



International Journal of Intellectual Advancements and Research in Engineering Computations

Design of Diode Voltage Measurement and Tuning Screw Insertion by Using a Single Fixture

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Abstract— Nowadays, technology is well-developed, but in some of the industries still operated by manual effort, semi-automatic, and automatic. Industries main aim is to improve production rates by minimizing workstation in assembly line. Main aim of our project is to cut human resource by eliminating unwanted complications, simplifying the process to improve productivity and making it most efficient. Our project involves in designing a fixture and machine for horn assembly line by combination of two machines in assembly line and making it into a single machine thereby increase in productivity and reduces man power.

Key words: Diode voltage clamper, single fixture, line balancing, tuning screw.

I. INTRODUCTION

In this modern world manufacturing is more and more competitive if the companies want to survive they want to update their self and improve efficiency. By minimizing the production cost and over all wages cost companies go with outsourcing or came improvement in existing factors. To reduce cost and improve quality of product stay competitive with manufactures, companies go with varying methods such as “lean manufacturing”. Main goal of lean manufacturing is to reduce waste in operations like long lead time, defects, material waste and human resource. In this paper study is made on application of lean manufacturing concepts to the continuous production process sector with the focus in horn manufacturing company. In the assembly line, fourteen stages are founded. In Each stage unique assembly of part is to be performed. Workstations are arranged in linear way and are connected by conveyor. Tasks at each workstation are performed by manual, semi-automatic and automatic. Once the part enters a station, part is assembled on the part and the

part is fed to the next workstation. Time taken to complete a task at each workstation is known as the process time. The cycle time of an assembly line is predetermined by a desired production rate.

II. PROBLEM IDENTIFICATION

- i. In the assembly line two labors are required to operate the two fixtures which involves in the assembly of tuning screw and diode voltage measurement.
- ii. This causes time delay in the manufacturing because process is done manually.
- iii. Combining both processes will increase efficiency of assembly line and reduce the work load to operator.

III. METHODOLOGY

5-M Method or 5-Factor Method is a simple method of analyzing the causes and consequences (problems) based on the following five causes:

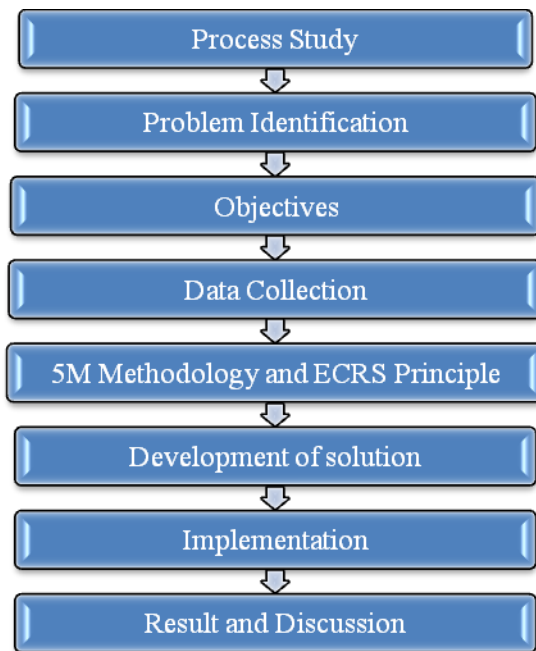


Fig-1 Methodology

A. *Man power*

Man power causes are in humans, people. We can increase the efficiency of workforce by following some best practices in manpower management.

B. *Machines*

It may cause in equipment, such as machinery, computers, tools, instruments, technology. Design, installation and maintenance of durable precise machines will reduce waste, saves money and create more precise products.

C. *Materials*

It may cause in defect or material properties. Attention to quality, cleanliness, performance and environment will help increase in manufacturing process.

D. *Methods*

It may cause in the rules, regulations, laws or standards. By combining latest methods in green manufacturing with time tested methods from history will create efficient manufacturing process.

E. *Management*

It may cause in improper management. Precise measurement of statistics within machines and across the manufacturing floor provides feedback which helps to keep our operation performing at maximum profitability.

(2010) presented there is a scarcity of empirical research showing productivity of assembly line based manufacturing firms. His paper attempts to bridge the gap by investigating an automobile horn manufacturing company, which is featured by manufacturing problems such as time loss and non-value added activities. Time study and operational analysis were conducted for all manufacturing stages of the horn assembly line and the bottleneck stages were identified. Three stages of the assembly line were modified as a consequence of the study, aiming to improve the process and labour productivity. The study led to the conclusion that the work-study techniques when utilized in manufacturing industries with a structured methodology would improve the work efficiency and labour productivity.

Sindhuja.D (2012) presented the procedure a new redesigned assembly line is proposed for bottleneck problem for continuous flow type horn assembly line. This paper presents the improvement of production rate and balance loss ratio of the manual assembly line. Using ECRS four principles (Eliminate, Combine, Rearrange and Simplify) minimize the idle time of machine at bottleneck station or the percentage of line balance loss. Verification of proposed system can be prepared by means of time values calculated from Modular Arrangement of Predetermined Time Standards (MODAPTS) method. The result shows that Bottleneck time (crimping stage time) reduced from 23.04 to 16.65 seconds and Production rate increased from 156 to 216 pieces per hour.

N. Sathiyarayanan (2016) explained about Lean principle is a technique used in all industries to improve performance, productivity, reducing the production cost, eliminate wastages and reduce non-value added, non-cyclic activities. This paper describes the effective utilization of man power in engine accessory production line carried out at XYZ organization located in South India. The various activities of the workers have been categorized into cyclic and non-cyclic activities. After observing the production line, there are 10 workers whose utilization ranges from 29.42% to 71.28%. A standardized work combination table is drawn for all 10 workers to identify their utilization. Using ECRS tool, some activities were eliminated, few processes were combined and machines were rearranged and simplified. Value Stream Map (VSM) is drawn to find out the current cyclic and non-cyclic activities. Future Value Stream Map is developed to design a lean process flow through the elimination of the root causes for the wastes and through process improvements. This paper uses some lean techniques thereby helps the management to improve the utilization of man power in engine accessory production line.

IV. LITERATURE REVIEW

Practical approaches to improving H. Sabatini

V. DEVELOPMENT OF SOLUTIONS

F. All Possible Solutions

At beginning stage of work we had completely understand about the main problem and then we analyzed all the possible solutions to do our case study. In the current mini vibrosonic horn assembly line, the tuning screw insertion and diode voltage measurement machines are founded in different workstations. But we have proposed a design to combine two workstations to a single workstation. By combine we have to alter some changes in standard operation procedure or create new standard operation procedure of machine. We have discussed two possible ways:

G. Design of fixture without spring:

Type-1 Proposed methodology for machine has a fixture without spring in bottom side of fixture. When the part arrives to the workstation operator takes the horn part and places it in fixture. Before placing horn housing in fixture inserts screw in fixture. After that cycle-1 is carried. In cycle-1 the double acting cylinder applies force on the horn housing assembly to hold it in rigid position. Then the tuning screw is inserted in the horn housing assembly as required amount of threads are pre-determined in by the PLC control system.

In cycle-2 the small size double acting cylinder applies considerable amount of load in the spool assembly to open contact between two spools. By opening spool assembly, we can easily check the diode voltage. The diode voltage is displayed in the indicator board which should be in the range of 28.2 to 32.5 volt. If it is in range green light glows (Passed) otherwise red light glows (Failed). Passed part is moved to other workstation by conveyer.

The main drawback of this type is maximum load is applied to horn housing assembly it may leads to changes in dimensions of housing and also difficult to insert screw during operation requires some other additions setups. Poor surface finish.

H. Design of fixture with spring:

Type-2 Proposed methodology of a machine has a fixture with spring in bottom side of fixture. When the part arrives to the workstation operator takes the horn part and places it in fixture. Before placing horn housing in fixture inserts screw in fixture. After that cycle-1 is carried. In cycle-1, operator press green button the double acting cylinder applies force on the horn housing assembly to hold it in rigid position cushion effect is achieved to part by placing spring in bottom side of fixture. So it is added advantage because we don't need extra setup to insert screw in horn housing assembly. As the threads starts fasten to horn housing assembly under load fixture moves

downwards. Then the tuning screw is inserted in the horn housing assembly as required amount of threads are pre-determined in by the PLC control system.

In cycle-2 the small size double acting cylinder applies considerable amount of load in the spool assembly to open contact between two spools. By opening spool assembly, we can easily check the diode voltage. The diode voltage is displayed in the indicator board which should be in the range of 28.2 to 32.5 volt. If it is in range green light glows (Passed) otherwise red light glows (Failed). Passed part is moved to other workstation by conveyer.

By using spring in bottom side fixture it is added advantage to the machine itself act as a cushion to part. Which is very effective and these can avoid the sudden stroke and damage of the part.

I. Selection of Solution:

Design of fixture with spring is most preferable because it is very simply setup and it doesn't need additional setups. And it is also more efficient then existing process and are easy to operate without fatigue to operator. Possible to damage of part is very less. Cost wise less.

VI. WORKING PROCEDURE

Insert tuning screw in the fixture and place the horn housing assembly arrives from spool holder riveting workstation. Press green button in machine to start cycle. Load is applied on the housing assembly to lock it immovable by double acting pneumatic cylinder. Cycle 1 starts tuning screw is inserted in to horn housing assembly by pneumatic air gun under pre-determined default threads denoted during programming. After reaching pre-determined threads pneumatic air gun stop. Then Cycle 2 starts, in this cycle small pneumatic cylinder is used to open spool assembly. By this opening we can check the diode voltage for that horn assembly. The diode voltage is displayed in measuring device. The diode voltage is within the range of standard level horn is passed to next workstation to continue production.

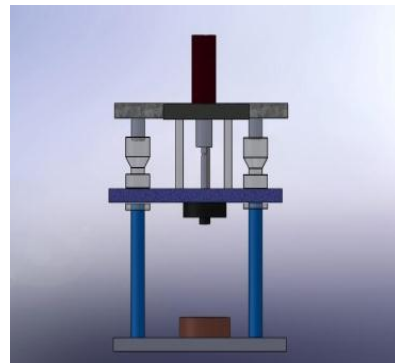


Fig-2 Diode Voltage Measurement and Tuning Screw Insertion

VII. RESULT AND DISCUSSION

New design proposed by us is more effective than the current production system in mini vibrosonic assembly line.

VIII. CONCLUSION

By implementing this, various time consuming activities in assembly line can be reduced. This not only improves horn production in assembly line and also human intervention is minimized. If the system is modified and used in assembly line of roots mini vibrosonic line, it will be easy and training time requires for operator is less.

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