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DESIGN AND DEVELOPMENT OF PIN GRINDING FIXTURE FOR SIX CYLINDER CRANKSHAFT

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Abstract: - Engine parts accurate machining became a vital aspect during the internal combustion engine manufacturing and development cycle. The crankshaft machining tolerance plays an important role in the engine vibration. As a consequence, the machining tolerance criterion may be correctly applied in order to improve the engine performance with the help of design and manufacturing feasibility. The purpose of this project is to design and develop a static fixture for pin grinding of crankshaft which requires pin should be accurately average so that machined accurately. Before designing fixture detail study of forging and machining of crankshaft are carried out. And according to IS3469 standards designing and modeling of forging crankshaft are studied. Fixture design is basically recognized as a subsequent activity process planning. The designing and manufacturing of fixtures are required higher accuracy so they consume more time, and it increases the manufacturing cycle time of any product that needs machining and/or assembly. The main reason is that fixtures should be designed by considering tight Tolerances, typically to 30-50% of the overall work piece tolerance. So the element parts of fixture are located and designed within the tolerance. These are designed and modeled in AutoCAD and Creo-Parametric software for feasibility purpose by using 2-D drawing and 3-D model of crankshaft.

Keywords: Engine Parts, Crankshaft

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INTRODUCTION

Studies in fixturing began in the 1940's the result leads to several manuals on jig and fixture design. Fixtures are used to manufacture duplicate parts accurately. Fixture design is basically recognized as a subsequent activity process planning. Most fixtures are designed for a particular work piece, thus being called `dedicated fixtures'. Due to current trends in manufacturing promoting a larger product mix, flexibility and quality, many companies are demanding fixturing systems to be more `flexible'. Flexible systems allow a variety of individual parts to be held during machining or assembly operations. Fixturing contributes significantly to overall manufacturing cost, sometimes neglected for the reason of cost reduction, thus minimizing cost to produce each dedicated fixture, and reducing storage of fixtures (Grippo et al. 1987) with typical costs of dedicated fixtures amounting to 10-20% of the total manufacturing costs. The economic impact of flexible fixturing could be dramatic (Gandhi and Thompson).

The designing and manufacturing of fixtures are required higher accuracy so they consume more time, and it increases the manufacturing cycle time of any product that needs machining and/or assembly. The main reason is that fixtures should be designed by considering tight tolerances, typically to 30-50% of the overall work piece tolerance. In addition since most fixtures are made from harden steels; the kinds of machining operation that can be used for their manufacture are constrained (Bidanda and Muralikrishnan 1992, Kusiak 1993).

Within the past decade, the manufacturing research community has focused on developing and improving technologies such as computer aided design and manufacturing (CAD/CAM),computer aided process planning (CAPP) A further technique that has been employed in CAFD is case-based reasoning (CBR) (Bi and Zhang, 2001). CBR (Kolodner, 1993; Maher, 1997) involves representing, indexing, and organizing past design cases in a case library such that they can be recalled, modified, and then reused in future design situations. Basically when a new design problem is encountered, a CBR approach identifies a past case that appears best matched to the current design requirement and then modifies that case to provide a satisfactory solution to a new design situation.

2.0 OBJECTIVE

Many of today's engines require extremely smooth crankshaft mains (journals) and pins finishes due to increasingly tighter bearing clearances and the use of deferent thinner viscosity motor oils. And if these polishing of the crankshaft mains and pins are not adequate, then excessive clearance should be there in between bearing shells and main bearing can cause premature

bearing failure. As clearance increases with wear, oil flow increases, which causes oil pressure to drop. Then the shaft may rub against the bearing surface and wear even faster.

To reduce such kind of machining errors crankshaft journal and pins should be properly grind for smooth surface finish and accuracy. For machining operation of crankshaft there is plenty of presetting are required to locate it on the machine, it takes too much time. To reduce time and ease to setup crankshaft, we make an arrangement to adjust and locate in such a manner that it reduces time for adjusting it on the machine and ease for operator to loading and unloading the job from machine before the machining. As these setup and Adjusting time is too much in machining cycle operation so we do fixturing for that job to reduce the setup and adjustment time on machine.

Different theories and concept are considered with deferent designing criterion for fixture design. By using these we have to design the fixture for accurately locating six cylinder crankshafts on pin grinding machine. In six cylinders crankshaft pins are indexed at an angle of 120° So the pin 1 and 6 are make average to the dowel pin in first setup then it is indexed at an angle 120°. Fixture which was previously used had required too much time to average the pin. So to reduce such time and increasing the productivity by designing the pin averaging fixture which will reduce the setup time and reduce the machining cycle time. This will results in increasing the production rate with increasing productivity.

The main objective of this fixture is as follows

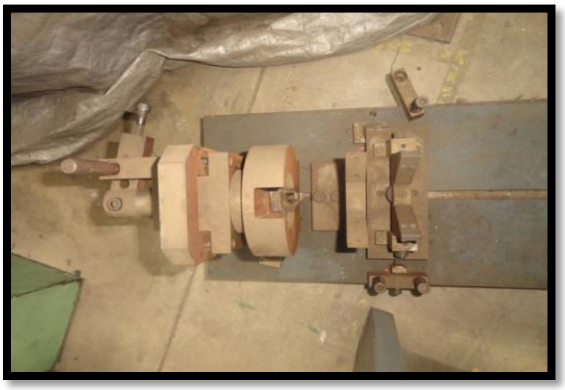
- A development in the machining fixture for pin averaging.
- Designing and modeling deferent parts of fixture.
- Check the developed fixture for accuracy and tolerance.
- Do the Analysis of assembled fixture for achieving the required output.

3.0 LITERATURE REVIEW

There have been many literatures in the area of fixture design. Attempts to automate the fixture design are not new. This Literature review focuses on machining fixture design and optimization of fixture parts with its tolerance and accuracy. Hargrove and Kusiak et al [2] reviewed some of the current developments in computer-aided fixture design (CAFXD), in this they indicated a growing interest in the development of computer-aided fixture design systems. The motivation for this manufacturing research was stimulated by the desire to reduce setup

and production costs, and the potential rewards of automation. In that paper the recent developments in CAFXD and projections for emerging systems was presented. Gandhi and Thompson et al [2] were designed for a particular work piece, thus being called dedicated fixtures' but the today's manufacturing promoting a larger product mix, flexibility, and quality. And these allow individual parts to be held during machining and manufacturing or assembly. Thus minimizing cost i.e. 10 to 20 % of total manufacturing cost, to produce each dedicated fixtures, flexible fixturing could had been dramatic. Kusiak et al [2] reviewed design and manufacturing of fixture can be time consuming and it increases the time consuming, and it increases the manufacturing cycle time of any product that needs machining and/or assembly. The main reason was that fixtures were designed to tight tolerances typically 30-50% of the overall work piece tolerance.

4.0 EXISTING FIXTURE FOR PIN AVERAGING



We were facing so many problems during the use of this fixture, like positioning, use of fixture and after some jobs one or two jobs get rejected. Due to this there is need of a full proofing fixture for pin averaging. In order to overcome the problems in previous fixture according to 4-2-1. Locating principle we have done certain Changes like restricting maximum number of degrees of freedom by putting rest pads bellow crankpins. Instead of v-locator we provided stopper for crankpin 1. The newly developed pin averaging fixture is as follow.

Figure 4.2: Newly manufactured fixture for pin averaging.

5.0 FIXTURE PARTS

5.1.1 Base plate

Firstly we had decided the length of the base plate by considering different points such as where to rest pins according to 4-2-1 principle of locating. This gives more stability for resting as compared to 3-2-1 principle of locating.

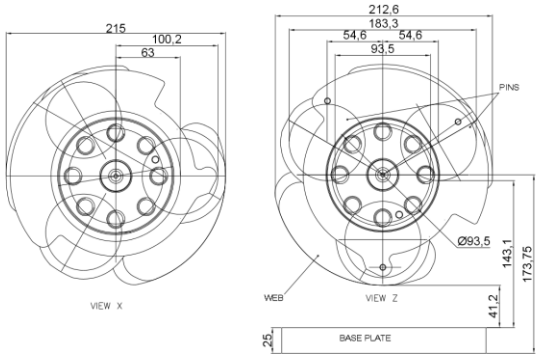


Figure 5.1: Side view of crank shaft.

5.1.2 Resting Brackets and Pads

Resting should be defined such that one is resting bracket and second is rest pads. Pads are used for easy height adjustments and in future development purpose.

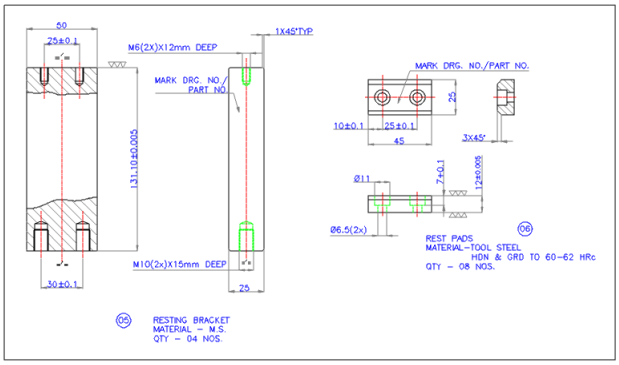


Figure 5.2 Rest pad and resting brackets

5.1.3 Piston, Aligning pin and Locating pin

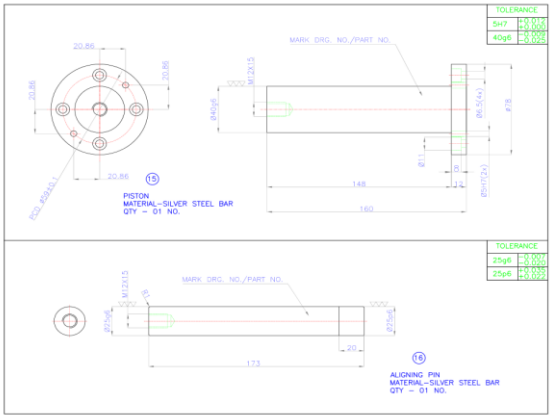


Figure 5.3 Piston and Aligning pin

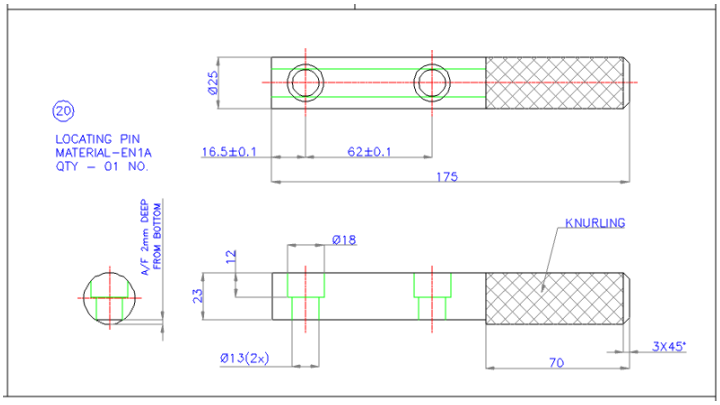


Figure 5.4: Locating pin

5.1.4 Guide and Brash bush

These are used for making easy sliding movement of parts within the fixture also it would reduce wear and tear of fixture parts while sliding. Further design details for all bushes are as bellows.

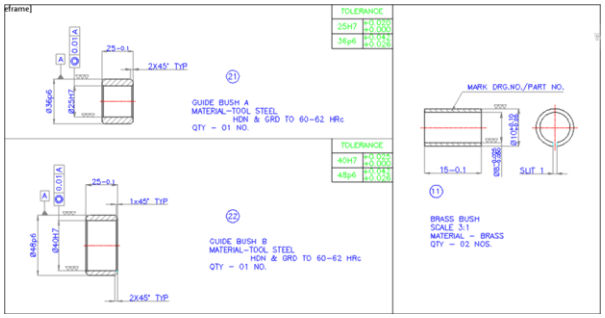


Figure 5.5: Guide and brass bush

5.2 Fixture Assembly

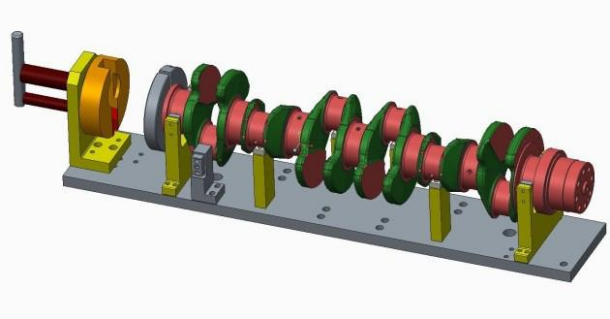


Figure 5.6 Fixture assembly

6.0 CONCLUSION

The physical model has been developed for pin averaging _xture for six cylinder crankshaft. The main input data required for carry out designing for this model was obtained from the crankshaft machined model and some machining requirement data of customer. The proposed model will help them to average pin efficiently. The implementation of this model is easy because the cost for machining is minimum and it would save too much setting or averaging time of crankshaft. The output given by this model is within the tolerable limits.

Since some parameters of pin grinding is achieved by this model but still some kind of improvement is necessary to do for increasing the accuracy of pin grinding.

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