

Detachable Supercharger Kit For Two Wheeler

Alok Ghude
Student in DBACER
Nagpur

Ketan Deshpande
Student in SRCOEM
Nagpur

Nilesh Belokar
Student in DBACER
Nagpur

Abstract

The air available at higher altitude is very thin therefore the amount of oxygen available in the air is very less. Therefore various problems are faced by two wheeler at higher altitude. The problems such as low power, shutting down of engine, low torque, etc hinder the use of two wheelers at higher altitude. This may be overcome by using lower octane fuel than normally being used which may not be available all the time and though if used it will not provide sufficient power to climb the hills. To make this happen a supercharger detachable kit can be used on which a novel concept is presented in the paper.

1. Introduction

Supercharging is the process of supplying to the engine, air fuel mixture at a pressure above the atmospheric. On an ordinary engine without a supercharger, the downward piston movement during the intake stroke creates the vacuum in the intake manifold which is used to draw the air-fuel mixture through the carburetor into the cylinder. With supercharging, however, due to high pressure the density of charge increases and, therefore, its weight per stroke is increased for the same swept volume. It is seen that power output of engine is almost directly proportional to the weight of charge per minute, therefore the supercharged engines gives more output.

Further at higher altitude, the air gets thin thus reducing the weight rate of air flow in the engine

leading to fall in the power output. It is here also that the supercharging comes to our aid by increasing the density and hence the weight rate of air flows in the engine, thus offsetting any fall in power output due to altitude.

2. Supercharged Vs Naturally Aspirated engine

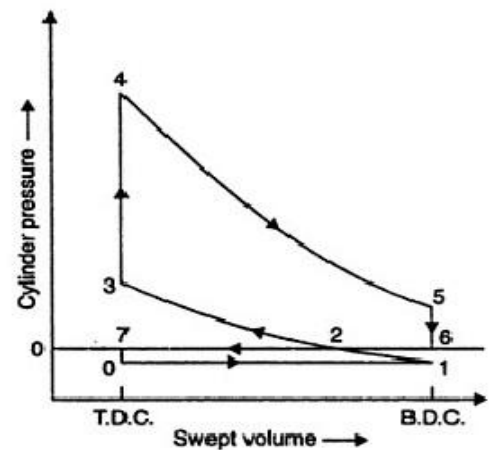


Fig-1 Theoretical naturally aspirated petrol engine (constant volume) pressure-volume diagram.

In Fig1 loop 2-3-4-5-6 represent the useful power developed, whereas loop 0-1-2-7 represents the negative power, i.e. the power required to induct the fresh charge in the cylinder.

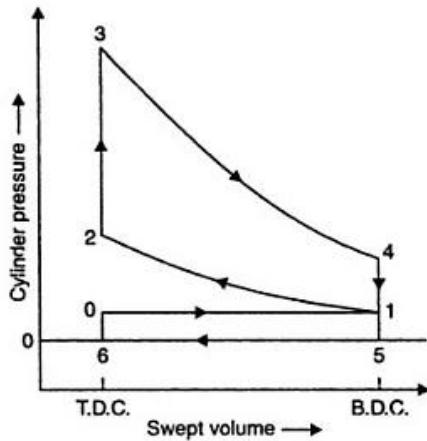
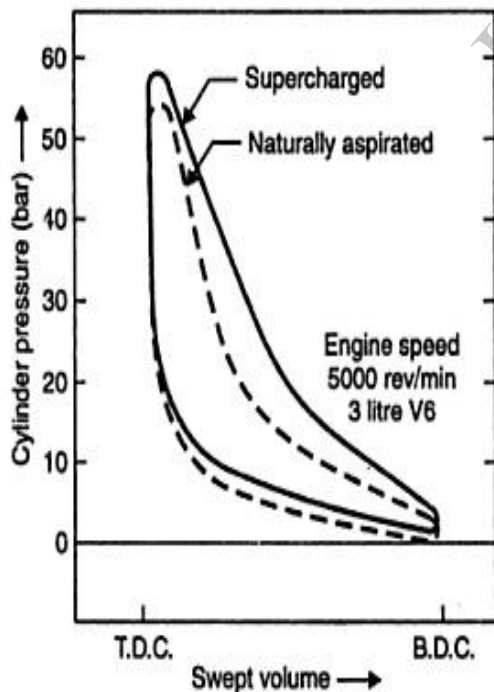


Fig-2 Theoretical supercharged petrol engine (constant volume) pressure-volume diagram.

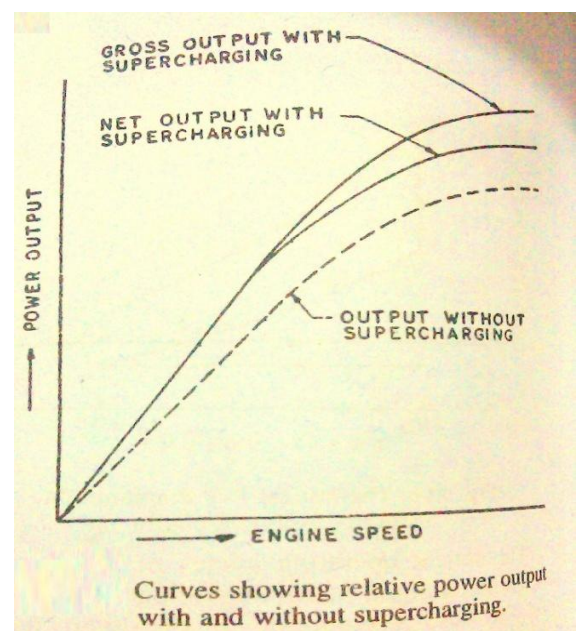
In the same way in Fig 2 the useful work is represented by the loop 1-2-3-4, while the lower loop 0-5-1-6 corresponds to work done in pumping fresh charge into the cylinder.

A comparison of actual P-V diagram is shown in figure .



From the figure it is seen that:-

- The mean effective pressure, represented by the vertical distance between the upper and the lower curves for each engine, is greater for supercharged engine throughout the cylinder swept volume.
- The loop area enclosed by the supercharged engine and hence the power developed in the same is much larger than in naturally aspirated engine.
- Along with increase of power output, the rate of fuel consumption is also increased, but then leaving aside the extremes, the fuel consumption per brake Kw hour does not increase, because the power increased keeps the pace with fuel consumption.
- The power consumed in compressing the air apart from the increased power itself, has to come from engine power itself. Thus the net gain of power is obtained only after deducting this power from the gross B.P. But it is seen that even this net power output is more than the power developed by the engine of the same size, but without supercharging. It is shown in the figure given below.



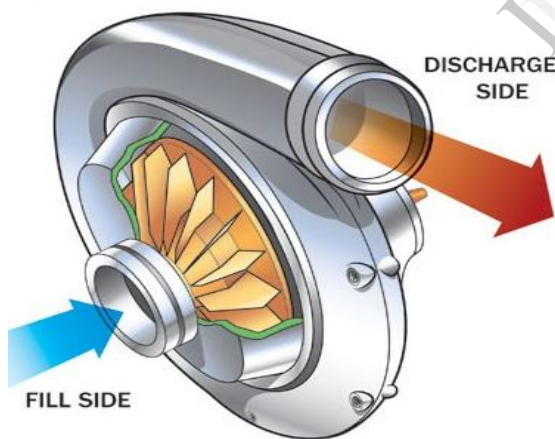
3. Types of Supercharger

Generally there are three types of superchargers viz.

1. Centrifugal type
2. Root's Type
3. Vane Type

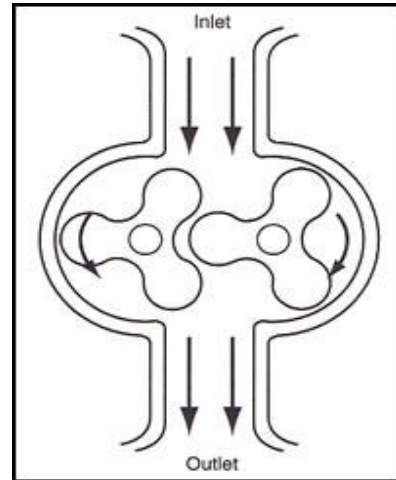
Centrifugal type:- This is the most common type of super charger in the automobile engines. It is run from the engine pulley by means of a v-belt. The air/fuel mixture enters the impeller at the centre and after passing through the impeller and the diffuser vanes, it enters the volute casing, where the part of kinetic energy is recovered and the mixture at supercharged pressure goes out of the casing to the engine. Generally due to the high pressure, about 30% more air fuel mixture is forced into the combustion chamber.

The impeller of this supercharged engine is to run at very high speeds, say upto 80,000 r.p.m., which dictate that it should be made out of some metal, which should be able to take the accompanying stress at such high speeds.



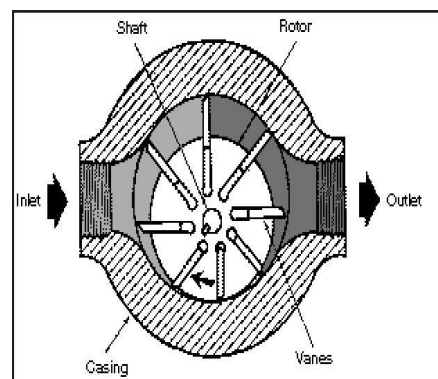
Root's Supercharger:- it consists of two rotor of epicycloids shape. Each rotor is keyed to shaft, which are connected together by means of gear of equal size, so that the two rotors revolve at same speed. The working action of this

supercharger is just like a gear pump, so that we get the mixture at outlet at a high pressure.



Vane type supercharger:- a number of vanes are mounted on the drum in such a manner that they can slide in or out against some spring force, so that all the time they are in contact with the inner surface of the supercharge body.

The vanes are usually made from laminates of linen impregnated with phenolic resin. However, Tufnol, Because of its similar qualities has also been used. The properties required for vane material are quiet running, low friction, low coefficient of thermal expansion and resistance to continuous exposure of oil and petrol. It is seen that the space between the body and drum goes on decreasing from the inlet to the outlet side as the drum rotates. Thus the mixture is entrapped between any two vanes at the inlet will experience decrease of volume and hence increase of pressure as it reaches outlet.



4. Detachable supercharger kit for two wheelers

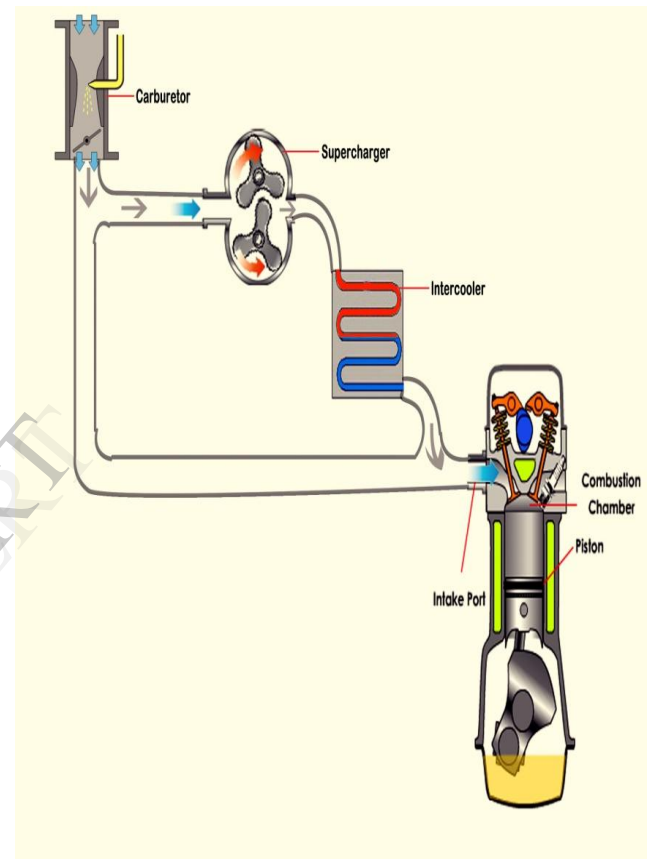
The two wheeler supercharger kit consists of the following component:-

- Supercharger (compressor)
- Intercooler
- Electromagnetic clutch
- Pulleys
- V-belts

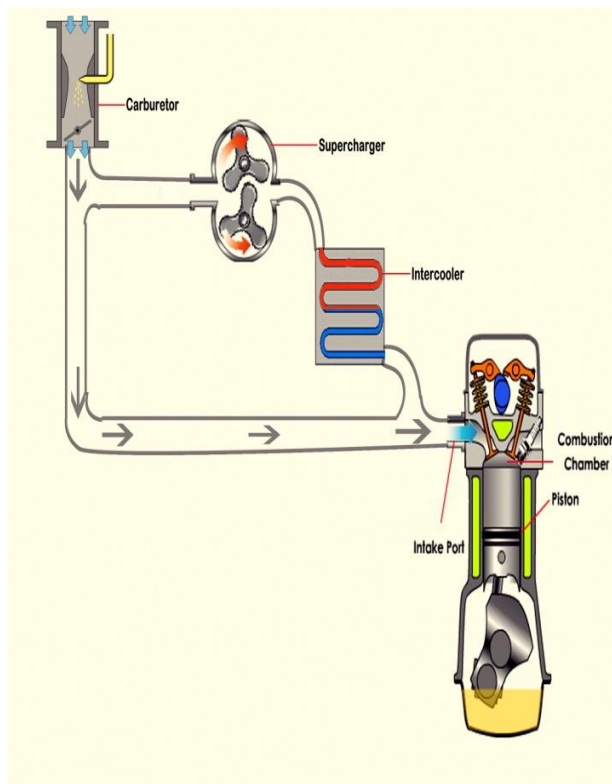
The supercharger used for two wheelers is basically a root type because it has low maintenance and can work efficiently at low speeds. The supercharger is mounted on the electromagnetic clutch pulley which is connected to pulley driven by the engine. The electromagnetic clutch serves the purpose of engagement and disengagement of the supercharger with engine, means it can be operated only when needed. The v-belts are use to transmit the power from one pulley to another pulley. The supercharger is placed between carburetor and inlet such that when supercharger is not working the flow of charge will directly go from carburetor to the intake vale. An intercooler is placed between the supercharger and inlet port of Si engine. The purpose of intercooler is to cool the charge so that the density is increased and more charge is induced into the combustion chamber. A switch is given on the control panel for the engagement and disengagement of the supercharger with the engine. A light will glow on the instrument cluster indicating that supercharger is engaged.

Case:-1 When the switch on the instrument cluster is pressed the electromagnetic clutch will engage supercharger. After the engagement the vacuum inside the supercharger will be greater than the engine vacuum. Therefore the charge will move

from carburetor to supercharger and then to intercooler and then through intake valve to the combustion chamber of engine. This is helpful when engine is running at higher altitude where the quantity of oxygen is less in the air.



Case:-2 When the engine is running at sea level the quantity of oxygen is sufficient in the air, so no need of supercharger at that time. So in this case the switch may be switch-off so that electromagnetic clutch may be disengaged and supercharger is deactivated. In this case engine vacuum will be greater than the supercharger vacuum, so the fluid will directly flow from carburetor to the intake valve.



5. Advantages

- The horsepower of the engine is increased within same size
- No lag is produced while throttling.
- With the help of this kit two wheelers can go to higher altitudes without losing its power.
- Optimum use of supercharger can be made using electromagnetic clutch which provides the facility of engagement and disengagement.
- Makes the two wheeler adaptable to the situation whichever the climatic condition might be.

6. Conclusion

With the use of detachable supercharger kit it can be concluded that two wheelers can gain more power within same engine without increasing its size. Moreover

electromagnetic clutch allows the use of supercharger only when needed thus saving the fuel and avoiding the knocking. Thus it is a boost for the two wheeler to explore its limits.

7. References

- [1] Automobile Engineering by Kirpal Singh Vol.2 (282-287)
- [2] IC engine By R.K. Rajput (511-520)
- [3] Automobile Engineering by Kripal Singh Vol.1