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Research Article

A Case Study of Improvement in Productivity of a Machine by Fixture Design Modification with Simulation

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Abstract

The thesis work is performed in Hero Motors limited Gaziabad, where state of art facilities are available and it provide clean, new ideas product design and latest technology. In this present thesis work 7.8% increase in productivity per month on the Tong Tai machine by just modifying the fixture design and decrease 32% manual time or13% machine time.

Keywords: *Productivity, Fixture Design Modification, Simulation etc.*

Introduction

With increasing automation and mechanization, production processes are shifting from manual to machines and to succeed in this new environment, equipment must run effectively. Proper utilization maximizes the performance and availability of machinery, which leads to increased productivity. The research work presented here focuses on how to improve the productivity by properly utilizing the available resources that is work piece holder, already available along with the machine from the manufacturer. A fixture is a work-holding or support device used in the manufacturing industry. The main purpose of a fixture is to locate and in some cases hold a work piece during either a machining operation or some other industrial process. A jig differs from a fixture in that it guides the tool to its correct position in addition to locating and supporting the work piece.

Problem Statement

This thesis is working on one particular machine, TONG Tai – 4. This machine was setup in the industry about one and a half year back and three other such machines are also available in the plant.

In the given project work found that theoretically the capacity of the machine is approx. 10,000 jobs per month. But actually the production coming out is only 270 jobs per day or 7000 jobs per month. This is big difference, which leads to a sufficient loss which can easily be marked on the charts of a company. So research work, main focus is going to be on the improvement of productivity as well as production of the machine. As improvement in production becomes the basic need of any industry to sustain in market

Objective of Present Work

The main improve and enhance the production and production rate of the machine.

Methodology

The project approach decided strategically is an iterative four step problem solving process, typically used in quality control and named PDCA Cycle

In this research work discovered that manual operations almost consume 28% of the total production cycle time, represented graphically in fig. as below.

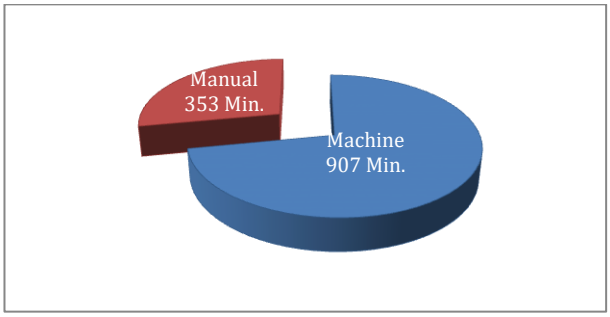

Figure: Cycle Time with present fixture

Data Analysis

The collected data is now tabulated for the machine TONG TAI and the improvements are going to be made

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accordingly in this data after properly analyzing it. This is going to check the working time of machine with present fixture, time for loading and unloading with present fixture and also the cycle time with it. The comparison of two machine tong Tai machine is shown in table and figure.

Table 1: Comparison of Machines

Description	Tong Tai - 3	Tong tai - 4
Operation Number	30 A	30 B
Number of Setups	2	2
Job Status	Complete	Complete
Operations	Drilling, Reaming, Surfacing, Tapping	Drilling, Reaming, Surfacing, Tapping
Machining Time	208 sec	280 sec
Loading and Unloading Time	37 sec	72 sec
Loading and Unloading Type	HCU	MCU
Parts produced per day	322*	270*

* = Excluding miscellaneous manual time

Difference between the production per day = 322 – 270 = 52 jobs

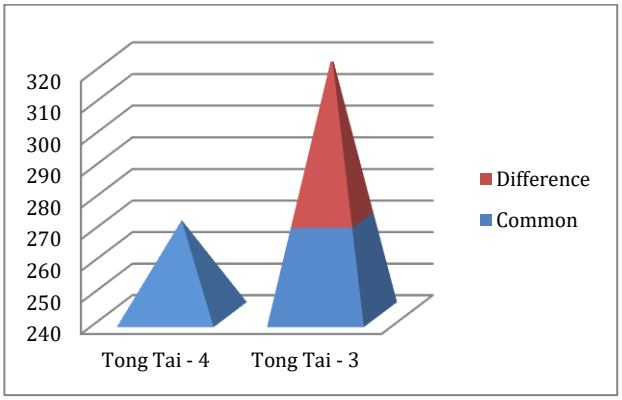

Figure 1: Comparison of production for various machines

Detailed working time with present fixture

S. No.	Basic Step	Operation	Time (in Sec.)
1	Unloading of job	Pickup Spanner	4
2		Loosening of Locking Nut	9
3		Drop Spanner	5
4		Turn Clamp to OUT position	6
5		Pickup Old Job	5
6		Air Clean the Fixture	10
7	Loading of job	Place New Job	9
8		Turn Clamp to IN position	6
9		Pickup Spanner	5
10		Tightening of Locking Nut	9
11		Drop Spanner	4
Total Time Taken			72

The present fixture No. of jobs produced in 4860 sec 17 jobs

Detailed Design of New Fixture

The new fixture given as a solution to the problem is yet a manually operated unit but is semi automatic in operation. The complete design of the new fixture is again done with Solidworks 2011 and it is designed in order to eliminate all kinds of drawbacks with the present fixture .the new design of the fixture which is the solution to present problem is designed with following special features:

- Reduction of 50% of operations than present fixture.
- Reduction of excessive manual labor.
- Pressurizes the job accurately and evenly.
- Semi automatic in function.
- Requires no special or formed tool like spanner for its operation.
- Can be made by modifying the present fixture.
- Simple and easy in construction.
- Requires less maintenance.
- Cheap and long life design.

Detailed Working Time with New Fixture

S. No.	Basic Step	Operation	Time (in Sec.) With Present Fixture	Time (in Sec.) With New Fixture
1	Unloading of job	Pickup Spanner	4	-
2		Loosening of Locking Nut	9	5
3		Drop Spanner	5	-
4		Turn Clamp and Arm to OUT position	6	5
5		Pickup Old Job	5	5
6		Air Clean the Fixture	10	10
7	Loading of job	Place New Job	9	9
8		Turn Clamp and Arm to IN position	6	5
9		Pickup Spanner	5	-
10		Tightening of Locking Nut	9	5
11		Drop Spanner	4	-
Total Time Taken			72	44

Rate of Increment of Production or Productivity

As we know that monthly target from Tong Tai – 4 = 10,000 jobs

Approximate increase in production with new fixture= 30 jobs/day

Hence increase in production per month = 30 X 26 = 780 jobs/ month

Percentage increment in production per month = (780/10000) X 100

Or Productivity Improvement per month =7.8 %

Conclusion

In present project production is enhanced for a machine by modifying the design of job fixture only

- The project is concluded with its aim achieved which is to enhance the production of Tong Tai machine. There is about 7.8% increase in productivity per month of the machine.
- By just modifying the design of fixture, about 32% reduction in the manual time per job 13% of machining time increment per job has been achieved.

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