Optimizing Sports Coupe's Engine

Sidhant Jandyal
Student
Department of Mechanical Engineering
GCET, Jammu

Navvivek Singh Thakur
Student
Department of Mechanical Engineering
GCET, Jammu

Vinod Sharma
Student
Department of Mechanical Engineering
GCET, Jammu

Sourav Jandial
Student
Department of Mechanical Engineering
GCET, Jammu

Mr . Sanjeev Gupta
Guide
Department of Mechanical Engineering
GCET, Jammu

Abstract

This paper includes the methodologies to reduce some of the major concerns facing by AUTOMOTIVE INDUSTRY – (i) "FRICTION LOSSES" in the engine, (ii) "WEIGHT" of the engine and (iii) "POWER EFFICIENCY" of the engine. We know that races are won and lost in the time lapse of "milliseconds". Contributing factors for time lapse are – losses due to friction in an engine, large weight of engine and less power output from engine. For this we benchmarked between three sports coupe – (i) Cheverolet Camaro, (ii) Audi R8 and (iii) Ford Mustang. From the given three we chose Cheverolet Camaro. Our proposed technologies would make Cheverolet Camaro's engine lighter , powerful and less losses due to friction ; their by overcoming those milliseconds gap.

Keywords- Sports Coupe

I. INTRODUCTION

Sports Coupe is basically a sports car in a Coupe (two door car with a fixed attached roof) form. Although Sports car and sports coupe almost synonymous , but a little difference between the two is that later is bit more practical compared to former (like bit bigger in size , better knee room etc.) ; but these practical features are on the expense of "power" i.e Sports Coupe generally has slightly less power compared to Sports car .

So we are considering three factors while optimizing:-

1) Reduction in friction losses
2) Reduction in Weight
3) Increase in Power

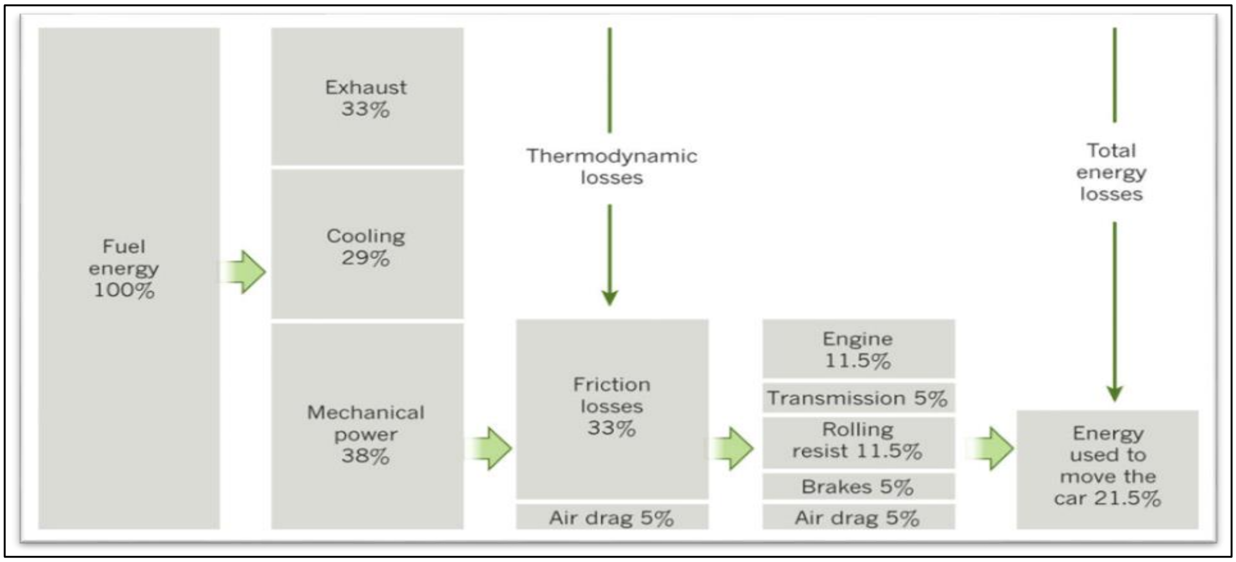

Fig. 1: Energy from Fuel Losses

Frictional losses is one of the most prominent factor causing downfall of sports coupe's engine performance. Figure 2 shows the contributing factors in frictional losses. Clearly piston – cylinder arrangement has the most percentage of losses share.

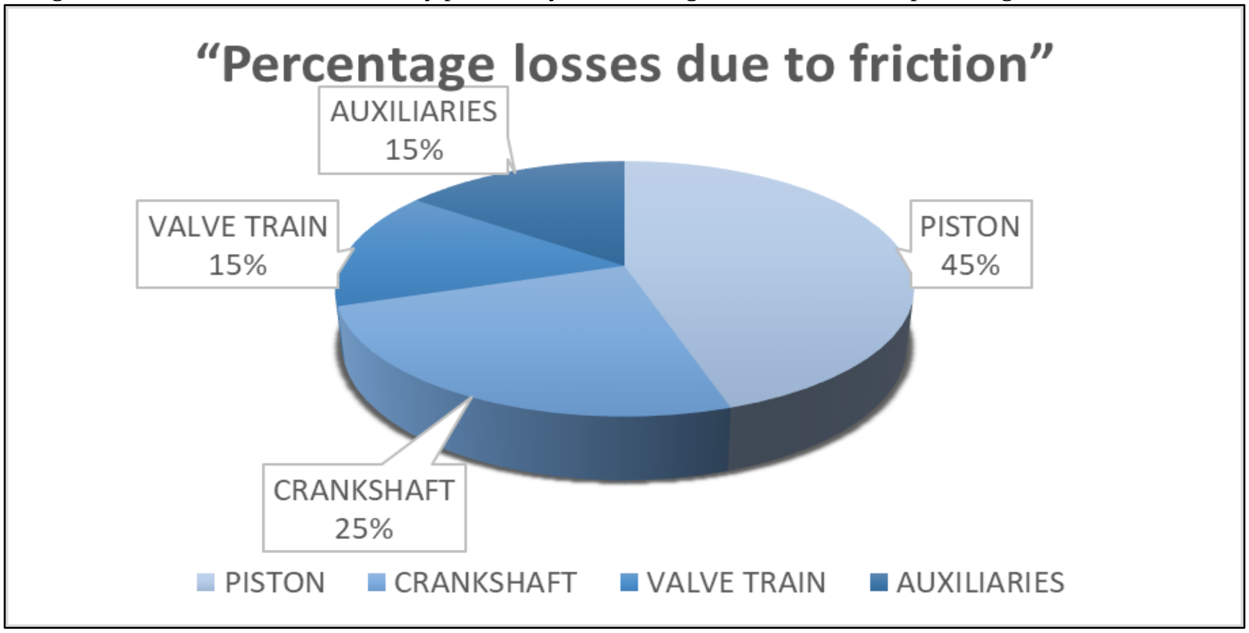

Fig. 2: Percentage Losses Due to Friction

Sports Cars are different from others in an aspect called as "POWER: WEIGHT". More power at a less weight, hence lighter sports coupe means more power can be obtained.

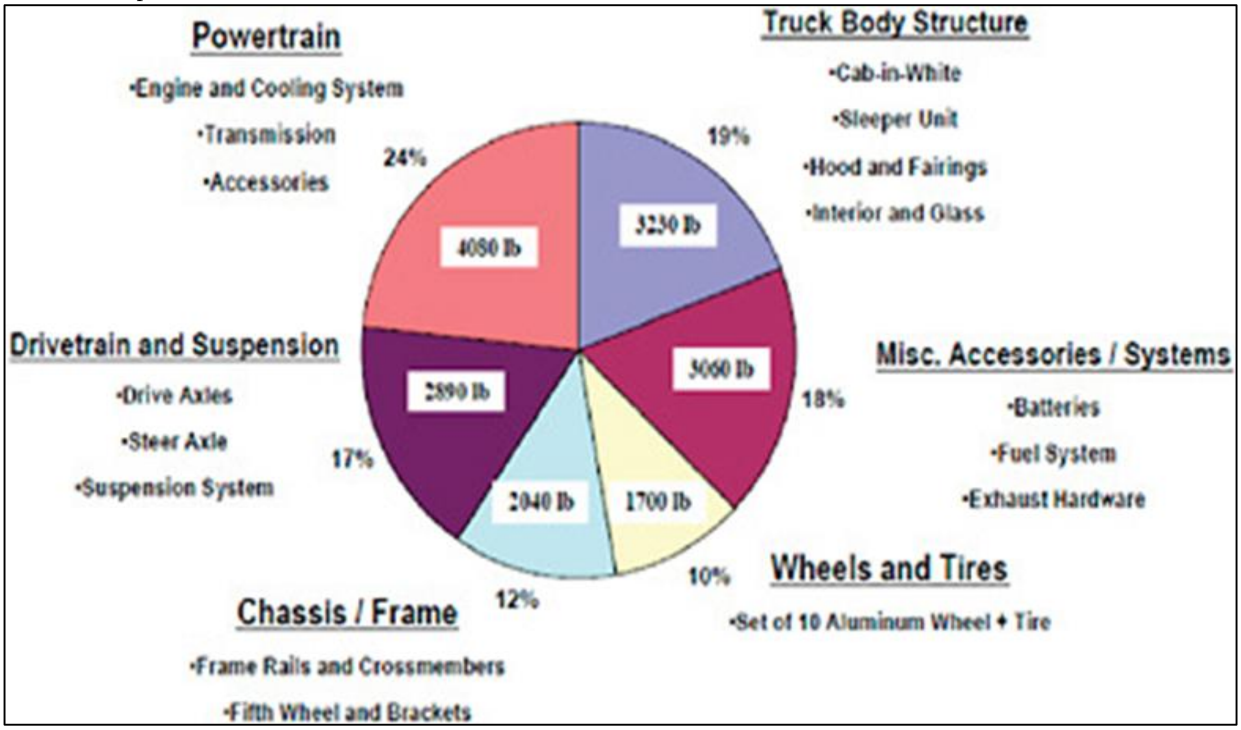

Fig. 3: Weight distribution in an engine

Power is of utmost importance, hence better combustion leads to better power delivery.

II. Author Guidelines for Manuscript Preparation

Following technologies for reduction in frictional losses:-

A. Mirror Bore Technology

Many engines today use lightweight aluminum materials for the cylinder block. In the cylinder block there is a cylindrical space inside which the piston moves up and down. However, since aluminum cannot endure the friction and heat that arises, designs also use a cast iron cylinder liner. Rather than inserting a cylinder liner, though, mirror bore coating technology sprays molten iron onto the surface of the cylinder bore and forms an iron coating layer on the walls inside. By giving this a mirror-like finish, the drag that arises when the piston is operating can be reduced.

The main purpose of this technology is to reduce drag, though there are other merits as well. Firstly, by removing the cylinder liner the design realizes a lighter engine. Moreover, compared to the roughly 2mm-thick cylinder liner, the 0.2mm mirror bore coating is extremely thin, making for better heat conduction. This results in better cooling performance and less engine knocking, and the efficiency of the engine as a whole is improved. The leeway gained can go towards increasing fuel economy and engine power. Mirror bore coating is able to improve the fundamental performance of the engine without the need for a special device.

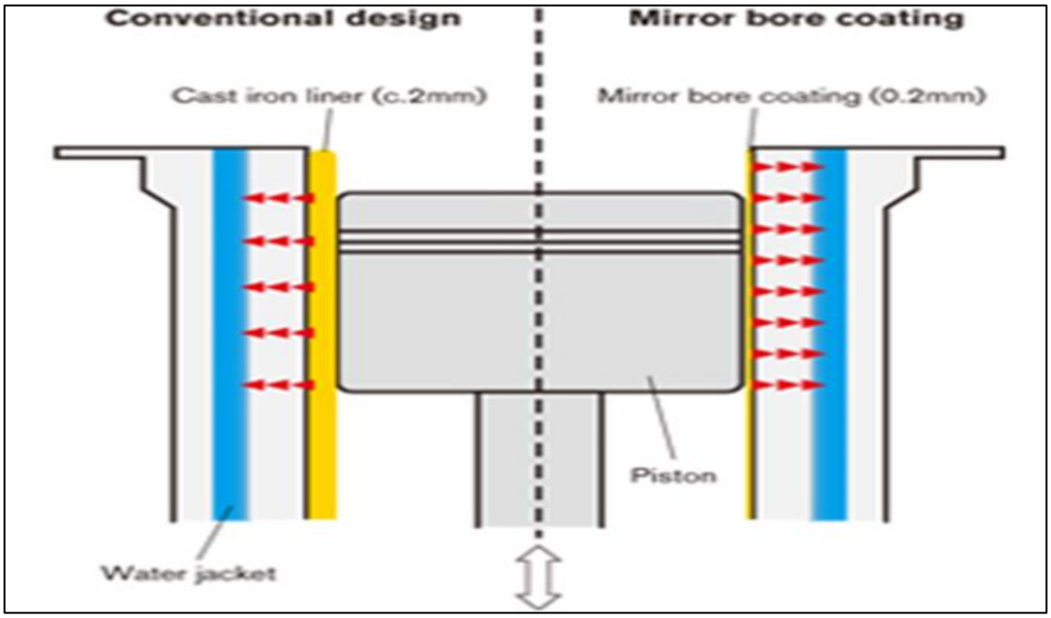

Fig. 4: Mirror Bore Technology

B. REM Superfinish

ISF stands for Isotropic Superfinish. The ISF Process is a unique patented process that generates a non-directional low Ra surface. It employs mass finishing equipment in conjunction with accelerated refinement chemistries that are non-hazardous and environmentally friendly. Among its many benefits, an ISF surface reduces friction and wear, increases part durability, and improves corrosion resistance. The process has proven applications in many industries including aerospace, automotive, gearing & bearings, medical, military, motorsports, off-highway and power generation.

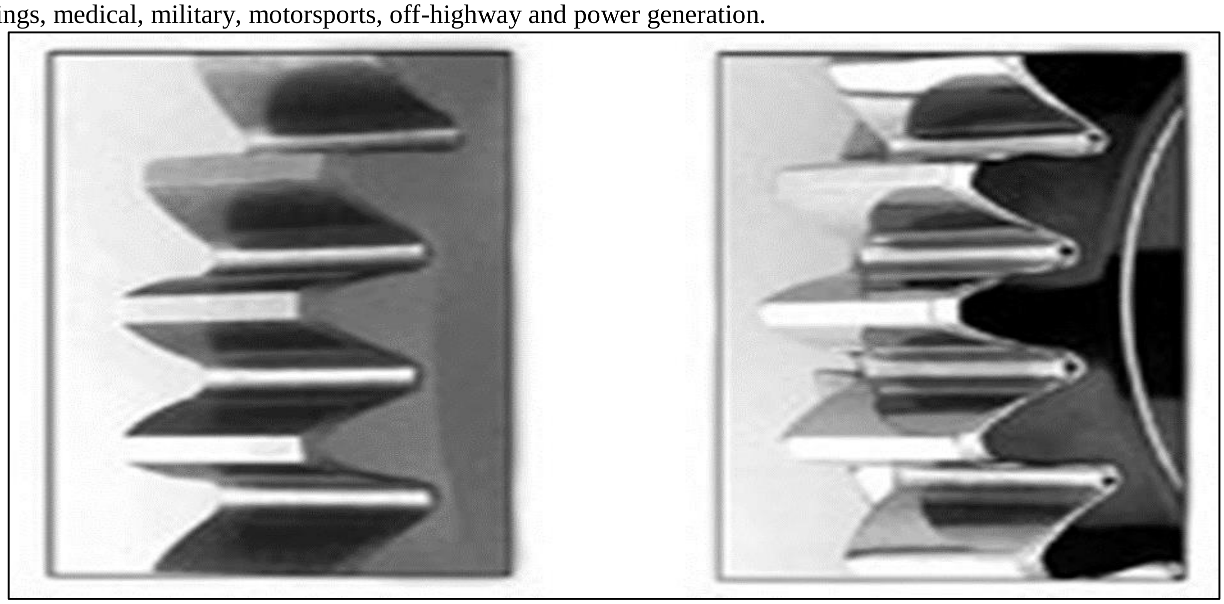

Fig. 5: Before (Left), After (Right)

C. MicroBlue Coating

MicroBlue® is a patented coating system that greatly reduces friction and extends the life of all moving and lubricated parts it's applied to. This includes any bearing type, all reciprocating engine parts, turbochargers, and transmission and differential parts. The improvements in efficiency and life are not subtle. Whether your aim is to improve fuel economy, extend life or simply win races, there is simply no other process on the planet that can compare to the improvements MicroBlue® brings to the equation.

MicroBlue® is different from other coatings in many ways. The most important of which is the way it's applied. It is literally blasted on the surface, and uses no heat or binders. And because it cannot bond to itself, build-up is a non-issue. And the best part is there's absolutely no size change, no adjustments needed. Where other coatings use adhesion to stay on the surface, the MicroBlue process creates an atomic bond, which makes it impossible to chip, flake or peel. What's more, its friction reducing abilities do not degrade over time. Your bearings will roll just as freely years from now, as they did when new.

Following technologies for reducing weight:-

1) Titanium Exhaust System

We will use exhaust manifold of Titanium because of following table

Property	*Iron*	*Titanium*
Melting Point	*1535 Deg Celsius*	*1660 Deg Celsius*
Boiling Point	*2750 Deg Celsius*	*3287 Deg Celsius*
Hardness (Brienell)	*200 Mpa*	*716 Mpa*
Speed Of Sound	*5120 M/S*	*5090 M/S*
Weight (Per Cubic Foot)	*491 Lbs*	*289*

2) GFRC Material

GFRC stands for Glass Fibre Reinforced Particles, which have a composition of 55% Fibre and 45 % of Resins. GFRC is better suited as compared to other material in Cylinder casing because of following figure.

Table 1. Material Properties

S.N°	Material	Elastic modulus (GPa)	Yield strength (MPa)	Ultimate strength (MPa)	Specific weight ($kg.m^{-3}$)
1	Aluminium	68	120	145	2700
2	E-Glass Fiber	72		3450	2540
3	Epoxy	3.5		95	1100

Fig. 6: GFRC comparisons

Following are the technology for increasing power:-

D. Twin Charger

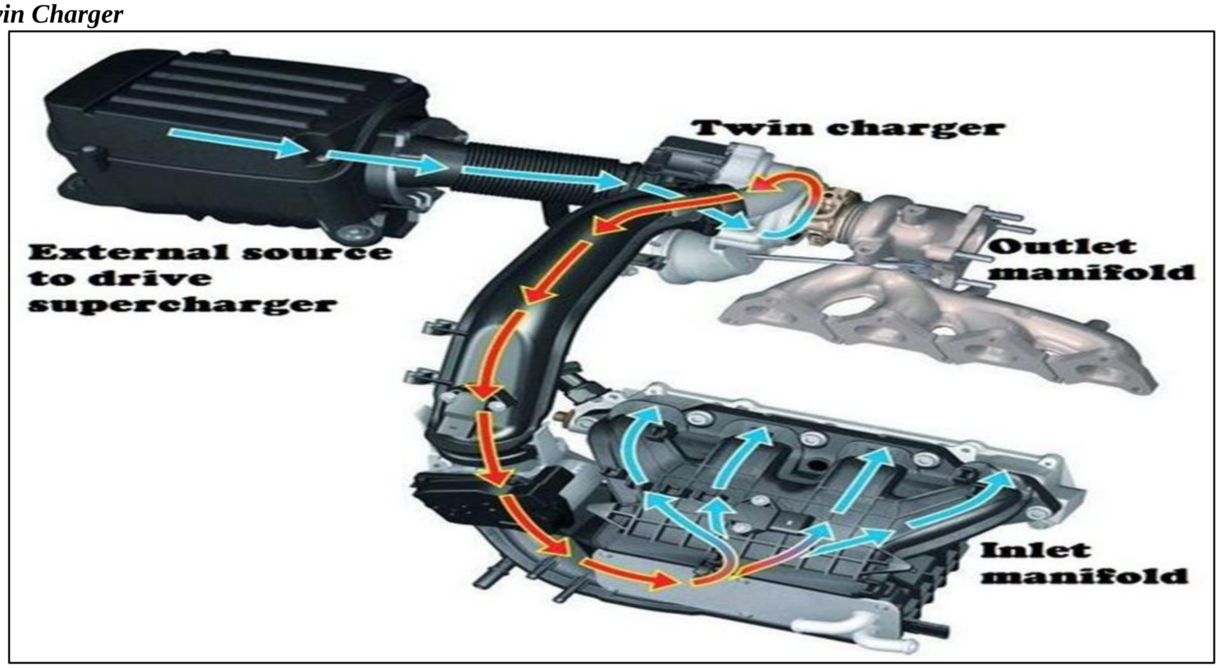

Fig. 7: Twin charger working

Twin charger refers to a compound forced induction system used on some piston-type internal combustion engines. It is a combination of an exhaust-driven turbocharger and an engine-driven supercharger, each mitigating the weaknesses of the other. A belt-driven or shaft-driven supercharger offers exceptional response and low-rpm performance as it has no lag time between the application of throttle and pressurization of the manifold (assuming that it is a positive-displacement supercharger such as a Roots type or twin-screw and not a Centrifugal compressor supercharger, which does not provide boost until the engine has reached higher RPMs). When combined with a large turbocharger — if the "turbo" was used by itself, it would offer unacceptable lag and poor response in the low-rpm range — the proper combination of the two can offer a zero-lag power band with high torque at lower engine speeds and increased power at the higher end. Twin charging is therefore desirable for small-displacement motors (such as VW's 1.4TSI), especially those with a large operating rpm, since they can take advantage of an artificially broad torque band over a large speed range.

III. CONCLUSION

1) Using Titanium in Exhaust Manifold
2) Using Gfrc in Cylinder Casing
3) Using Twin-Charger
4) Applying Mirror-Bore Coating on Cylinder Head
5) Using Ceramics with Micro-Blue Coating on Main Bearing Caps
6) Using Rem Superfinish on Gears

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