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"A REVIEW ON CONNECTING ROD THERMAL ANALYSIS"

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ABSTRACT

The Connecting Rod is one of the main parts of internal combustion engine. The main function of connecting rod is to transmit the power. Connecting Rod is designed for the purpose to transmit the power from the engine to the shaft and to convert reciprocating motion into rotary motion. Therefore, the strength together with fatigue and high temperature resistance of the material become important parameters for completing the designing process of the connecting rod. They require at least one connecting rod & no of connecting rod depending upon the number of cylinders in the engine. Connecting rods are mainly manufactured by forging from either wrought steel or powdered metal. They could also be cast. Anyhow, castings could have blow holes which are detrimental from durability and fatigue points of view. The fact of forgings, it's produce blow-hole-free and better rods gives them an advantage over cast rods.

Keyword: *Connecting rod, Aluminium alloy connecting rod, Analysis of connecting rod*

I. INTRODUCTION

Connecting rod is an intermediate link which connects the piston and the connecting rod 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 connecting rod.[1] 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 connecting rod are worked together more efficiently and more accurately.[2] 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.[3] The connecting rod does this essential task of changing over responding energy of the chamber into rotational energy of the connecting rod. It contains an upper forked portion which is assembled at the crosshead bearings and the lower part assembled at the lower side i.e. crankpin bearing.[4] With this scarcely blueprint there is seriously overpowering centre point stacking on the associating bar which achieves its top at the upper perfect considering the way that the gas pressure and the inertial forces encourage to expand the overall force. Other whimsical working conditions, for example, chamber seizure and passing enlargement in pinnacle weight can withal achieve astringent expansion in highlight on the con-pole and it could bomb because of attaching because of these forces. Unremarkably associating bars are produce made and the material utilized is reliably sensitive and

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medium carbon steel.[5] The terminuses where the con bar is joined with the X-head or crankpin having course which are produced of white metal working surface and shims (think pressing) are adjusted to reveal the necessary upgrades.

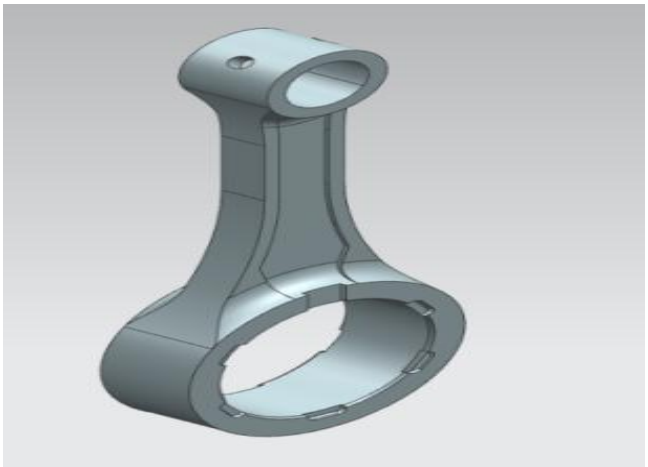

Fig. 1 Model of connecting rod

II. LITERATURE SURVEY

2.1 Introduction

The interfacing poles introduced to a stunning condition of stacking. It experiences high cyclic various the sales of 108 to 109 cycles, which assortment from incredible compressive weights considering devouring, to over the top flexible hundreds due to inaction. Along these lines, toughness of this issue is of key centrality. Because of those sections, the interfacing bar has been the subject of concentrates for unequivocal parts sweeping of creation period, materials, execution generation, weakness and different others. For the current day see, it wound up basic to explore limited detail displaying system, update structures, and affinities underway period, new substances, inadequacy appearing and assembling respect evaluation. These short sythesis chart decisions a part of these viewpoints.

Webster et al. [1983] performed three dimensional finite element analysis of a rapid diesel engineconnecting rod. For this analysis they utilized the greatest compressive burden which was estimated tentatively, and the most extreme tractable burden which is basically the latency heap of the piston get together mass. The heap circulations on the piston stick end and wrench end were resolved tentatively. They demonstrated the connecting rod top independently, and furthermore displayed the jolt claim utilizing bar elements and multi point limitation conditions.[1]

Repgen [1998] dependent on weakness tests did on indistinguishable segments made of powder metal and c-70 steel (crack part steel), in this paper he composes the weariness quality of the manufactured steel part is 21% higher than the powder metal segment and utilizing the break part innovation brings about a 25% cost decrease over the traditional steel producing process.[2]

Shenoy et. al. [2005] did dynamic examination and headway of connecting rod. The dynamic examination was finished keeping cost and weight decline parameters as key focus centers.[3]

Roy [2012] made an endeavor to comprehend various structures of connecting rod and separate them to get a perfect arrangement. The picked structure would do well to brings about various parameters and were under safe pressure. It was seen that the assortment in nervousness result from the present examination was of 9.6% and 10.5% independently. [4]

Vegi et. al. [2013] proposed another arrangement and finished examination of connecting rod to consider the assortment in the results using particular materials from carbon steel to fabricated steel. It is seen that modification in material had no effect on proportionate stress for both the cases, yet they declared that for molded steel material the factor of security and robustness have been improved, similarly the weight of produced steel supposedly was not actually the carbon steel. [5]

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Kumar et. al. [2014] finished powerful examination on connecting rod using Bajaj pulsar (150cc) to reduce the weight and moreover lessen the depiction of dormancy. They nitty gritty that 42CrMo steel mix is 11.67 % lighter material stood out from 20CrMo and 6.42 % lighter when appeared differently in relation to 30CrMo steel.[6]

Joshi et. al. [2015] tackled the improvement of weight and arranging of connecting rod by considering differing materials such has great carbon fiber, treated steel and aluminum composite. They nitty gritty that the vonmises stress for carbon fiber is less diverged from various materials. [7]

Bhargav et. al. [2015] contemplated different materials by means of finishing both static and dynamic examination on a connecting rod. It is seen that the von-mises pressure and weight of Al-MWCNT (Multi Wall Carbon Nano Tube) are less appeared differently in relation to Ti-6Al-4V, E-glass and carbon steel. [8]

Taware et. al. [2015] did FEA examination of connecting rod used in Hero Splendor motorbike and thought the effect of advancement in material from ASTM A216 GR WCB and Aluminum 360, by then the results were investigated and assumed that there is less winding in ASTM A216 GR WCB which aides in long robustness and besides it is more affordable.[9]

Kuldeep et. al. [2015] contemplated different material by means of passing on FEA examination on connecting rod with the purpose of weight decline and growing the strength.[10]

Ramakrishna et. al. [2015] analyzed the effect of advancement in materials by means of finishing FEA examination on connecting rod, decline in the largeness of connecting rod was seen by superseding the material from 4340 blend steel to AlSiC-9 and found that AlSiC-9 is 61.65% lighter compared to 4340 amalgam steel connecting rod. In latest couple of decades, various researchers [12-18] have managed headway of vehicle parts to redesign the execution characteristics yet genuine emphasis is given on engine sections. In current examination, the restricted part examination is done on the connecting rod to comprehend the arrangement parameters like pressure, strain, distortion, etc by considering different materials. Sensible dimensional changes are proposed dependent on diversion results, to the current connecting rod design in order to redesign the structure. [11]

Mahipal Manda el. al. [2017] Connecting rod is an imperative portion of the engineunique structure, it isn't only a transmission fragment yet likewise moving part, meanwhile it must withstand variable weight, for instance, flexible, compressive force and turning in the working methodology. As such, unique characteristics consider on the connecting rod has transformed into an imperative bit of structure. Secluded examination is an effective method to choose vibration mode shapes and weak bits of the complex mechanical system. In this examination, a particular examination was associated with a connecting rod by ANSYS programming at three essential working conditions, for instance, most outrageous malleable and compressive on little end, and flexible of top end of connecting rod, the central explanation behind examination is to recognize the model parameters of connecting rod.[12]

Naman Gupta et. al. [2018] Connecting rod is one of the basic pieces of the engine social occasion, it goes about as a referee between piston get together and crankshaft. It started from the sawmills to the enginedistinctive transmission forces. The connecting rod partners responding piston to turning crankshaft, transmitting the push of the piston to the crankshaft. It has two completions. The little end is related with the piston by a gudgeon stick while furthest edge is related crankshaft using wrench stick. The responding development made in the midst of the transmission of brake control at piston head makes distinctive pressure follows up on the connecting rod. It is generally use to transmit the force through segment. Thusly, it is basic to reduce the weight with the idea of beyond what many would consider possible for collecting of better connecting rod. This further examination move towards von misses pressure so we give indications of progress part with decreased weight, monetarily adroit and give favored result over various portions. This paper depict a general report on three plans of connecting rod close by present day structure.[13]

Vinayak Chumbre el. Al. [2018] Connecting rod is a middle of the road interface which associates the piston and the crankshaft in an inside burning motor, the primary work of connecting rod is to change over the straight movement of the piston (push force) into rotational movement of the crankshaft. In this investigation, an endeavor has been made to dissect and comprehend the connecting rod structure utilizing Finite Element Analysis technique. A perpetual model of connecting rod is demonstrated utilizing NX 6.0 and on this model static auxiliary analysis is completed by utilizing ANSYS14.5 reproduction instrument. Further analysis was completed by considering various materials to comprehend the varieties of identical von-mises stress, strain, all out deformation and factor of security.[14]

Ajit [2019] In this Project the stress distribution is evaluated on the four stroke engine connecting rod by using FEA. The finite element analysis is performed by using FEA software. The couple field analysis is carried out to calculate stresses and deflection due to thermal loads and gas pressure. These stresses will be calculated for three different

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materials. The results are compared for all the two materials and the best one is proposed. In this paper, a connecting rod for two wheeler is designed by analytical method and computational method . On the basis of that design a physical model is created in CATIAV5. Structural system of connecting rod has been analyzed using FEA. With the use of FEA various thermal stresses are calculated for a particular loading conditions using FEA software ANSYS WORKBENCH 19.2 The same work is carried out for different material. Also the thermal analysis of the connecting rod is performed. The obtained results are compared on the basis of various performances with considerable reduction in weight.[15]

III. FAILURE OF CONNECTING ROD

The connecting rod is under huge stress from the responding burden addressed by the piston, really extending and being compacted with every insurgency, and the pile augmentations to the square of the engine speed increase. Frustration of a connecting rod, expectedly called "hurling a rod" is a champion among the most inescapable explanations behind destructive engine dissatisfaction in cars, as frequently as conceivable putting the wrecked rod through the side of the crankcase and thusly rendering the engine sad; it can result from shortcoming near a physical defect in the rod, oil disillusionment toward a path as a result of imperfect upkeep, or from disillusionment of the rod shocks from a distortion, badly designed fixing. Re-utilization of rod shocks is a regular practice as long as the shocks meet producer assignments. Regardless of their progressive occasion on communicate centered vehicle events, such disillusionments are conflicting on engenderment automobiles in the midst of regular step by step driving. This is in light of the fact that engenderment auto sections have a considerably more cosmically huge factor of wellbeing, and regularly progressively methodical quality control.

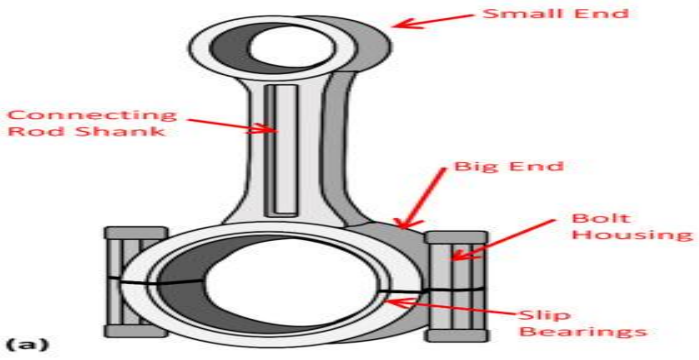

Fig 3.1. Diagram of an assembled connecting rod, rod cap, bolts and slip bearing with key features and components annotated in red

IV. METHODOLOGY

3.1 Introduction

The previous researchers were found various method from personal product development experience. In this paper first made a model with simen NX10, Autocad , CATIA and and simulation software used like hyper mesh . Solidwork, Altair . In this process first apply meshing and the meshing after apply boundary condition and processing of meshing to find the all section are differentiated in small part this is called FEM technique. After modelling simulation step is done. The below fig show the flow chart methodology of modelling and simulation.

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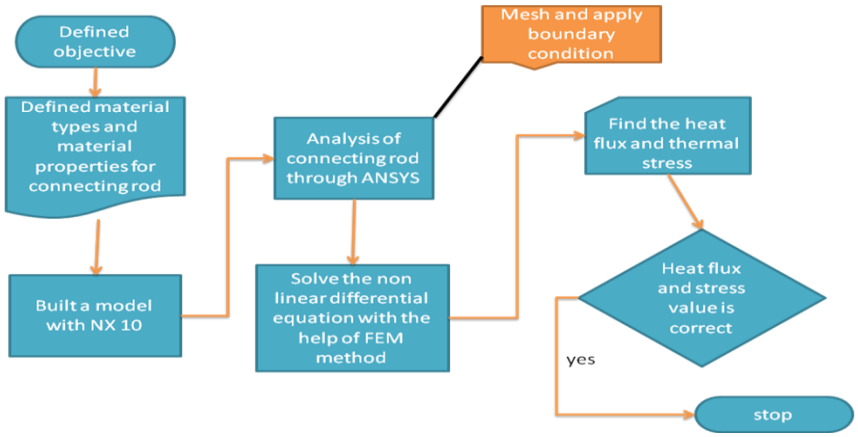

Fig 4.1 methodology of connecting rod

V. CONCLUSION

Connecting Rod play a vital role in the performance and power capacity of IC engine. Failure of connecting rod be limited by improving design or by improving material quality or by improving both the parameters. Performance of connecting rod can be improved by changing the material composition. Different materials have different properties and by alloying materials the desired properties can be achieve. Thus in this paper a literature review is done to formulate the methodology for further work.

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