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# Development and Modelling of Milling Fixture for Enhancement in Productivity

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**ABSTRACT**

Number of operations required to be done om a single workpiece results into huge set up time and manufacturing lead time. Milling machine is one of the most widely used machine on which number of jobs can be manufactured. Due to which the machine is overutilize so, any arrangement / tool / device which reduces its machining time is desirable. Milling fixture developed under this work helps to reduce set up time and manufacturing lead time. With proper study and implementation of work study and method study the bottlenecks in the workstations and operations. With aim to reduce worker fatigue fixtures proved to be accurate solutions. The present work focuses on minimizing lead time as well as worker fatigue. The cost-effective solution for product results into cost savings to the company. Productivity improvement enables company to withstands in the competitive market. Number of operations like milling, slotting, drilling is accommodated in a single fixture. The operations process chart / outline process chart contributes to decide time study implementation. Bottleneck is identified and removed with the successful implementation of milling fixture.

**Keywords :** - Lead Time, Work Stud, Milling Fixture, Time study, Bottleneck Workstation

## I. INTRODUCTION

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. 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. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically, and to ensure interchange ability of components. 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.

Therefore, keeping in view increase in productivity, product quality, repeatability i.e., interchange ability and overall economy in batch production by machining, the following factors are essentially considered during design, fabrication and assembly of jigs and fixtures [1] Easy, quick and consistently accurate locating of the blank in the jig or fixture in reference to the cutting tool [2] Providing strong, rigid and stable support to the blank [3] Quick, strong and rigid clamping of the blank in the jig or fixture without interrupting any other operations [3] Tool guidance for slender cutting tools like drills and reamers [4] Easy and quick loading and unloading the job to and from the jig or fixture [5] Use of minimum number of parts for making the jig or fixture [6] Use of standard parts as much as possible [7] Reasonable amount of flexibility or adjustability, if feasible, to accommodate slight variation in the job - dimensions. [8] Prevention of jamming of chips, i.e., wide chips-space and easy chip disposal [9] Easy, quick and accurate indexing system if required. [10] Easy and safe handling and moving the jig or fixture on the machine table, i.e., their shape, size, weight and sharp edges and corners [11] Easy and quick removal and replacement of small parts [12] Manufacturability i.e. eases of manufacture [13] Durability and maintainability [14] Service life and overall expense.

## 2. LITERATURE REVIEW

Prit Shah et al. [1] proposed the modular welding fixture to enhance the productivity. Design consists of designing the frame structure for the maximum allowable load on the table. Different elements are used for location and how the same elements can be rearranged for different shapes and sizes of workpiece and hence the same fixture can be used for infinite number of arrangements.

Soosung Kim et al. [2] studied design and fabrication of remote welding equipment. The remote welding equipment for nuclear fuel bundle fabrication in a hot-cell was designed and developed. To achieve this, a preliminary investigation of hands-on fuel fabrication outside a hot-cell was conducted with a consideration of the constraints caused by the welding in a hot-cell. S.N.Shinde et al. [3] designed the fixture which reduces cycle time and operator labor while increasing functionality; and allows complex welding operations to be completed on simple two axis welding arms.Bing Li et al. [4] proposed the quality design of fixture planning for sheet metal assembly. A quality design model of fixture planning for sheet metal assembly with resistance spot welding is then developed; both the performance expectation and the variance are considered in the formulation of the objective function. H. Nalbandh et al. [5] reviewed the optimized fixture design using genetic algorithm. Genetic Algorithm method has been selected as optimization of fixture design.Biswajit Parida et l. [6] developed a clamping system and an instrumented setup for a vertical milling machine for friction stir welding (FSW) operations and measuring the process forces. Praveen B. et al [7] studied the Impact of Fixture Design on Productivity Enhancement in

Fabrication of Wheel Loader's Front Chassis and mentioned that the major commercial importance of any mechanical industry is characterized by increase in productivity. Jigar D Suthar et al. [8] studied design and analysis of welding fixture for the exhaust impeller. Fixture is used in manufacturing of impeller during welding to hold the different parts of the impeller assembly like blades (vanes), upper and lower plates. Sneha Ubale et al [9] studied designed for the components which are difficult to weld in the normal way or without any holding unit. This paper presented a review of fixture design analysis and optimization in terms of fixture layout, clamping position and part deformation. Naveen A M et al [10] designed welding fixture for motor case assembly and analyzed it with the help of CATIA V5R17.They focused on the Design and Analysis of the Welding Fixture for Motor Case Assembly. A. M. Mhaske et al [11] designed and analyzed the welding fixture and aimed to demonstrate a systematic approach for sheet metal assembly fixturing. The problem has been constrained as fixturing for assembly of sheet metal components of Load all Inner Boom. Kulkarni Kaustubh A. [12] studied that the 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. Kiran Valandi et al [13] aimed at designing a fixture used for performing machining operations at certain angle (102.5 degree) on the Crank case used in commercial vehicles. The design is proposed so that the required operations are performed properly with the conventional CNC machines to obtain required dimension which includes Design & Structural analysis of fixture is carried out using known and proven methods, i.e., Creo Elements/Direct modelling 17.0 Software. number of parts. Kumara B et al [14] modified the design of old fixture due to some drawback. The old fixture is not suitable for drum having slot on top face current fixture is complicated in design and there is more work in fitting the button to fixture ring.

## II. METHODOLOGY

[A] Work Study

Work-study forms the basis for work system design. The purpose of work design is to identify the most effective means of achieving necessary functions. Historically, this work-study aims at improving the existing and proposed ways of doing work and establishing standard times for work performance. “Work-study is a generic term for those techniques, method study and work measurement which are used in the examination of human work in all its contexts.

Table 1 : - Earlier Method

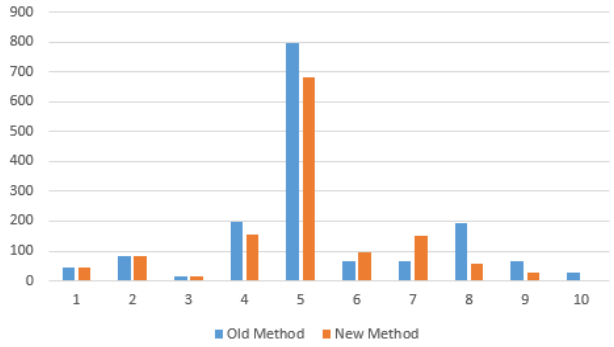
| Operation No. | Time Required (Seconds) |
|---|---|
| 1 | 45 |
| 2 | 85 |
| 3 | 15 |
| 4 | 198 |
| 5 | 795 |
| 6 | 65 |
| 7 | 65 |
| 8 | 195 |
| 9 | 68 |
| 10 | 30 |
| **Total** | **1546 Sec (25 min. 46 Sec)** |

Table 2 : - New Method

| Operation No. | Time Required (Seconds) |
|---|---|
| 1 | 45 |
| 2 | 85 |
| 3 | 15 |
| 4 | 154 |
| 5 | 684 |

| | |
|---|---|
| 6 | 94 |
| 7 | 150 |
| 8 | 58 |
| 9 | 30 |
| **Total** | **1315 Sec (21 Mins. 55 sec)** |

## III. RESULTS AND CONCLUDING REMARKS




The number of activities are reduced in newly developed fixture. As a result, the total number of products manufactured increases i.e. productivity increases. Also ease in operating is achieved through fixture implementation and worker fatigue reduces.

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