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REVIEW ON LOAD ANALYSIS AND MATERIAL OPTIMIZATION OF CONNECTING ROD USING FEA METHODS

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Abstract - Internal combustion engines have at least one connecting rod to transmit the thrust of the piston to the crankshaft, and as the result the reciprocating motion of the piston is translated into rotational motion of the crankshaft. From the viewpoint of functionality, connecting rods must have the highest possible rigidity at the lowest weight capable to withstand varying loads. It has been found that structural failure of various components results in engine missing and starts producing noise and vibration during racing, mileage gets affected and black or white smoke arise; also pickup gets reduced. In automobile industry damaged or broken parts are generally too expensive to replace or repair especially in case of engine. In this concern here we present a review of causes along with preventive maintenance suggestions schedule for better engine life. Later on, finite element modeling and analysis will be performed using ANSYS 12.1 software package to perform a linear static and a coupled thermal-structural contact analysis of the component. A contact analysis is to be carried out to analyze the stresses arising from the interference of the connecting-rod bearing and the piston-pin bushing.

***Keywords*- Internal combustion engine, Connecting rod, Component failure, Finite element analysis, ANSYS**

I. INTRODUCTION

The outline and production of Inward Ignition (IC) Motors is under critical weight for development. The up and coming era of motors needs to be minimal, light, effective, and adaptable, yet create less contamination and utilize less fuel. Imaginative engine plans will be required to meet these contending necessities.

To comprehend the genuine effect, we would need to retreat in time in excess of one hundred years. A period without the straightforwardness of jumping into a vehicle to take us anyplace we need to go is just about incredible. In any case for the early auto designs, the gigantic progressions in car innovation would be significantly all the more amazing

In the last fifty years, automobiles have figured out how to think, alter, and even ensure. The dominant part of individuals need a vehicle that will get them from point A to point B as effortlessly as could reasonably be expected, additionally put a little grin on their appearances. As a rule, the grin is made by a snappy punch of the quickening agent and joined by an inclination of monstrous power and control. The car producers are well mindful of this, and to accomplish it, they outline speedier, lighter, and more productive motors to do the occupation. In any case precisely what happens inside a motor and what are the dangers included in planning the strongest motor on the square? In this extend, one part of a motor specifically, the joining bar, will be examined. Being a standout amongst the most vital parts in a motor's plan, the joining bar must have the capacity to withstand enormous loads and transmit a lot of force. It is no astonished that a disappointment in an interfacing pole could be a standout amongst the most exorbitant and harming disappointments in a motor. Anyhow essentially saying that isn't sufficient to completely comprehend the elements of the circumstances. Though the course of the project, an ideal model of a connecting rod, piston will be modeled and optimized. It will get to be clear precisely why these parts are so paramount to the operation of vehicles, and besides how inclined to failure they could be. On the other hand, before an excess of progressively is said on the designing points of interest, a little foundation data is important.

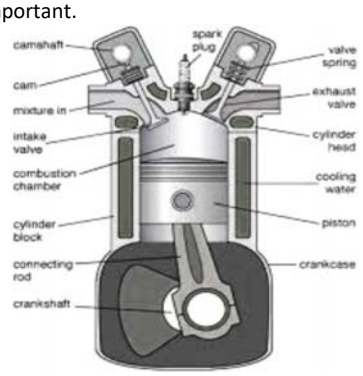

Figure 1.1: Internal combustion engine parts.

Crankshaft and connecting rods are the fundamental segments of internal combustion engines which change

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over responding dislodging of the cylinder to a revolving movement. A common auto crankshaft comprise of primary journals, connecting rod journals (wrench pins), stabilizer, oil gap and a push bearing journal. During the administration life, combustion and dormancy strengths following up on the crankshaft cause two sorts of stacking on the crankshaft structure; torsion load and twisting burden. Engine cylinders are a standout amongst the most mind boggling parts among all car segments. The engine could be known as the heart of an auto and the cylinder may be viewed as the most imperative piece of a engine. The cylinders structure the base 50% of the combustion chamber and transmits the power of ignition through the wrist stick and associating pole to the crankshaft. Cylinder failures emerge because of numerous reasons: mechanical anxieties; warm burdens; wear systems; temperature corruption, oxidation components; and so forth. Exhaustion is a wellspring of cylinder harms. Despite the fact that, generally, cylinder harms are ascribed to wear and oil sources, fatigue is in charge of a bigger number of cylinder harms. What's more a few harms where the fundamental driver is credited to wear and/or grease components may have in the underlying driver birthplace a fatigue break.

In light of an examination of seventy auto segment disappointments got for examination the dispersion of part failure and the conveyance of reasons are given in Fig 1 and 2 separately. From this it could be seen that the most widely recognized segment failure is that of the engine (41%) and that the most well-known reason for failure is misuse (29%).

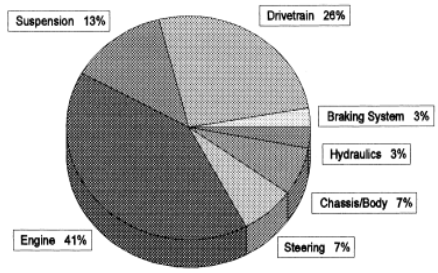

Fig.1.2 - The distribution of component failures

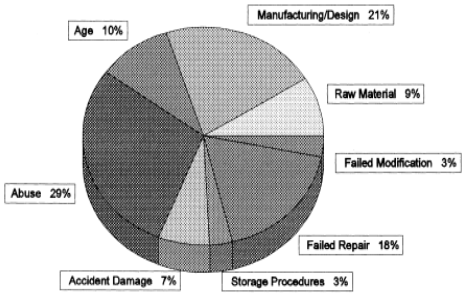

Fig.1.3- The distribution of causes of failure

Since most basic part failure is that of engine so we concentrated on engine square get together which convey cylinder, connecting rod and crankshaft subjected to high warm hassles and in addition cyclic anxieties which depends some degree on drivers driving propensities

II. FUNCTION OF CONNECTING ROD

The capacity of connecting rod is to transmit the push of the cylinder to the crankshaft, and as the result the responding movement of the cylinder is deciphered into rotational movement of the crankshaft. It comprises of a pin-end, a shank area, and a wrench end. Pin-end and wrench end pin gaps are machined to allow precise fitting of orientation. One end of the uniting bar is joined with the cylinder by the cylinder pin. The flip side spins with the crankshaft and is part to allow it to be clipped around the crankshaft. The two sections are then joined by two bolts.
Connecting rods are subjected to drives produced by mass and fuel combustion. These two strengths brings about pivotal and twisting hassles. Twisting hassles show up because of erraticism, crankshaft, case divider distortion, and rotational mass power. Along these lines, a connecting rod must be equipped for transmitting pivotal pressure, hub clamping, and twisting anxieties brought about by the push and draw on the cylinder and by divergent power
The connecting rods subjected to a complex state of stacking. It experiences high cyclic heaps of the request of 10^8 to 10^9 cycles, which go from high compressive loads because of ignition, to high malleable loads because of latency. In this way, strength of this segment is of basic imperativeness

III. LITERATURE SURVEY

[1] P S Shenoy et.al. studied detailed load analysis under service loading conditions for a typical connecting rod, followed by quasi-dynamic finite element analysis (FEA) to capture stress variations over a cycle of operation. It was found that even though connecting rods are typically tested and analyzed under axial loading and stress state, bending stresses are significant and a multiaxial stress state exists at the critical regions of connecting rod.

[2] Thomas et.al. has done the analysis regarding the "Design of Connecting Rod for Heavy Duty Applications Produced by Different Processes for Enhanced Fatigue Life." The work was aimed at evaluating the fatigue life of a heavy duty connecting rod under 2 different conditions namely without considering the effect of shot peening and with considering the effect of shot peening. It was concluded that shot peening can significantly increase about 72% in fatigue life cycles of a connecting rod component.

[3] James R. Dale et.al.evaluated connecting rod for improved fatigue strength. In the analysis comparison was carried out between powder forging materials & C-70 materials. As a result Powder Forging materials demonstrate improved fatigue strength on the order of 25–33% over C-70 material of the same design.

[4] Prabhala et a undergone "Plan And Weight Optimization Of IC Engine" by Replacing the steel parts with aluminum composite segments. By watching the examination aftereffects of two congregations it was reasoned that utilizing aluminum compound for both interfacing pole and cylinder is more valuable than utilizing steel for cylinder as naturally general weight is decreased in this way the force needed to run itself via car is diminished bringing about the build in the mileage.

[5] A. R. Bhagat et.al. describes the stress distribution of the seizure on piston four stroke engine by using FEA and analyzed the thermal stress distribution of piston at the real engine condition during combustion process. As a result it was observed that stress distribution on the piston mainly depends on the deformation of piston. Therefore, in order to reduce the stress concentration, the piston crown should have enough stiffness to reduce the deformation.

[6] P.Brabec et.al done the investigation in regards to "FEM Analysis of Connecting Rod for Stationary Engine" which addresses the processing of the quality and bending attributes of a stationary motor uniting pole. The results unmistakably demonstrate that the associating bar is not altogether quality focused on and a more regrettable variation is the anxiety at max. burning weight and the extent that contortions are concerned, it is imperative to stay away from such mutilations of the uniting bar huge end which would take up the bearing freedom.

[7] T.t Mon et.al experienced the "Limited Element Analysis on Thermal Effect of the Vehicle Engine". In this study FEM was utilized to create computational model to examine the temperature conveyance in the Vehicle Engine that used Spark ignition framework for force generation.

[8] Vivek C. Pathade et.al. has experienced the anxiety dissection of associating bar.

IV. OBJECTIVE

- To plan a higher quality to weight proportion connecting rod get together for an IC Engine.
- To create a robust model of the get together for execution assessment
- To dissect the interfacing bar gathering execution in the ANSYS product under obliged burden condition.
- To upgrade different configuration parameters and to set determination for usage.
- To reduce the chance of the maintenance of engine due to connecting rod assembly problem.

V. NEED OF THE PROJECT

Connecting rod is one of the main components of an IC Engine. The connecting rods subjected to a complex state of loading. Therefore, durability of this component is of critical importance. In automobile industry damaged or broken parts are generally too expensive to replace or repair especially in case of engine.

VI. METHODOLOGY

- Literature survey regarding connecting rod and various parameters affecting performance.
- Design of various part of connecting rod assembly & selection of suitable lubrication system.
- Analysis of assembly using software ANSYS 12.1
- Reconsideration of various design parameters for getting optimum performance
- Comparison of proposed design with existing available component.

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