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"A REVIEW ON IC ENGINE CONNECTING ROD"

Ajit Kumar [1], Prof. Ravindra Mohan [2]

[1] *P.G. Scholar, Dept. of Mechanical Engineering, IES, College Bhopal, MP, India*
[2] *Assistant Professor, Dept. of Mechanical Engineering, IES, College Bhopal, MP, India*

ABSTRACT

Connecting rod is an intermediate link which connects the piston and the crankshaft in an internal combustion engine, the main work of connecting rod is to convert the linear motion of the piston (thrust force) into rotary motion of the crankshaft. In this study, an attempt has been made to analyze and understand the connecting rod structure using Finite Element Analysis method. This paper deals with the past literature survey which shows that in internal combustion engine components like piston, connecting rod and crankshaft are worked together more efficiently and more accurately. Here the materials are highly compared to their previous materials which are used in these components. This study deals with the various loads which are acting on these different-different components on their main loading sections. The objectives of this paper are to study costs and materials optimization with the help of thermal stress analysis by FEA technique.

Keyword: *Connecting rod, Thermal stresses, Finite Element Analysis (FEA), Optimizations, Combustion engine, Cost*

I. INTRODUCTION

One source of energy in automobile industry in internal combustion engine, I.C. engine converts chemical energy into mechanical energy in the form of reciprocating motion of piston. Crankshaft and connecting rod convert reciprocating motion into rotary motion. The Automobile engine connecting rod is a high volume production, critical component. If connects reciprocating piston to rotating crankshaft, transmitting the thrust of the piston to crankshaft. Every vehicle that uses an internal combustion engine requires at least one connecting rod depending upon the number of cylinder in the engine. There were different types of materials and production method used in the creation of connecting rods. The major stresses induced in the connecting rod are combination of axial bending stress in operation. The axial stresses are produce due to cylinder gas pressure (compressive only) and the inertia force arising in account of reciprocating action (both tensile and compressive), whereas bending stresses are caused due to the centrifugal effects. It consist of three designs in the alienate frame work with weight reduction as compare to the general connecting rod. It reduce the cost with the similar permissible limit and better material for minimizing deflection in connecting rod.

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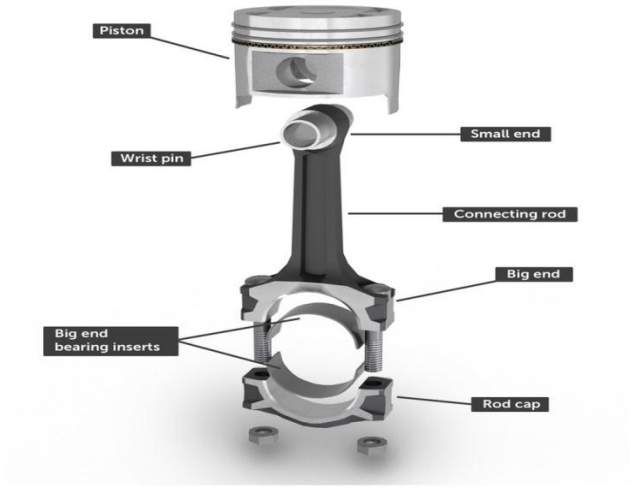

Fig.1 Connecting Rod Parts

II. LITERATURE REVIEW

Kumar et. al. [1] carried out finite element analysis of the four-stroke petrol engine connecting rod using ANSYS workbench in the aim of weight reduction& also reducing the inertia force on the connecting rod. Fatigue analysis is also carried out & results showed a reduction of 3.05% of weight of original connecting rod.

Roy [2] made an attempt to understand various designs of connecting rod and analyse them to get an optimal design. The selected design had better results in various parameters and were under safe stress. It was observed that the variation in stress and strain result from the existing analysis was of 9.6% and 10.5% respectively.

Shenoy et. al. [3] carried out dynamic analysis and optimization of connecting rod. The dynamic analysis was carried out keeping cost and weight reduction parameters as main focus points.

Dupare et. al. [4] obtained the maximum weight reduction in a connecting rod, without affecting the main structural parameters.

Vegi et. al. [5] proposed a new design and carried out analysis of connecting rod to study the variation in the results using different materials from carbon steel to forged steel. It is observed that change in material had no effect on equivalent stress for both the cases, but they reported that for forged steel material the factor of safety and stiffness have been improved, also the weight of forged steel was observed to be less than the carbon steel.

Joshi et. al. [6] worked on the optimization of weight and designing of connecting rod by considering different materials such has high strength carbon fiber, stainless steel and aluminium alloy. They reported that the vonmises stress for carbon fiber is less compared to other materials.

Kumar et. al. [7] carried out dynamic analysis on connecting rod using Bajaj pulsar (150cc) in order to reduce the weight and also reduce the moment of inertia. They reported that 42CrMo steel alloy is 11.67 % lighter material compared to 20CrMo and 6.42 % lighter when compared to 30CrMo steel.

Bhargav et. al. [8] compared different materials by carrying out both static and dynamic analysis on a connecting rod. It is observed that the von-mises stress and weight of Al-MWCNT (Multi Wall Carbon Nano Tube) are less compared to Ti-6Al-4V, E-glass and carbon steel.

Taware et. al. [9] carried out FEA analysis of connecting rod used in Hero Splendor motorbike and studied the effect of change in material from ASTM A216 GR WCB and Aluminium 360, then the results were compared and concluded that there is less deformation in ASTM A216 GR WCB which helps in long durability and also it is cheaper.

Kuldeep et. al. [10] compared different material by carrying FEA analysis on connecting rod with the aim of weight reduction and increasing the stiffness

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Ramakrishna et. al. [11] studied the effect of change in materials by carrying out FEA analysis on connecting rod, reduction in the weight of connecting rod was observed by replacing the material from 4340 alloy steel to AlSiC-9 and found that AlSiC-9 is 61.65% lightercompared to 4340 alloy steel connecting rod. In last few decades, many researchers [12-18] have worked on optimization of automotive vehicle components to enhance the performance characteristics but major emphasis is given on engine components. In current study, the finite element analysis is carried out on the connecting rod to understand the design parameters like stress, strain, deformation etc. by considering different materials. Suitable dimensional changes are suggested based on simulation results, to the existing connecting rod design in order to optimize the structure.

Mahipal Manda el. al. [12] Connecting rod is an important component of the automobile engine dynamic system, it is not only a transmission component but also moving part, at the same time it must withstand variable load such as tensile, compressive force and bending in the working process. Therefore, dynamic characteristics study on the connecting rod has become an important part of design. Modal analysis is an ef ective method to determine vibration mode shapes and weak parts of the complex mechanical system. In this study, a modal analysis was applied to a connecting rod by ANSYS software at three critical working conditions, such as maximum tensile and compressive on small end, and tensile of cap end of connecting rod, the main purpose of analysis is to identify the model parameters of connecting rod such as natural frequency, vibration mode shapes and provide a basis for structural dynamics analysis and the follow-up optimal design of connecting rod.

Naman Gupta et. al. [13] Connecting rod is one of the important components of the engine assembly, it acts as a mediator between piston assembly and crankshaft. It started from the sawmills to the engine various transmission forces. The connecting rod connects reciprocating piston to rotating crankshaft, transmitting the thrust of the piston to the crankshaft. It has two ends. The small end is connected to the piston by a gudgeon pin while other end is connected crankshaft using crank pin. The reciprocating motion generated during the transmission of brake power at piston head causes various stress to acts on the connecting rod. It is generally use to transmit the force through mechanism. So, it is important to reduce the weight with the consideration of the permissible limit for manufacturing of better connecting rod. This further analysis move towards von misses stress so that we get the better component with reduced weight, cost effective and provide better result than other components. This paper illustrate a general study on three designs of connecting rod along with modern structure.

III. FEM TECHNIQUE FOR OPTIMIZATION

In optimization of different internal combustion components, material and cost are to be taken according to their respective densities and market price. The best material according to the required need is taken as suitable. FEM is numerical methods for solving the problems of stress and thermal analysis which give optimize result to suitable materials. Typical problems areas of interest include structural analysis, heat transfer and fluid flow analysis. The analytical solution of these problems are generally requires the solutions for boundary value problems for partial differential equations. The finite element method is formulation of the problems which results in a system of methods yields approximate values of the unknowns at discrete numbers of points over the domain. To solve the problems, it subdivides a large problem into smaller parts, simpler or smaller parts which is called finite elements. FEM are uses

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variational methods for the calculation of variations to approximate a solution by minimizing its associated error function.

IV. CONCLUSION

Conclusion of this paper is to deal with the weight and cost optimization of internal combustion engine with their respective previous studied material. This review study deals that the more efficient and useful material which is to be analyzed according to their market price and respective densities of them by FEA technique. In FEA technique desired analysis is thermal stress analysis on each section of the internal combustion engine components has to be done.

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