Power Generation From Exhaust Gases of Vehicle

Pravin K. Ghule[1], Sharad R. Gaikwad[2]
[1]Lecturer, Dept of Mechanical Engineering
[2]Dept of Mechanical Engineering
[1, 2]MGM's Polytechnic Aurangabad, Maharashtra, India.

Abstract- *This project aims at the constantly increasing the growth in the number of vehicles is one of the reasons for the deterioration of the ecological situation in cities and large settlements. In order to provide a simple and practical method for measuring the exhaust emission and assessing the effect of pollution control, a model is based on the relationship between traffic flow and vehicle exhaust emission under a certain level of road capacity constraints. The content of toxic substances in the exhaust of diesel and gasoline engines varies and depends on the type of engine and mode of operation, as well as on the quality of the fuel, the composition of the combustible mixture in the engine cylinders, speed and driving conditions, ignition system and fuel control. The number of all toxic components in the exhaust gas exceeds the maximum permissible standards by tens and hundreds of times. One of the most reliable ways to reduce the toxicity of vehicle exhaust gases and remove harmful substances is the complete oxidation of exhaust components using catalytic compositions on metal or ceramic block carriers.*

Keywords- Ceramic Carriers, IC Engine, Metallic Carriers, Exhaust Gases

I. INTRODUCTION

Now-a-days technology is moving at a very faster rate. The conventional sources of energy are on a verge of extinction. scientists are merging towards the use of non-conventional energy resources. But it also requires some kind of energy to convert it into another form. Our project is related in utilizing the kinetic energy of exhaust gases of vehicle which is of no use.In I.C Engines, during the combustion process and the subsequent expansion stroke the heat flows from the cylinder gases through the cylinder walls and cylinder head into the water jacket or cooling fins. Some heat enters the piston head and flows through the piston rings into the cylinder walls or is carried away by the engine lubricating oil which splashes on the underside of the piston.Internal combustion engines at best can transform about 25 to 35 percent of the chemical energy in the fuel into mechanical energy. About 35 per cent of the heat generated is lost to the cooling medium, remainder being dissipated through exhaust and lubricating oil.In our project we are not using this wasted heat but we are using kinetic energy of exhaust gasses.

MATERIAL SELECTION

A) TURBINE:-

Turbine is device having rotating wheel on which is series of blades uniformly fastened on its periphery.

There, the high velocity and volume of the gas flow from silencer is directed the over the turbine's blades, spinning the turbine and, for so, drives their mechanical output. The energy given up to the turbine comes from the reduction in the temperature and pressure of the exhaust gas.

Energy can be extracted in the form of shaft power, compressed air or thrust or any combination of these and used to power aircraft, trains, ships, generators, or even tanks.

Turbine - Extracts the energy from the high-pressure, high-velocity gas flowing from the combustion chamber.

Design of turbine wheel

The wheel (or turbine) is a tangential flow impulse turbine. The exhaust air strikes the bucket along the tangent of the runner. Figure2.1 shows the runner of a wheel. It consists of a circular disc on the periphery of which a number of buckets evenly spaced are fixed. The shape of the bucket is of a cup or bowl. The high velocity air of exhaust gases strikes on the cup of the runner. The buckets are made of stainless steel spoons.

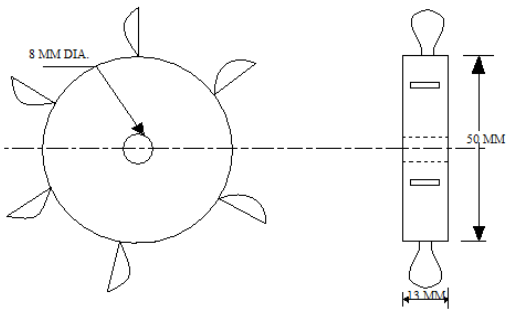

Figure 2.1 turbine wheel

B) FRAME

The casing is design as shown in the figure. Two hose clips of 116mm diameter is taken so that it can be mounted easily on the silencer and can be tightened as per the requirement using nut and bolt arrangement. Four rods of 6mm diameter and 240 mm in length are welded of the periphery of both the hose clips so that it can form a rigid casing for mounting of other accessories.

C) SUPPORTING COLUMN

These are two wooden blocks of dimension 115 *35*20 mm as shown in the figure. Grooves are cut on both sides of the column so that it can be easily mounted on the casing and are fixed with the help of araldite. The column is made such that, the bearings and the motor can be easily mounted on it.

D) GEARS

Gears are toothed wheels used for transmitting motion andpower from one shaft to another shaft.

Gears of velocity ratio 3.4:1 are directly purchase from the market. The velocity ratio of the gears is calculated as follows:

$$\text{VELOCITY RATIO} = \frac{\text{NO. OF TEETH ON DRIVING GEAR}}{\text{NO. OF TEETH ON DRIVEN GEAR}}$$

The gear ratio should be more as possible as so that more rpmcan be achieved, output can be increased.

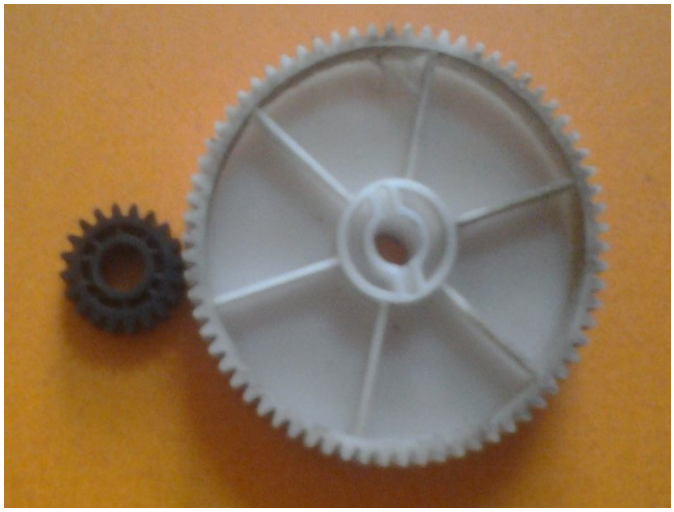

Fig.2.2Gears

E) D.C GENERATOR

An electric D.C Generator is a machine which converts mechanical energy (or power) into electrical energy (or power).

Principle of D.C Generator

It is based on the principle of production of dynamically (or motional) induced emf (Electromotive Force). Whenever a conductor cuts magnetic flux, dynamically induced emf. is produced in it according to Faraday's Laws of Electromagnetic Induction. This emf. causes a current to flow if the conductor circuit is closed.

Hence, the basic essential parts of an electric generator are :

- A magnetic field and A conductor or conductors which can so move as to cut the flux
- A D.C Generator of 3 volts capacity is directly purchased from the market.

Fig. 2.5 D.C Generator

F) BEARINGS

A **bearing** is a device to allow constrained relative motion between two or more parts, typically rotation or linear movement.

Bearings may be classified broadly according to the motions they allow and according to their principle of operation as well as by the directions of applied loads they can handle.

Principles of operation

There are at least six common principles of operation:

- plain bearing, also known by the specific styles: bushings, journal bearings, sleeve bearings, rifle bearings
- rolling-element bearings such as ball bearings and roller bearings
- jewel bearings, in which the load is carried by rolling the axle slightly off-center
- fluid bearings, in which the load is carried by a gas or liquid
- magnetic bearings, in which the load is carried by a magnetic field
- Flexure bearings, in which the motion is supported by a load element which bends.
- Bearings of standard dimension of no. Z82g are directly purchased from the market. No. Of bearings required are two as the turbine is mounted between the bearings so as to rotate freely without friction.

Fig. 2.7 Bearings

III. DESIGN CONSIDERATIONS

For the design of the proposed model, the following considerations are made.

1. The set up is so designed that is does not have any effect on the efficiency of the engine.
2. It can be easily mounted on the vehicle.
3. The exhaust gases can be fully utilized as possible.
4. It must be light in weight.
5. It is simple in construction so as to fabricate locally with least available resources and skills.
6. It is of low cost, simple in construction and maintenance.

The following special equipment's should be used in the design of proposed model.

1. Arc welding set with 3mm welding rod.
2. Engineer's bench and vice.
3. Metal sheet cutter and saw.
4. Marking compass
5. Files and general engineering hand tools

IV. WORKING PRINCIPLE

The exhaust gases of the engine are having high velocity and pressure. So by utilizing the velocity of exhaust gases a small generator can be run which would be capable to charge a cell phone. So, we are designing a set up which uses the high velocity of exhaust gases to run a small gas turbine which in turn runs a small generator which would be capable enough to generate power so that a cell phone can be charged.

This set up also can be used:-

1. 1.To operate the various vehicles accessories such as head and tail lamps, side indicators, horn, IR sensors, etc.
2. Above certain speed of engine the generator gives large output than required. So this extra output can be stored using a battery and can be used at times when the speed of the engine is low and the output required is less.

TESTING OF PROPOSED MODEL

Different readings at different RPM of the engine are noted as shown below in the table.

Sr. No.	SPEED In Km/hr	OUTPUT OF GENERATOR in Volts	CURRENT In Ampere	POWER DEVEL-OPED in W
1	20	2.12	0.05	0.1202
2	30	3.4	0.9	0.39
3	40	4.82	0.17	0.9475
4	50	5.15	0.28	1.6332

O/P table

Different vehicles have different exhaust gas velocity so the reading may vary from vehicle to vehicle.

COST ESTIMATION

Sr no	Material name	Specification	Quantity	Cost
1	Dc motor	12 dc gear	1	200
2	Bearing	10 mm id	2	140
3	Shaft	10mm od 300 mm length	1	70
4	Spur gear	Spur	2	140
5	Mechanical structure		1	800
Total				1,350

V. ADVANTAGES

1. It requires no external power to drive the generator.
2. Increased efficiency of the engine with the same input.
3. Its weight does not have any effect on the efficiency of the engine.
4. Can be easily carried along with the vehicle.
5. It is simple in construction so as to fabricate locally with least available resources and skills.
6. It is of low cost, simple in construction and maintenance.

VI. APPLICATIONS

It is basically designed to generate electricity this electricity we can be use it

1. To charge cell phone.
2. To operate the vehicles various accessories such as head and tail lamps, side indicators, horn IR sensors etc.
3. Above certain speed of engine the generator gives large output than required. So this extra output can be stored using a battery and can be used at times when the speed of the engine is low and the output required is less.
4. It can also be use to charge digital cameras, I-Pod etc.

VII. FUTURE SCOPE

By further modification, of this set up can be also be used for various purposes as follows:-

1. To operate the vehicles various accessories such as head and tail lamps, side indicators, horn etc.
2. Above certain speed of engine the generator gives large output than required. So this extra output can be stored using a battery and can be used at times when the speed of the engine is low and the output required is less.
3. This set up also can used at chimney sugar industry, thermal power plant, in bathrooms at tap etc.

VIII. CONCLUSION

The main objective of the paper is to find the relationship between Vehicle exhaust emission and traffic flow under a certain level of urban road capacity constraints. Waste heat from internal combustion Engine and using it for heating or generating mechanical or electrical Work. It would also help to recognize the improvement in performance And emissions of the engine. 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 vehicle. 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.

IX. APPENDIX

REFERENCES

[1] Design of machine elements Second edition Tata Magraw HillPublication by V. B. Bhandari
[2] I.C Engines By V. Ganeshan
[3] Machine Design ByKhurmi and Gupta.
[4] http://en.wikipedia.org/wiki/Gas_turbine
[5] e.http://en.wikipedia.org/wiki/Bearing_(mechanical)
[6] http://en.wikipedia.org/wiki/electric D.C. generator.