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Increasing Productivity Of Inter Axle Drive Head (Iad) Workstation In Drive Head Assembly

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Abstract-Productivity Improvement is one of the most important factors for an organization to survive in this growing competition. Globalization has given rise to new standards for products and the demands of the customers are met keeping the appropriate standards for quality. A literature review is carried on productivity improvement and reducing customer complaint by adapting Automation (Image Capturing Device) for a drive head assembly process of axle in an automotive industry. Automation reduces human intervention with machines which reduces defects and increases productivity. The aim of the study to eliminate errors by reducing workers effort and should eliminate waste.

Index Terms - Productivity Improvement, Automation, Customer Complaint, Defects, Quality

1 INTRODUCTION

Productivity describes various measures of the efficiency of production. Productivity defined as the ratio of output to inputs used in a production process, i.e. output per unit of input. Productivity plays an important role in manufacturing industries. The maximum utilization of man and machine increases productivity which in turn increases efficiency. Productivity was increased by decreasing input by keeping output constant or Productivity can also be increased by increasing output keeping the input constant. This paper deals with increasing output by keeping input constant. There are many ways to increase productivity.

This literature paper deals with increasing productivity by adapting Automation to critical process in an Axle assembly in an automotive industry. Automation reduces human intervention with products which reduces defects and increases output by reducing cycle time. Automation has played vital role in productivity improvement in manufacturing sector[1].

Productivity was improved by eliminating bottleneck process in Axle assembly process.

2. Literature Review

The following are brief review of literatures on "Increasing Productivity in manufacturing unit" concept.

1. Gyanendra Prasad Bagri and Prem Raushan make a method study/motion study and work measurement/time study identified that there is more than required manpower at various workstations. Die used in forging was not placed efficiently.We see major reason for idle man and machine is due to bar heater. It consists of three lines, which heat the rod in its row independently. Heating time for given rod is 77.2 seconds which cannot minimized. We here propose five lines instead of three, it would bring the effective heating time down to 13.45. Thus, we would be able to improve the productivity of our workstation by decreasing the cycle time from 25.73 sec to 14 sec, decreasing the worker from 5 to 4 and if hydraulic arm was employed as suggested it can even come down to 3. Apart from it we are able to improve material handling process by separating the forging section from machining [1].

2. Samuel, G.L. and Darwin, M. (2009) [2] studied the assembly of heavy vehicle brake is a difficult task for the operators working in the assembly line, primarily due to its heavyweight. The existing system in our study has seven operators assembling about 395 heavy vehicle brake assemblies per day using manual tools. The company wanted to enhance the capacity to meet the market demands with most of the existing resources and without increasing operator fatigue. Based on the time study results, it was identified that assembly operations such as brake shoe location, expanding the retainer springs and camshaft pressing are found to be more stressful and time-consuming tasks. A modular brake assembly station was designed, developed and implemented in the brake assembly line. The assembly station was designed in such a way as to facilitate easy/rapid loading and unloading of assembly components. In this assembly system, the operator fatigue was minimised to perform the assembly operations, such as holding and stretching of brake shoes. The cycle time study shows a considerable amount of reduction in bottleneck operation such as brake shoe assembly. Therefore, productivity increased by 25.8%.

3. A survey by Ford et al. (1987) indicated that linear programming, simulating and network models are among the most highly used methods. During the last two decades, attempts were made to develop system-based techniques for manufacturing system analysis and design for productivity improvement. More specifically, several researchers (Greene, 1991) have argued that quality and productivity are not separate. Morgan's (1989) review provided evidence on PERT/CPM, linear programming and simulation as being among the most frequently used methods. Grunberg (2003) mentioned that the improvement of manufacturing productivity have been on since the start of the industrial era as per the first known and well-documented practitioners in the area of performance improvement. Competition between companies has increased as markets have become increasingly global and there are no signs that this competition will ease. This increased competition creates an even greater need for better improvement methods that can sustain competitiveness.

3. METHODOLOGY

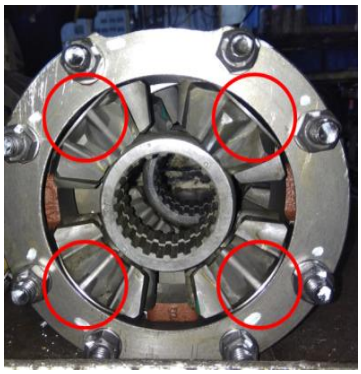
3.1 Study the Assembly Process

There are seven steps in this assembly process. Study assembly process one by one. List out the parts assembling in each process. Note down the time required in each process.

3.2 Identify the Problem

Identify the bottlenecks during assembly process. We find out the reason for workers causing problem. During assembly of spider and washer, the workers are placing two washers instead of one. This causing fatigue load on gears which causes failure. Due to workers negligence and also washer of very small in size defects are found.

Fig 1- show washers



used for assembly process.

3.3 Calculate Cycle Time

Calculate the total cycle time required to complete the process. Identify the assembly process which causing the highest cycle time to complete the process and also which is causing defects in the assembly process. In this assembly process we can observe this process causing problem and also it has the highest cycle time.

3.4 Automate the Process

Automation is used for the bottleneck process to eliminate defects. Image Capturing Device (ICD) was installed to identify the washers placed during third assembly process. It captures the real time image compares with the actual image and shows errors to the workers. Workers can easily identify the error and can alter the process. ICD lock the next process if error was found. Once, the problem is resolved then it unlocks the next process. This helps in reducing moving defect assembly to next process and also eliminates rework.

3.5 Reduce Cycle time

ICD reduces the cycle time required to complete the process. After automation the total cycle time reduced by 70 sec.

3.5 Increasing Productivity

After, the installing ICD reduces cycle time which increases productivity.

3.7 Reduce Customer Complaint

The errors were reduced in the assembly of drive head process. Due to the defect free products the customer complaint is eliminated.

4. IAD ASSEMBLY PROCESS (CYCLE TIME IN SEC)

S1. Placing bottom ring (30)
S2. Locating eight number of bolts (60)
S3. Placing spider with four de-Pinion (90)
S4. Placing spider washer ring (60)
S5. Locating top half ring (30)
S6. Placing washers with nuts (60)
S7. Tightening of nuts (90)

Total time taken for assembly = Cycle time=
30+60+90+60+30+60+90= 420 sec (7 min)

5. Automation (Image Capturing Device)

It is a device which capture image and verifies with actual image. Initially the actual/correct image was stored in the memory of that device. Then during process it captures image. It sends that image to its memory where it verifies with original/actual image. The program (logic) provided such that it captures the real time image and verifies. After verification, it provides information to workers to do further process.If the

image found to be defect, displays the defect location and then it locks the next process.

Fig 2- show Automation (Image Capturing Device) used to identify defects and to increase Productivity.

It consists of four sensors with camera. It rotates along the axis to the working area captures image and displays that capture image on the monitor screen. The displayed image will shows the defect area with red signal to the workers. Then the worker will eliminate those defects/errors on that particular area.

Automation eliminates errors and reduces cycle time of the assembly process as shown in below table. Therefore, the production capacity increased from 45 to 70 per shift. The production increased to 70 numbers by keeping the input constant. The efficiency of man and machine also increased. The productivity increased by 55.5%.

5.1 Time taken for Complete Assembly Process

Table 1-Time taken for seven processes to make assembly

PROCESS	1	2	3	4	5	6	7	TOTAL
TIME TAKEN sec (Before Automation)	30	60	90	60	30	60	90	420
TIME TAKEN sec (After Automation)	30	60	30	50	30	60	90	350

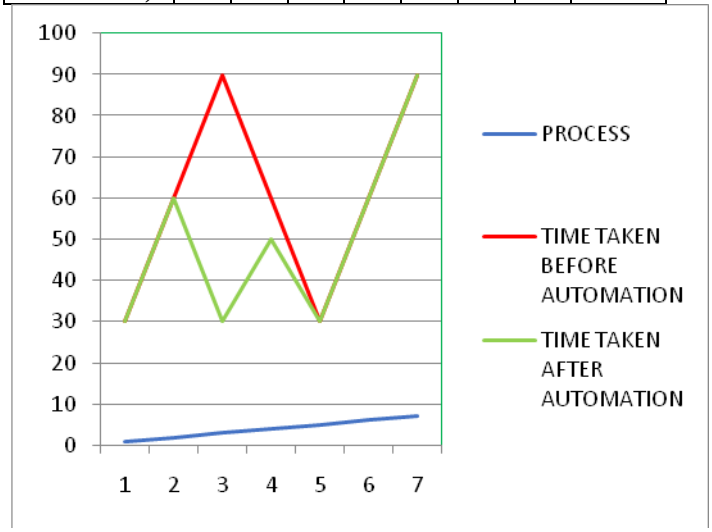


Fig 3- Graph showing time taken Before and After Automation

6. FIGURES AND TABLES

Production of assemblies increased from 45 per shift to 70 per shift. Fig show number of assemblies increased after automation compared with before automation.

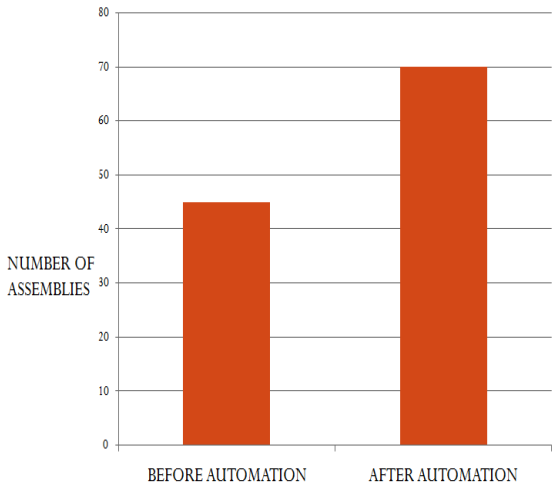


Fig 4- show number of assemblies before and after automation

6.1 Monthly details of Errors of Last 6 Months

Table 2- Monthly details of errors in last six months before Automation

MONTHS	AUG	SEP	OCT	NOV	DEC	JAN
ERRORS	8	9	8	8	9	1

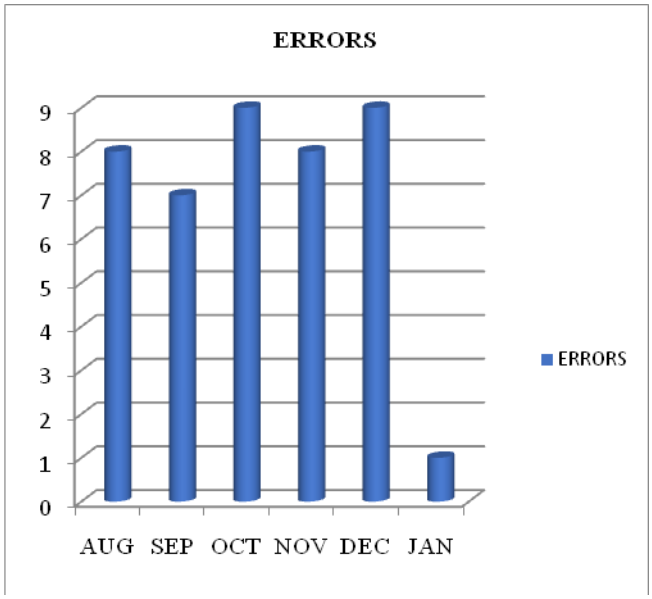


Fig 5-Graph showing last six months Errors

Figure show errors of data having last six months. We can observe that august to December the errors are more. Automation has done in January which reduced the defects.

6.2 Difference between Before Automation and After Automation.

BEFORE AUTOMATION	AFTER AUTOMATION
1. Cycle Time = 7 min	1. Cycle Time = 5.8 min
2. Productivity = 45 Per Shift	2. Productivity = 70 Per Shift.
3. Workers Under Physical and Mental Pressure.	3. No Physical and Mental Pressure.
4. Rework due to problem Identification.	4. Rework was eliminated.
5. Breakdown of product.	5. No breakdown

7. Results and Discussion

From the above figures and tables we can observe that by adapting automation (Image Capturing Device) productivity was increased and also the errors are reduced. Thus, we would be able to improve the productivity of our workstation by decreasing the cycle time from
420 sec to 350 sec, decreasing the worker fatigue.

8. Acknowledgments

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valuable suggestions that have helped us in improving this paper significantly.

9. CONCLUSION

The proposed system was successfully utilised in producing drive head assembly process for Rear axles and it has increased productivity and reduced operator fatigue. In this assembly system, the operator fatigue was minimised to perform the assembly operations, such as checking the washers, rework. The cycle time study shows a considerable amount of reduction in bottleneck operation such as washer placing.

The cost involved for implementing the proposed assembly system is significantly medium cost and makes it viable for industry.

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