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Design and Development of Milling Fixture

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Abstract **Fixture is required in various industries according to their application. Design of new fixture is a modified over the old fixture due to some drawback. The fixture setup for component is done manually therefore more cycle time is required for loading and unloading the material. So, there is need to develop system which can help in improving productivity, accuracy and reduction of time. Modified fixture reduces operation time and increase productivity and high quality of operation is possible. The company uses plate fixture having pins for adjustment or locate circular job. They have to use 16 different fixtures for 16 different types of shafts. The main objective of our project is to design and optimize the fixture for shafts having various dimensions used in automobile gear box and to achieve the accuracy of V-block of 20 microns.**

I. INTRODUCTION

Over the past century, manufacturing has made considerable progress. New machine tools, high-performance cutting tools, and modern manufacturing processes enable today's industries to make parts faster and better than ever before. The work holding methods have also advanced considerably, the basic principles of clamping and locating are still the same. Mass production methods demand a fast and easy method of positioning work for accurate operations on it. Jigs and fixtures are production tools used to accurately manufacture duplicate and interchangeable parts [1]. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically, and to ensure interchangeability of components [1] [2] [3]. The economical production of engineering components is greatly facilitated by the provision of jigs and fixtures. The use of a jig or fixture makes a fairly simple operation out of one which would otherwise require a lot of skill and time. Both jigs and fixtures position components accurately; and hold components rigid and prevent movement during working in order to impart greater productivity and part accuracy. Jigs and fixtures hold or grip a work piece in the predetermined manner of firmness and location, to perform on the work piece a manufacturing operation. A jig or fixture is designed and built to hold, support and locate every component (part) to ensure that each is drilled or machined within the specified limits. The correct relationship and alignment between the tool and the work piece is maintained [4] [5].

II. LITERATURE SURVEY

1)A Review on Design of Fixtures. International Journal of Engineering Research and General Science Volume 2, Issue 2, Feb-Mar 2014 ISSN 2091-2730. S. S.Pachbhai, L. P.Raut

The requirement of the fixture is minimizing deformation of work piece. With the help of fixture operation time is considerably reduce and machining become easy. Fixture is also beneficial for reducing cycling time and increasing production rate. There are various methods of clamping used for different type of applications.

The various types of location methods are

1) Flat locator
2) Jack pin locator
3) Drill bush locator
4) V- locators

There are various steps for fixture design

1) Define requirement
2) Gathering information
3) Develop several option

4) Choose the best option
5) Implement the design
6) Some important consideration while designing the fixture
7) Study of work piece and finished component size and geometry.
8) Type and capacity of the machine, its extent of automation.
9) Provision of locating devices in the machine.
10) Available clamping arrangements in the machine.
11) Available indexing devices, their accuracy.
12) Evaluation of variability in the performance results of the machine.
13) Rigidity and of the machine tool under consideration.
14) Study of ejecting devices, safety devices, etc.
15) Required level of the accuracy in the work and quality to be produce.

PRINCIPLES OF LOCATIONS

The principle of location is being discussed here with the help of a most popular example which is available in any of the book covering jigs and fixtures. It is important that one should understand the problem first. Any rectangular body many have three axis along x-axis, y-axis and z-axis. It can more along any of these axes or any of its movement can be released to these three axes. If the operation to be done on the cylindrical object requires restriction of the above mentioned free movements also than some more locating provisions must also be incorporated in addition to use of the V-block. It consists of two parts:

A. For the first time he evaluated varying contact forces and work piece position errors in each clamping step by solving a nonlinear mathematical programming problem. This is done by minimizing the total complementary energy of the work piece-fixture system. The prediction proves to be rigorous and reasonable after comparing with experimental data and referenced results.

B. The optimal clamping sequence is identified based on the deflections of the work piece and minimum position error.

III. SYSTEM ARCHITECTURE

In our system we are having the main system blocks as below which include

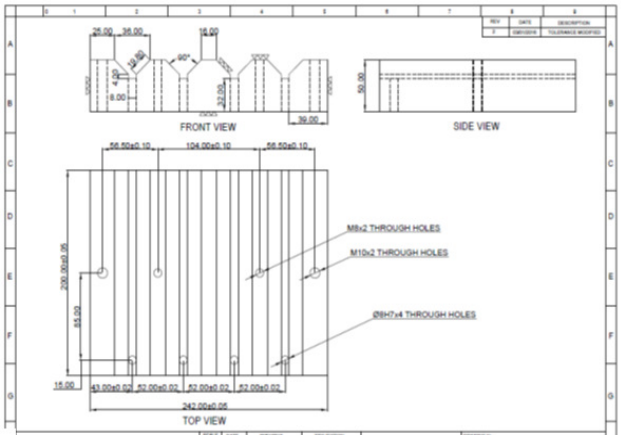

Fig : Design of project

New Fixture

The problems of the previous fixture were observed and by taking them into consideration few modifications of this fixture were proposed and with the help of company guide we made some changes in order to solve the problems like poor surface finish, accuracy and productivity.

Sr. No.	Elements	Movements restricted
1	Plate surface	-Z
2	One cylindrical pin and two surfaces of V-block	Z (CW) Z(CCW) Y(CW) Y(CCW) X(CW) X(CCW) -Y +Y -X +X
3	Clamp	X(CW) X(CCW) +Z

IV. RESULT ANALYSIS

A. Old fixture

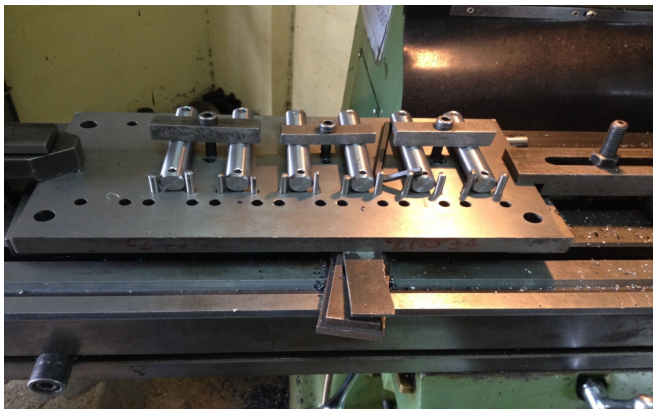

Fig: old fixture

In the industry there were 19 different types of shafts and for each type of shaft 19 different fixtures were used. Therefore the cost of manufacturing was very high. The fixture required regrinding after certain period of time and use as the material used for fixture is MS. MS has low wear resistance so wear of fixture was high. Different types of shafts required different fixtures so setting time of fixture was very high. There was a certain bend in the fixture at its centre due to loading and unloading of shafts. This bend in fixture affected the accuracy in between the production. As the accuracy was hindered, continuous inspection of the lot was needed. So there was no adaptability of fixtures.

b. New fixture

Fig : New Fixture

The development of fixture is done in such a way that only 1 fixture is needed for various types of shafts. It reduces the initial cost as number of fixtures is reduced drastically to just 1 fixture. The material used for fixture is OHNS. Its high wear resistance property makes it desirable where wear is going to happen. Hence the wear of shafts as well as fixture is negligible. Single fixture being used in manufacturing reduces the setting time of fixture has reduced. This increases the production rate in a shift. There was no bend observed in this fixture. This results in constant accuracy throughout the lot. The inspection required is sample inspection not the continuous inspection like in previous fixture. The adaptability of this fixture is good.

Difference between New fixture vs Old fixture.

New fixture	Old fixture
Modified fixture reduces operation time and increase productivity and high quality of operation is possible.	The fixture setup for component is done manually therefore more cycle time is required for loading and unloading the material.
Accuracy is more as compared to old fixture.	It provides less Accuracy.

V. CONCLUSION

Paper plates can be manufactured at high rate with the available machines. Manufacturing normally requires hydraulic press machines to operate at a very high speed. But the problem is that they are used for making one or two plates simultaneously, which shows a less production rate. Therefore there may be the chances of increase in production rate by simultaneously punching the number of sheets in a single pass.

ACKNOWLEDGMENT

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