A Review on Process Development of Joint Face Machining to Ensure Proper Assembly of Connecting Rod

Ravindra P. Rathod[1] Prof. Paresh V. Machhar[2] Prof. Hitesh L. Jadav[3]
[1]P.G Student [2,3]Assistant Professor
[1,2,3]Department of Mechanical Engineering
[1,2,3]HJD-Institute of Technical Education and Research, Kera- Kachchh-370430 (India)

Abstract— The automotive industry has been experiencing a competitive environment and striving hard to find methods to reduce manufacturing cost, waste and improve quality. The ultimate goal is to speed up the process there by increasing productivity with quality through a proper utilization of man and machine. In a manufacturing industry, the layout and material flow in the shop floor decides its productivity. This work has been carried out to assemble connecting rod with minimum production time in industry. Efforts are made to reduce the motion waste in the shop floor. The problems is by using SPM or Conventional machines to manufacture connecting rod it takes more effort and time consuming process, also less accurate assembly of connecting rod sub-assembly. Consistency in the Quality could not be achieved. By replacing Special Purpose Machine with Vertical Machining Centers it gives proper assembly of connecting rod at joint face with reducing operation and production time of connection rod without disturbing its quality or rather to say with a better quality.

Key words: Accuracy, Cycle Time, Differential Case, Fixture Design, Machining Operation

I. INTRODUCTION

The connecting rod as we know it today, operating inside the cylinder of an internal combustion engine, was first used in 1860, when the French inventor, Etienne Lenoir, built a small, single-cylinder, internal-combustion engine. In 2008, an estimated 62.5 million automobiles will be manufactured globally. Assuming an average of 5 cylinders per engine, this is 312.7 million connecting rods manufactured for the automotive industry alone. These connecting rods will be manufactured by a variety of manufacturing processes and a variety of materials. Figure 1 presents schematic illustrations of a connecting rod and its location and function in an engine. [1]

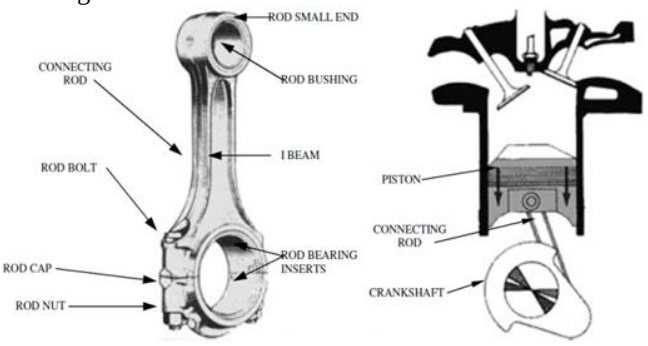

Fig. 1: Schematic illustrations of a connecting rod [1]

A. Possibilities To Manufacture Connecting Rods:

1) Hot Forging:

It is a predominant technology to fabricate conrod. Due to a complex geometry, conrod cannot be produced in one blow and therefore dies with several impressions have to be employed.

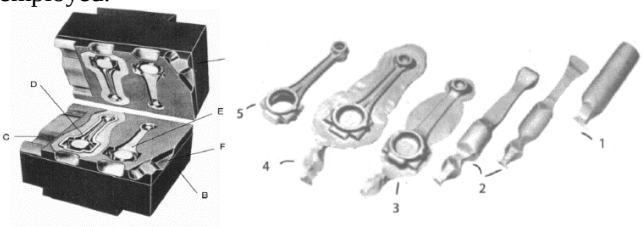

Fig. 2: Conrod forging Process [2]

2) Powder Metal (PM) Based Process:

In this process pre-blended powder material is filled up into the die, and then compacted at room temperature with the subsequent creation of preform by sintering at 1050-1300°C for 15 minutes. This preform is afterwards ejected from the die, heated in the furnace and finally hot forged to the final shape. In this way high density forging is produced.

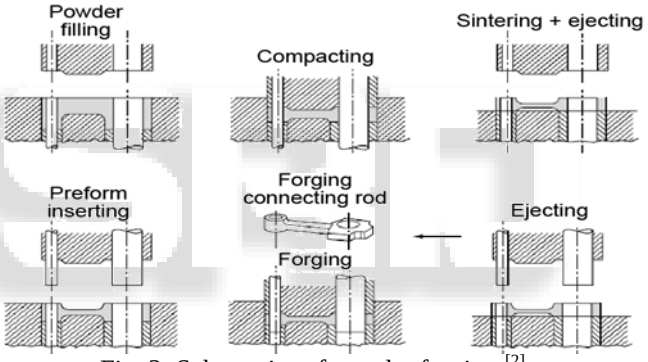

Fig. 3: Schematics of powder forging [2]

3) Casting:

Cast conrods are produced in green sand molds. Due to specific requirements of casting technology design of conrod has to be modified (I-beam cross section, radii). Material utilization in conrod casting reaches 90%. Mechanical properties of cast conrod are improved by sand blasting or shot peening. [2]

II. LITERATURE SURVEY

Danielle Visser [3] this paper discuss a brief history of the connecting rod and then discuss the various methods of modern manufacture including: sand cast, wrought forged, and powder metallurgy, with focus on wrought forged and powder metallurgy. Finally, this paper will cover some of the more recent developments in the connecting rod industry including: titanium, aluminum, magnesium, and polymeric connecting rods. It was concluded that for larger engines with lower RPMs powder metallurgy was the dominant method of manufacture in North America. However, in Europe and Asia, forged connecting rods seemed to be the preferred method of manufacture.

Pal suraj et. al [4] this paper concludes the steps in 3D modeling of connecting rod steps are useful to create 3D model of connecting rod using CAD software. First we

choose reference plane and set dimension in mm and then we go to sketcher and then extrude these entities to design both ends of connecting rod. After that reference plane is selected again for shank of connecting road and then we extrude the entities symmetrically. Once again plane is selected for making entities of groove. At last datum plane is selected for creating small holes on piton end and then holes are made on the periphery of piston end.error by almost 6 % in comparison to IV Quadrant Computer Aided Mass Balancing Method.

Maninar nirav P. et al. [5] I came to know about the concept about how to design fixture for machining process. Centering, locating, orientating, clamping and supporting can be considered the functional requirements of fixture. I have studied example of rotary fixture.

Miriam MATÚŠOVÁ et. al [6] An attempt to make process analyses leads to asked progress of manufacturing structures and production processes. On the basis of present analysis needs of technological project realization is possible to direct it into a system of production preparing. Detailed spatial arrangement of manufacturing devices and workstations is organizational activity influenced on material moving in the manufacturing process, on controlling and directing methods of technological operation sequence.

Pavel KOVAČ et al [7] paper presents the current state of research in cutting process and machine interactions for a wide variety of cutting processes. Also emphasis on understanding, modeling and simulating all modes of interaction.

Andrea MUDRIKOVÁ et al [8] an attempt to make trend in manufacturing is characterized by production broadening, innovation cycle shortening, and the products have new shape, material and functions. Production strategy focused to time need change from traditional functional production structure to production by flexible manufacturing cells and lines.

III. Conclusion

Concluded that how to design fixture for machining process. Centering, locating, orientating, clamping and supporting can be considered the functional requirements of fixture. Different Steps for fixture design process methodology; Functional requirement, Fixture functions, Functional design, detailed design and fixture validation. Throughout Process to create connecting rod in 3D modelling software. Detailed spatial arrangement of manufacturing devices and workstations is organizational activity influenced on material moving in the manufacturing process, cutting process and machine interactions for a wide variety of cutting processes.

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