

Mechanism of Turbo Charger for 2 Stroke Engine to Improve Efficiency

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ABSTRACT: Turbochargers are used throughout the automotive industry as they can enhance the output of an internal combustion (IC) engine without the need to increase its cylinder capacity. The application of such a mechanical device enables automotive manufacturers to adopt smaller displacement engines, commonly known as “engine downsizing”. Historically, turbochargers were often used to increase the potential of an already powerful IC engine. The emphasis today is to provide a feasible engineering solution to manufacturing economics and “greener” road vehicles. It is because of these reasons that turbochargers are now becoming more and more popular in automobile applications. The aim of this project is to provide a review on the techniques used in turbocharging to increase the engine output and reduce the Exhaust emission levels.

I. INTRODUCTION

1. GENERAL:

Two stroke and four stroke engine. In two stroke engine due to the cycles limitations fuel will not properly burn. By considering this drawback we decided to make a project which will help to increase the average or performance of engine in two stroke engine. In stroke engine the air fuel ratio is 14:1 or 16:1 but in actual practice the ratio is less because of insufficient air fuel ratio so we decided to get that air fuel ratio by adding a new concept of turbo charger to the vehicle. The concept of turbocharger is explained as below.

2. TURBO CHARGER:

The meaning of turbo charger is to give pressurized air to the engine without mounting any component to run of engine power. The turbo charger means a fan used in unit. It direct means a air fan which rotates on the power of wind this powered wind is provided is given to us by the exhaust manifold is used to remove the burnt gas in the atmosphere the gas coming from the engine is so fast & it contains two types of energies. They are

1. Pressure energy.
2. Heat energy.

Due to the pressure & heat energy the air in the manifold gets preheated or it is very hot vapor this air contains lot of power. The power is of no use the power is just left in silencer the power wasted by the exhaust gas in the form of pressure is about approx. 30% .the efficiency of the pressure energy can be utilized. The energy means to find a component in the silencer or the manifold. It is done in mostly for four wheeler vehicles. It is a system to give pressurized air to carburetor. The carburetor adjusts the regulator

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valve according to the air need & the use of petrol (fuel) will be decreased. This will increase the average by minimizing the fuel to be supplied by increasing the air fuel ratio.

3. PRESENT SYSTEM IN TWO WHEELER AUTO:

The present system I automobile in two wheelers is the air from the exhaust Is the air from the exhaust is given to the air from the exhaust is given to the exhaust manifold from there the gas is made flow to silencer or muffler. Because in two wheelers the place is less & the advancement is less. While the engine runs during that time the during the suction stroke the engines requires about 20% of energy developed to move the piston down because the air in two wheelers are to be sucked from the atmosphere. For example the flow of air through the engine is just like a nose. But during the whole process the pressure energy is of the piston & the air flows from the intake manifold is due to vacuum pressure & when the piston will move up the vacuum energy is not completely filled due to which the oxygen percentage in the combusting chamber is insufficient for the fuel burning in two wheelers.

II. RELATED WORK

1. TURBOCHARGER IN TWO WHEELER ENGINE: (S. VANANGAMUDI, S. PRABHAKAR, C. THAMOTHARAN AND R. ANBAZHAGAN)

In 1909, a Swiss inventor named Alfred buchi building on what the super charger guys were learning, demonstrated that he could harness some of the energy remaining in the exhaust stream of a diesel engine and use it to drive a compressor. He correctly reasoned that a significant quantity of the combustion energy was literally wasted out the tailpipe at the end of every exhaust stroke. If he could harness some of this "WASTE HEAT " energy with, say a turbine, he could power a compressor and have the benefits of a super charger, without corresponding huge crankshaft horse power drain. With this simple revelation, the turbo charger was born.

2. SOME INNOVATIONS IN DESIGN OF LOW COST VARIABLE COMPRESSION RATIO TWO STROKE PETROL ENGINE. (A.SRINIVAS, G.VENKATASUBBAIAH, P.VENKATESWAR RAO & M. PENCHAL REDDY)

The two stroke engine is simple to construct. The engine requires two piston strokes or one complete revolution for each cycle. Exhaust ports in the cylinder walls are uncovered by the piston, permitting the escape of exhaust of gases and reducing the pressure in the cylinder. The charge now flows into the cylinder and is compressed in a separate crank case compartment to a pressure greater than atmosphere pressure. Intake ports are uncovered by the piston and the compressed charge flows into the cylinder, expelling most of the exhaust products, however some charge do escape with the exhaust [1, 2]. Comparing four stroke engines, two stroke engines can delivers 50 to 80 % greater power per one piston displacement, high power to weight ratio(twice as many power impulses per cylinder revolutions) piston pin & crank pin experience force in one direction and finally, low cost due to valueless design . The above mentioned features are exploited by the two wheelers stunt drivers, mountain climbing bikes, drag race motor cycles etc. The two stroke engine is simple to construct. The engine requires two piston strokes or one complete revolution for each cycle. Exhaust ports in the cylinder walls are uncovered by the piston, permitting the escape of exhaust of gases and reducing the pressure in the cylinder. The charge now flows into the cylinder and is compressed

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3. FABRICATION AND IMPLEMENTATION OF TURBO CHARGER IN TWO-WHEELER: (AMALORPAVA DASS. J, MR.SANKARLAL.P)

The output of the engine exhaust gas is given to the input of the turbine blades, so that the pressurized air produced. This power, the alternate power must be much more convenient in availability and usage. The next important reason for the search of effective, unadulterated power are to save the surrounding environments including men, machine and material of both the existing and the next fourth generation from pollution, the cause for many harmful happenings and to reach the saturation point. The most talented power against the natural resource is supposed to be the electric and solar energies that best suit the automobiles. The unadulterated zero emission electrical and solar power, is the only easily attainable alternate source. Hence we decided to incorporate the solar power in the field of automobile, the concept of many Multi National Companies (MNC) and to get relieved from the incorrigible air pollution.

4. FABRICATION AND PERFORMANCE TEST OF TURBOCHARGER FOR TWO WHEELER: (B JNANA DEEPAK, N KRISHNA PRIYA, B REVANTH, K S JAYA PRAKASH AND B HEMANTH KUMAR)

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5. EXPERIMENTAL ANALYSIS OF SPARK IGNITION ENGINE (BELOW 100CC) WITH SUPERCHARGER USING E10 FUEL: (RAHUL KUMAR SHARMA, MANOJ SHARMA, SUMEET SINGH, VIKRANTH K RAO, ASHISH JAIN)

It is known fact that the power output of an engine increases with an increase in amount of air or mixture in the cylinder at the beginning of compression stroke because it allows the burning of more quantity of fuel. The amount of air induced per unit time can be increased by increasing engine speed or increasing air density during suction stroke. The increase in engine speed requires rigid and robust engine as the inertia load increases rapidly with an increases speed. The engine friction and bearing loads also increase and volumetric efficiency and falls with increasing speed of engine. Therefore this is not possible. Now another method in which we have to increase the suction pressure is called supercharging. Equipment used for this is called Supercharger. The power output is also be increased by increasing the compression ratio, but is also not desirable as it increase the maximum cylinder pressure. The rate of increase in maximum Pressure in cycle with increased compression ratio is less than the rate of increase in mean effective pressure in case of supercharged engine.

6. TURBOCHARGING OF IC ENGINE: A REVIEW: (MOHD MUQEEM, DR. MANOJ KUMAR)

A turbocharger is a device used to allow more power to be produced for an engine of a given size. A turbocharged engine can be more powerful and efficient than a naturally aspirated engine because the turbine forces more intake air, proportionately more fuel, into the combustion chamber than if atmospheric pressure alone is used. Its purpose is to increase the volumetric efficiency of the combustion chamber. Various new technologies have been introduced to assist the turbocharging of internal combustion engine so that the volumetric efficiency may improve more. These technologies include inter-cooling of the charged air before going in to the combustion chamber so that its mass flow rate is increased. The other technology is twin charging in which firstly the engine is boosted by a supercharger then it is boosted by a turbocharger when the energy of exhaust gas is sufficient to rotate the turbine blades. There are various other technologies used for this purpose of improving the volumetric efficiency which will be discussed later in the literature review.

III. PROPOSED MECHANISM

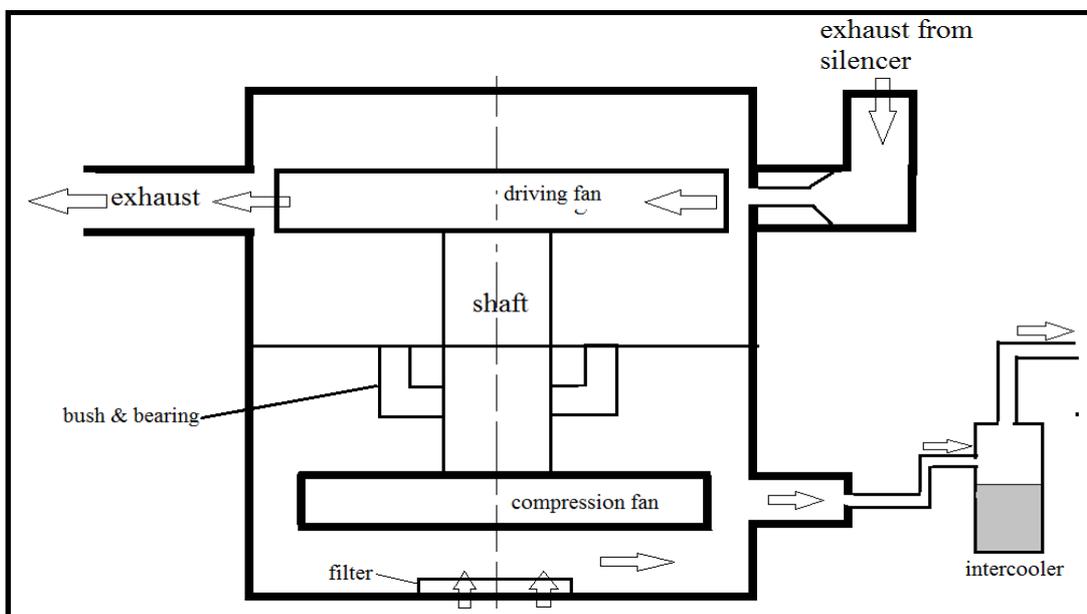


Figure No.2 Modified System Used In Project

In this system, the heat energy released from the engine exhaust Can be used to pre heat. The oxygen and the pressure energy can also be used to do some work the following material are designed to prepare two Wheeler turbo chargers are as follows.

1. Design of ventury meter.
2. Design of driver fan.
3. Design of shaft.
4. Selection of bearing.
5. Selection of bush.
6. Design of comp fan.

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7. The outlet design.
8. Design of intermediate cooler.

IV. EXPERIMENTAL INVESTIGATION

Ventury meter is an apparatus used for finding out the discharge in The pipe if consist of following three types. There are three types of ventury meter they are as follows.

- Convergent cone:-

It is a short pipe, which converges from the pipe diameter To throttle diameter the slope of convergent side, is kept between in four or In five.

- Throat:

It is circular pipe having diameter equal to half or one third of pipe.

- Divergent cone:-

It is diverging pipe 5 to 4 times longer then the convergent cone connects through diameter with the pipe dimensions. It is also known as outlet of ventury meter.

Diameter of convergent =35mm

Flow through the air =3.5m/s

By formula for calculation of Q = discharge through silencer.

$$Q = a_i \times v_i$$

$$= \pi/4 \times d^2 \times 3.5$$

$$= \pi/4 \times (35/1000)^2 \times 3.5$$

$$Q = 1.54 \times 10^{-4} \text{ m}^3/\text{s}$$

The discharge of the gas is $1.54 \times 10^{-4} \text{ m}^3/\text{s}$.

Obtained from design assuming

$$V1 = 3.5$$

$$V2 = 7 \text{ as } d2 \text{ is } \frac{1}{2} \text{ times of } d1$$

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By formula of energy theorem at that point we get

$$\frac{P_1}{\rho \cdot g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho \cdot g} + \frac{V_2^2}{2g} + Z_2$$

as $Z_1 = Z_2$

$$P_1 - P_2 = \frac{\rho \cdot V_2^2}{2} - \frac{\rho \cdot V_1^2}{2}$$

$$P_1 - P_2 = (7)^2/20 - (3.5)^2/20$$

$$P_1 - P_2 = 2.45 - 0.6175$$

$$P_1 - P_2 = 1.833.$$

But $P_1 = 2 \text{ times } P_2$.

$$P_1 - 2 P_2 = 1.833.$$

$$P_1 = 1.833 \text{ N/m}^2.$$

The pressure released from the ventury meter at the outlet fan is 1.83 N/m².

1. BEARING SELECTION:

Bearing is one of the important components in turbo charger because the bearing the component in which the rotation of smooth fan takes place the bearing used in the project is of SKF company. This company is well know at the manufacturing of bearing.

- Material: - carbon steel.
- Bearing No : - 627 no.
- Size : - outer diameter 19mm.
Inner diameter 6mm.

The bearing had cover of Z type on both side for two purposes

1. To let the grease near bearing.

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2. To prevent the let of carbon inside.
3. To play oil seal for gas.

2. SELECTION OF BUSH:

The bush is also such of that type that the outer diameter of the bush must be of 19mm and the inner dia must be of 7mm. the bush helps to prevent bearing from dust.

- Material :- rubber bush

3. DESGIN OF A CIRCULAR RIB FOR FIXING BEARING AND BUSH:

Rib is also made of mild steel to the following reasons.

1. Good conductor of heat.
2. Easy to machining.
3. The finishing is good.
4. Good for welding purpose.

4. Design of rib:

The assumption made for fan

1. There are no forces on rib.
2. The rib holds only the bearing and bush.
3. It is made only because the thickness of hub is not so much to have grip in bearing and bushes it is done to support it.

The thickness of rib is assumed as 5mm. without any calculation.

V. CONSTRUCTION MECHANISM

We make new silencer for our project. We made new modified silencer at the place of old silencer for our project vehicle. It consist of shaft which is fitted with bearing on the shaft driving an compression fan is fitted the use of driving fan is to rotate compression fan with the help of exhaust gas at the bottom of silencer the filter is provided to suck the atmospheric air from the atmosphere. We made the intercooler for cooling the superheated air. The intercooler and silencer port joined by pipe the sucked air is passes through intercooler to carburetor. The original silencer of the vehicle is replaced by our modified Silencer.

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Figure No.3 Construction of Turboc

ASSEMBLY



Figure No.4 Assembly

In the assembly we implement the fabricated turbocharger to the silencer of vehicle. In this assembly the arrangement consist of the turbine wheel, blower and the bush, bearing. The outlet of the turbocharger is attached to the intercooler and the intercooler outlet attached to the carburetor of the engine through the pipes.

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VI. WORKING MECHANISM

The fresh air flows through the following methods of turbo charger.

1. From atmosphere.
2. To the compression fan.
3. Flow through pipe.
4. To intermediate cooler.
5. To the carburetor.

The fresh air present in the atmosphere is sucked by the compressor fan. By creating low pressure due to this low pressure the air flow in the chamber and the gas is made to flow in the pipe this flexible pipe is attached to intermediate cooler.

Main function is when the air flow through comp chamber that time the thermal temperature of silencer and the fan temperature makes the density of air less to increase this density the intermediate cooler is provided. In this, the fresh charged air is brought in contact with the oil and cooled it the air is cooled and given to silencer.

VII. OBSERVATIONS

1. TESTING OF VEHICLE:

Readings are taken as the sample tasting method. the process is carried out by taking different quantity of fuel and running the vehicle at steady state condition. The readings of performance are considered as the average of the vehicle.

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SR. NO.	FUEL QUANTITY	TRIAL NO.	WITHOUT TURBOCHARGER	WITH TURBOCHARGER	INCREASE IN AVERAGE	RESULT
1.	50 ml	1	2.50 km	2.85 km	0.35km	0.35 km
		2	2.52 km	2.90 km	0.38km	
		3	2.49 km	2.82 km	0.33km	
2.	100ml	1	4.80 km	5.48 km	0.68 km	0.71 km
		2	4.90 km	5.62 km	0.72 km	
		3	5.00 km	5.74 km	0.74 km	
3.	500ml	1	25 km	28.50 km	3.50 km	3.50 km
4.	1000ml	1	50km	57km	7 km	7 km

Table no. 1

The trial & testing shows the average of vehicle increased by adding turbocharger to the vehicle about 6 km to 7 km per liter of fuel.

VIII. RESULTS AND DISCUSSION

RESULT:

sr. no.	fuel quantity	Increase in average
1.	50 ml	0.35 km
2.	100 ml	0.71 km
3.	500 ml	3.50 km
4.	1000 ml	7 km

Table No.2 Result

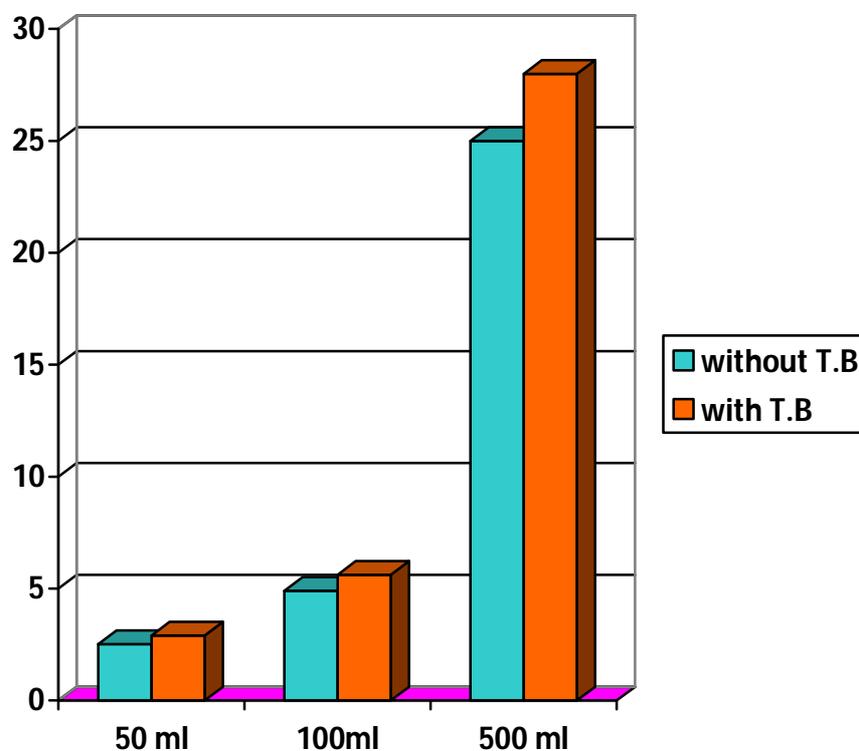
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As we are taking the testing of vehicle with and without turbocharger the above result is obtained. For taking the above observation we used the average tube. Hence from above result table it shows the average of the vehicle is increased by 7 km/liter

IX. GRAPHICAL REPRESENTATION



Comparison of Fuel Efficiency

The above graph shows the comparison between the vehicle used with and without turbocharger at the above reading. The graph shows the efficiency of vehicle

X. CONCLUSION

We have designed and fabricated a prototype of the Turbocharger was implemented in Two-wheeler, in which the efficiency of the Engine can be increased. Thus we have developed a method to increase the efficiency of the engine and at the same time to control the Emissions from the engine. The experimental setup of block diagram is shows the arrangement of turbocharger in two-wheeler. This type of engine will be more efficient than existing engines. It is also good with regard to economical considerations and engine efficiency.



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REFERENCES

1. Heywood JB. "Internal Combustion Engines". USA: McGraw-Hill, 1988.
2. M Ayaz Afsar, Mr Prafulla V. Pawar, Mr Prathik Dahule, Mr. S. Papinwar. "Experimental investigation of direct air injection scavenged two stroke engine". 2009 International symposium on computing, communication and control (ISCCC). Proc. Of CSIT vol.1 (2001). PP. 21-24.
3. Colin R. Ferguson, Allan T. Kirkpatrick. "Internal combustion engines, Applied Thermosciences". John Wiley & Sons (Asia) Pte Ltd, Singapore. 2004.
4. Amjad Shaik, N Shenbaga Vinayaga Moorthi and R rudramoorthy. "Variable compression ratio engine: A future power plant for automobiles- An overview". Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering September 1, 2007 vol. 221 no. 9. pp1159-1168
5. N. Seshaiiah. "Efficiency and exhaust gas analysis of variable compression ratio spark ignition engine fuelled with alternative fuels". International journal of energy and environment. Vol.1, Issue 5, 2010. pp 861-870.
6. Yashvir Singh, Nishant Kr. Singh, Rakesh Prasad and Hemant Kr. Nayak, "Performance Analysis of Supercharging of Two Wheelers" International Journal of Mechanical Engineering.