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Simulation of ultracharger

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ABSTRACT

The motive of the study is to increase the efficiency and power parallel by giving enough air to the combustion chamber for stoichiometric air fuel ratio mixture for complete combustion. Historically, turbocharger and supercharger were used to increase the power of the engine. In the present study, let boost the initial intake manifold pressure to the combustion chamber. The aim is to reduce this problem but economically it's not suitable one. In the present segment, most innovator use modern technology to eradicate the problems in force induction for getting higher efficiency. But there also lies another consideration which is pollution norms. . So the only way is to give enough air to the combustion chamber. To compensation this force induction is used.Which have two segment super charger which runs on crank power and turbocharge which runs on exhaust pressure. Super charge has benefits at low and mid-range and turbocharge has benefits at mid and high range.So to conquer at any range ultra-charger is used. This is the up gradation of force induction. At low and mid-range, It runs on belt as soon as the rpm of engine at mid and high range, it disengage the belt and runs on exhaust pressure.In short form ultra charger is the combination of centrifugal supercharger and ball bearing turbocharger.

Index words: Automobile, Internal Combustion Engine, Forced Induction, Turbocharger, Supercharger and Hybrid, Performance.

INTRODUCTION

Forced Induction

Forced induction is used in the automotive and aviation industry to increase engine power and efficiency. A forced induction engine is essentially two compressors in series. The compression stroke of the engine is the main compression that every engine has. An additional compressor feeding into the intake of the engine causes forced induction of air. A compressor feeding pressure into another greatly Increases the total compression ratio of the entire system. This intake pressure is called boost. This particularly helps aviation engines, as they need to operate at higher altitudes with lower air densities [1].

Higher compression engines have the benefit of maximizing the amount of useful energy evolved per unit of fuel. Therefore, the thermal efficiency of the engine is increased in accordance with the vapour power cycle analysis of the second law of thermodynamics. The reason all engines are not higher compression is because for any given octane, the fuel will prematurely detonate with a higher than normal compression ratio. This is called pre-ignition which is detonation or knock in combustion chamber and can cause severe engine damage. High compression on a naturally aspirated engine can reach the detonation threshold fairly easily. However, a forced induction engine can have a higher total compression without detonation

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because the air charge can be cooled after the first stage of compression, using an intercooler [2, 3].

High compression causes high combustion temperatures [4-6].

The displacement and efficiency of a naturally aspirated engine limit how much power it can make. The engine can only inhale so much air because the atmospheric force that's pushing air into the engine is only 14.7 lbs. per square inch at sea level. To make matters worse, atmospheric pressure decreases with elevation. Air density also decreases with temperature because hot air is thinner than cold air. Most stock naturally aspirated engines only achieve a peak volumetric efficiency of 75% to 85%. Turn up the boost pressure to 14 to 16 psi and you can usually double the power output of most engines [7, 8].

K27 TEL TURBOCHARGER

Turbo charging systems make basically use of a turbine-compressor arrangement in the exhaust line of the engine where the exhaust gases are used to rotate the turbine that drives the compressor which in turn compresses the inlet air to the required boost pressure.

Fig. 1 Tel Turbocharger

Boost Lag

Turbo-lag basically refers to the time required for the turbo to spool up i.e. the time required for the required boost pressure to be achieved, this occurs mainly because of the finite time required for the pulse of exhaust gas to reach the turbine, hence making the turbocharger very unresponsive and sluggish at low speeds.

Variable geometry turbocharger are capable of reducing the turbo-lag to a large extent but is generally expensive and still has the disadvantage of back-pressure.

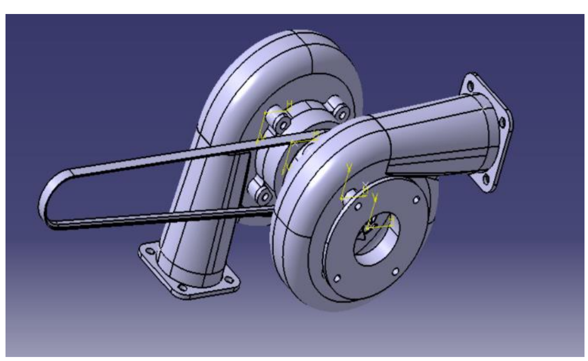


Fig. 2 Design for Ultracharger

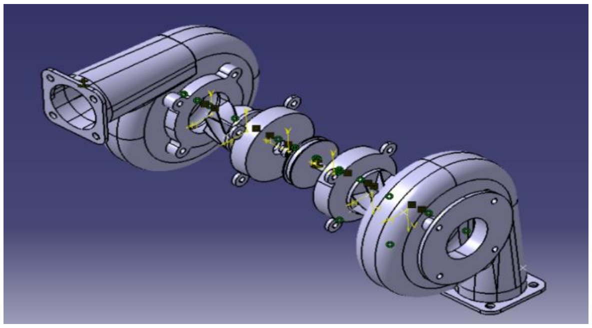


Fig 3.Exploded View of Ultracharger

Components
Ratchet wheel, Vee belt. Pulley

Application

It can be used for all automobile vehicles such as Car, Bikes, Trucks and special application

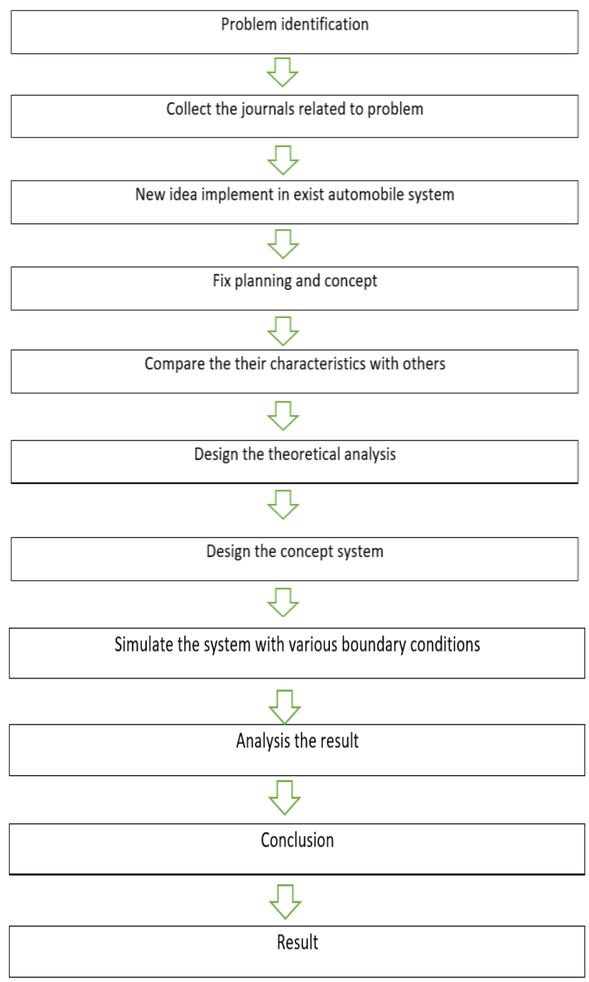
LITERATURE RIVIEW

1. Kusztelan, Y.F. Yao *et al*, Invented the turbocharger concept for increase the efficiency of internal combustion engine who said this is possible because the engine performance is related to the force acting upon the piston which produces work and therefore torque. The resultant high density airflow then enters the engine combustion chamber to mix with the fuel. Due to the increased air density (hence higher mass flow rate), the brake mean effective pressure acting upon the piston crown is enhanced.
2. Nicola Terdich and Ricardo Martinez-Botas calculated the turbocharger by assist with electric motor who said Electric turbocharger assistance (ETA) consists in assisting the turbocharger operation by means of an electric motor/ generator, which is mechanically coupled to the turbocharger shaft. Electrically assisted turbochargers are mainly used to improve the engine transient response.In the electric machine rotor has been fixed on the turbocharger shaft, so that the full motor/generator sits within the turbocharger bearing housing. The turbine is a variable geometry type, where the geometry is altered by changing the nozzles angle
3. Yukio Yamashita *et al*, developed Electric Supercharger to Facilitate the Downsizing of Automobile Engines Variable geometry (VG) turbochargers, which can vary the turbine capacity in response to the engine load.
4. Steven D and Arnold k developed Turbocharging Technologies to Meet Critical Performance Demands of Ultra-Low Emissions Diesel Engines Constant engine speed and constant Brake Mean Effective Pressure (BMEP) lines are shown on a typical compressor map. The turbo performance envelope is defined by a maximum speed line, choke flow line and surge line. The maximum speed of the compressor combined with the aerodynamic blade shape determines the pressure ratio capability of the design.
5. K. Tanimoto and k. kajikara analyzed performance of hybrid ceramic ball bearing turbocharger who said bearings of turbochargers are required to have good acceleration response, rotational performance (low torque, vibration, low temperature rise at high speeds, etc journal bearings using a floating bush which are a kind of slide bearings and hydrodynamic or hydrostatic thrust bearings are mainly used as support bearings of turbine shafts, and steel ball bearings are used for some engines to improve rotational performance of acceleration response.
6. Zhibin Wang1 *et al*,Researched on Supercharger for the Diesel the air entering into the cylinder is increased by the supercharger technology that can not only improve the power of diesel engines but also ameliorate the economy of diesel engines by reducing the fuel consumption. This is the supercharger working principle. In addition,

the combustion is more thorough due to sufficient amount of air entering not only improving fuel economy but also reducing harmful exhaust emissions.

7. Bo Hu *et al*,published Observations on and potential trends for mechanically supercharging a downsized passenger car engine. A review Engine downsizing, which is the use of a smaller-swept volume engine to provide the power of a larger-swept volume engine, is widely accepted as one of the most viable solutions to address the fuel economy and the environment issues facing passenger car engines. Reduced pumping loss, improved heat transfer and better friction conditions, which thus shift the operating points of the engine into a more efficient area, are the major reasons for the improved fuel efficiency in the frequently used areas of low-load engine operation.
8. Wan Saiful-Islam and Wan Salim published Study of Externally Waste-gated Turbine Performance under Steady and Pulsating Inlet Conditions for Improved Turbocharger Matching The pressure energy available in the exhaust gas is utilized to drive a turbine, which in turn drives an air compressor. The compressor increases the intake air density to a higher-than-ambient value, allowing the combustion to take place at a higher volumetric efficiency.

METHODOLOGY



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DESIGN OF THE ULTRACHARGING SYSTEM SETUP

The system which is to be designed for demonstration and experimental purposes as shown below:

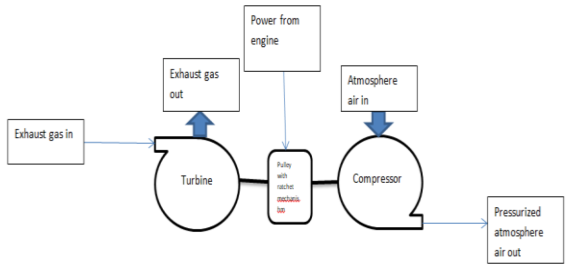

Fig.4 Design setup

An ultra-charger is an engine powered turbocharger consisting of a high speed turbine and a ratchet mechanism in between two casing. The turbine and compressor is high-speed wheel, as in a conventional turbocharger. There is mechanical link (Shaft) between the turbine and compressor. In other words, ultra charger refers to an upgraded hybrid setup, in which ratchet speed and power are dependent upon the turbine speed and power. This design flexibility leads to further improvements in turbine and compressor efficiency, beyond a conventional turbocharger.

RESULT AND DISCUSSION

There is a new material called “self-lubricating material”. Not yet done researches about it. But if it increases the performance or life of this concept then it is induced in it. The turbo lag can be reduced as an external air compressor is used to run the turbine of the turbocharger. when compared to the K27 Tel turbo charging method because of the reduction in resistance to flow of exhaust gas by the heat pipes when compared to the turbine of the heat exchanger.

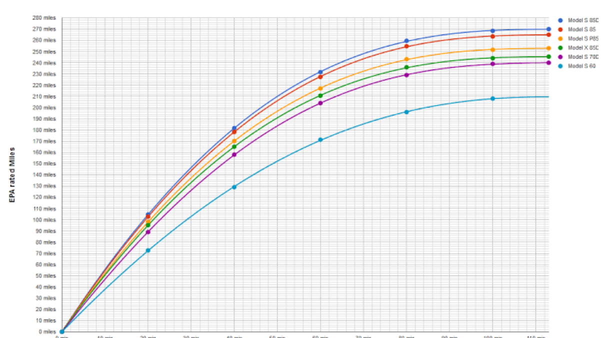

Fig.: Pressure Range of Ultracharger

CONCLUSION

By analyzing all the report the most common saying is that turbocharger have boost lag. So the concept is to eliminate the boost lag by using the power from the engine through belt and pulley.

Reduced Turbo-lag - Since the system has the air compressor end (which is responsible for the circulation of working fluid) coupled directly to the engine camshaft, the turbo tends to spool up almost instantly providing required boost pressure even at low speeds of operation.

By this analysis to increased initial pressure of the engine without any external devices.

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