the electricity which can be stored in battery for the later consumption. In this project, we are demonstrating a concept of generating power in a moving vehicle by the usage of turbines. Here we are placing a turbine in the path of exhaust in the silencer.An engine is also placed in the chassis of the vehicle. The turbine is connected to a dynamo, which is used to generate power. A dynamo is a device which is used to convert the kinetic energy into electrical energy. The generated power is stored to the battery. It can be stored in the battery after rectification. The rectified voltage can be inverted and can be used in various forms of utilities. The battery power can be consumed for the users comfort.

Keywords: Petrol engine, dynamo, exhaust and turbine, revolutions per minute (r. p. m)

1. INTRODUCTION

In recent years, energy shortages and environmental issues become increasingly Prominent, c l e a n n e w energy technologies have been gradually attracted s o c i a l a t t e n t i o n. With the development of thermoelectric generation, thermoelectricgeneration,asakindofgreenenergytechnologyusedinawide rangeandmeetingtheenvironmentrequirement,hasbeenpaidmoreandmore attention.Thethermoelectricgenerationisakindofallstaticcleanpowergeneration, which converts the heat into electricity though they seeback effect of semiconductor.Thethermoelectricgenerationisasolidcomponentwhichhasno rotationandmanyadvantages,suchascompactstructure,highreliability,nonoise inwork,nowear,noleaks,goodanti-radiationandflexiblemovement,etc.Itcan generate electromotive forceincase oftemperature difference.
Forthetotalfuelcombustionheatofvehicleengine,poweroutputaccounts for30%to42%(dieselengine)or25%to30%(gasolineengine),theremaining energydischargedbythewayofwasteheatthroughtheenginecoolingwaterand tailgasaccountsfor58%to70%(dieselengine)or70%to75(gasolineengine).It isnotonlyawasteofenergy,butalsocausesacertaindegreeofthermalpollution of atmosphere. For i m p r o v i n g t h e v e h i c l e e n e r g y e f f i c i e n c y and r e d u c i n g t h e e x h a u s t p o l l u t i o n,thermoelectricgenerationsarearrangedaroundtheautomotiveexhaust tubetorecoverythe exhaust heat. Firstly, through the actual experimental test of several kinds of thermoelectric m o d u l e s, t h e i r p e r f o r m a n c e p a r a m e t e r s i n d i f f e r e n t s i z e s w e r e grasped.Thentheadaptivethermoelectricmodulewaschoseandthebestoptionof theexhaustheatpower systemmodelwasdetermined. Secondly, during the internship in the company, according to output performance of thermoelectricmodulesandunderstandinginitsbestworkenvironment,themodel of automotiveexhaustwasteheat powergeneration systemwas designedandprocessed.

Theoutputofthemodelwasestimatedbyuseofheattransfermodel,which providestheoreticalbasisforthesystem.Finally,atestplatformbasedonthe modelofpowergenerationsystemwasbuilt,bywhich theoutputperformanceof themodelwastested.Throughthetest,theperformanceandtheenergy conversion efficiencywere obtained,andarealsenseof energyrecoverywasachieved.

2. WORKING AND DESIGN

Power is generated by using automobile exhaust gas is very simple and easy non-conventional

process. Energy generation using vehicle silencer needs no fuel input power to generate the output of the electrical power. This project using simple mechanism same as wind energy power generation. For this project the main Working Principleis Conversion of the forced kinetic energy into electrical energy. In this the exhaust gases released from the automobile Silencer is used to rotate the turbine (fan blades) by arranging it is very conveniently. The nozzle is attached to the silencer is used to proper flow of exhaust gases with high velocity and steady flow with uniform direction to rotate the turbine. The dynamo attached to the turbine with shaft is used to convert the forced kinetic energy (K.E) into electrical energy (E.E) is by rotating dynamo.

PROJECT DSIGN

The main components used in this process is

- Engine
- Turbine
- Dynamo
- Battery
- Nozzle
- Exhaust pipe

2.1ENGINE:

AnICengineisoneinwhichtheheattransfer totheworkingfluidoccurs withinthe engine itself, usuallybythe combustionof fuelwiththe oxygenof air.

Inexternalcombustionenginesheatistransf erredtotheworkingfluidfrom thecombustiongasesvia aheatexchanger.E.g. steamengines,Sterlingengines.

ICenginesincludesparkignition(SI)engin esusingpetrolasafuel,and compressionignition(CI)engines(usually referredtoasDiesel engines)usingfuel oil, DERV,etc. as a fuel.

Inthese enginesthereisa sequenceof following processes:

1. Suction
2. Compression
3. Expansion
4. Exhaust

- Four strokesof the piston- hencethe 4-stroke engine,or
- Two strokesof thepiston- hence2-strokeengines.

PETROL ENGINES:

Inpetrolenginestheair-fuelratio(AFR)ismaintainedatanapproximately constantvalueof14-16:1bythecarburetororfuelinjectionsystem.Thetop temperature(T3)andthetorqueredeterminedbythea mountofair-fuelmixture admittedbythethrottle.Hencepetrolenginesaredescri bed asbeingquantity governed.

Inpetrolenginesairandfuelarepre-mixedandignitedbyanelectricspark and the combustion process proceeds as a flame front across the combustion chamber.Ifthedesignandmixtureiscorrectthentherea renoproblemsbutifarc> 9themixturetendstoexplodeprematurely.Also,fuelw illnotigniteandburn exceptbetweenair-fuelratiosofbetween10and20to

2.2TURBINE

A steam turbine is a mechanical device that extracts thermal energy from pressurized steam, and converts it into rotary motion. It has almost completely replaced the reciprocating piston steam engine primarily because of its greater thermal efficiency and higher power-to-weight ratio. Because the turbine generates rotary motion, it is particularly suited to be used to drive an electrical generator – about 90% of all electricity generation in the United States is by use of steam turbines. The steam turbine is a form of heat engine that

derives much of its improvement in thermodynamic efficiency through the use of multiple stages in the expansion of the steam, which results in a closer approach to the ideal reversible process.

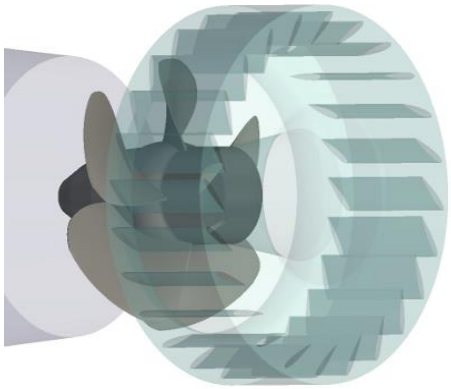


Fig.2.Turbine

2.3DYNAMO:

Dynamo is an electrical generator. This dynamo produces direct current with the use of a commutator. Dynamo were the first generator capable of the power industries. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. On small machines the constant magnetic field may be provided by one or more permanent magnets, larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils.

Fig.3.Dynamo

2.4NOZZZLE:

Jet nozzles are also use in large rooms where the distribution of air via ceiling diffusers is not possible or not practical. When the temperature difference between the supply air and the room air changes, the supply air stream is deflected upwards, to supply warm air, or downwards, to supply cold air. Nozzles can be described as convergent or divergent (expanding from a smaller diameter to a larger one). A de Laval nozzle has a convergent section followed by a divergent section. And is often called a convergent divergent nozzle.

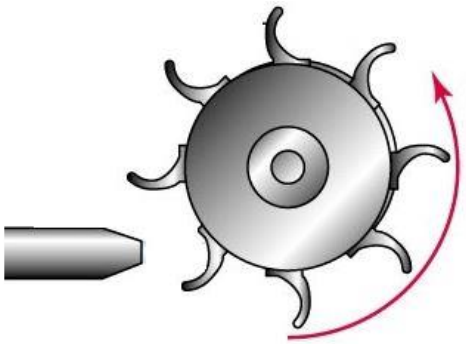


Fig.4. Nozzle and Turbine

2.5BATTERY:

It is a device user to store the power. The power is stored in the form of DC current only. There are many types of batteries are used Lead acid, lithium fluoride and in this work 8Amp current and 12 voltage specification is used.

Fig.6. Battery

2.6 EXHAUST PIPE

Theexhaustpipeisthepassagewayfortheexhaustgasestoflowfromthe manifoldtothemuffler.Itisaheavysteeltube,usuallyflangedatbothends,and attachedtothe muffler.Thediameteroftheexhaustpipeisusuallydeterminedbythesizeofthe engine.Onasmall,one-cylinderengine,apipenolargerthanahouseholdwater pipeisenoughtodothejob.Largerenginesmayrequireexhaustpipes80-100mm indiameter tocarrythe larger amountof exhaustgases.

Thelengthoftheexhaustpipeisdetermined bythedesignofthevehicle.If theengineisinthefrontofthevehicleandthemuffleris mountedintherear,the pipe willbelong.(Often,longpipeswillbemade intwosections.) Toprovideasmuchroadclearanceaspossible,pipesareformedinodd shapesthatfitwellupunder the vehicleswithouttouchingother components.Pipes aresupportedfromthevehicleframebyhangers.

3. ADVANTAGESANDAPPLICATIONS

3.1 ADVANTAGES

- Powerisstored;wehavetouseotherapplicationlikelighting,
- Waste heatisconvertedintousefulenergy(electrical energy).
- Compactinsize
- Affordable andeasilyinstallable

3.2 APPLICATIONS

Power generation using vehicle exhaust gas system can be used in most of the two wheeler‘s and four wheelers

- It is applicable for all stationary and moving vehicles.
- It is applicable for all Automobiles.
- The generating power is applicable for house hold uses.
- Auxiliary uses like indicators, horn etc.
- No problems of discharge in the batteries.
- It is a simple non – conventional energy process.
- This generating power can reduce the need of power.
- To generate the power no need of fuel input.
- It is used in vehicles.

4. TABULATION CALCULATION

TURBINES

Number of Blades	= 25
Diameter	= 10cm

INVERTER

It Converts DC to AC (12Volts to 230 Volts)

BATTERY

12Volt Rechargeable Battery

FORMULA TO BE USED

Area of Swept, $A= (22/7) \times (\text{radius of turbine})^2$

Velocity of the Turbine = ((22/7)x D x N)/60

Where

D=diameter of turbine

N=number of revolution per minute

POWER AVAILABLE AT THE TURBINE,

$P= (1/2) \times \text{Density} \times (\text{Velocity})^3 \times Cp \times \text{Area}$

MODEL CALCULATION

Swept area by the turbine, $A = (22/7) \times \text{radius}^2$

$=3.14 \times (0.05)^2$

$=0.00785\ m^2$

Velocity of the turbine, $V= ((22/7) \times D \times N)/60$

$= (3.14x0.10x45)/60$

$=0.2357$ m/s

Power available at the turbine

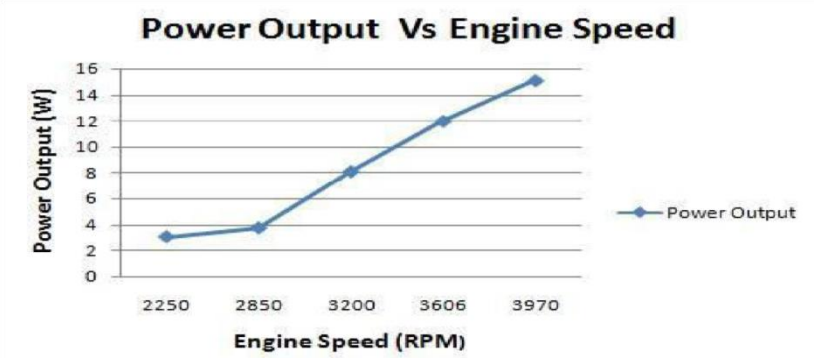
$=1/2x \text{ density} \times \text{area} \times (\text{velocity})^3 \times Cp$

$=1/2 \times 1.23 \times 0.00785 \times (0.2357)^3 x0.4$

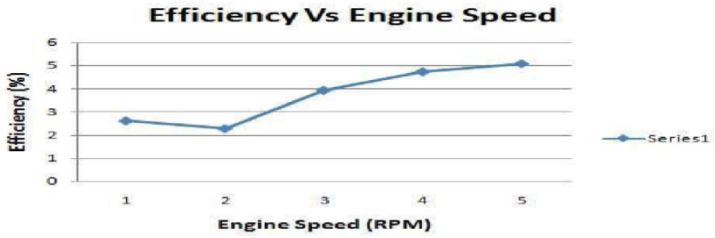
$=2.57x10^{-5}$ watts

Revolutions Per Minute for turbine	Speed of turbine in m/s	Power Available At The Turbine
45	0.2357	$3.222x10^{-5}$
48	0.2514	$3.875x10^{-5}$
54	0.2828	$4.374x10^{-5}$
57	0.2985	$5.1365x10^{-5}$

Tab.4.1 Estimate Power in Different Speed



`The graph shows that the power output is function of engine speed. At the speed of 3970 RPM, the power developed by TEG was 15.225 W.



The graph explains the relation between the overall efficiency of the system and engine speed. At 3970 RPM the efficiency obtained was 5.078%.

5. CONCLUSION

From the study, it has been identified that there are large potentials of energy savings through the use of waste heat recovery technologies. Waste heat recovery entails capturing and reusing the waste heat from internal combustion engine and using it for heating or generating mechanical or electrical work [7, 8, and 9]. It would also help to recognize the improvement in performance and emissions of the engine if these technologies were adopted by the automotive manufacturers.

The study also identified the potentials of the technologies when incorporated with other devices to maximize potential energy efficiency of the vehicles. The project carried out by us made an impressing task in the field of mechanical department. It is used for to produce the current in vehicle exhaust unit.

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