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REVIEW ON PROCESS OPTIMISATION AND AUTOMATION OF CHEMLOCK OPERATION FOR RUBBER BUSHES

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Abstract — *Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens. The biggest benefit of automation is that it saves labour, save energy, materials and to improve quality, accuracy and precision. This paper consist of a brief overview of process optimisation practices in industries and implementation of automation. This research paper focused conceptual design of Chemlock machine for rubber bushes.*

Keywords- *Process Optimisation, Industrial Automation, Chemlock Operation, Process Layout, PLC*

I. INTRODUCTION

The overall goals of this research is to propose any staffing changes to optimise the process to increase the throughput. The result of this research will help the company to increase throughput by efficiently using the resources available in facility. In order to achieve a well-balanced processes it is important to eliminate factors that causes the losses and wastages. For the purpose of balancing time study of various stations is to be carried out. Method to do particular operations should be analysed. Minimisation of idle time the production system is also to be analysed for determining wastes and factors that create losses.

For reducing cycle time of respective product, an operation, namely chemlock, is to be automated which is getting done manually. Also automating that operation reduces time as well as waste of material in it. Proper achievement of target will be successfully done. In this operation an adhesive is sprayed on bushes for bonding of rubber with metal. Manual process needs much time and also there is wastage of adhesive.

II. LITERATURE REVIEW

1. Ghosh and Gagnon [1] discussed the results of a comprehensive review and analysis of the assembly line balancing literature. Quantitative developments and qualitative issues are addressed at both the strategic and tactical levels. The numerous quantitative and qualitative factors which the literature mentions could impact the design, balancing and scheduling of assembly systems are organized into an eight-level hierarchical, factor/decision taxonomy. This comprehensive taxonomy is used to assess our progress in assembly system design and operation.
2. Mamodiya and Sharma [2] focused on Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers , heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. The biggest benefit of automation is that it saves labor, save energy, materials and to improve quality, accuracy and precision. The wireless communication technologies are widely applied in the fields like Industrial Automation. Injection molding machines can fasten the molds in either a horizontal or vertical position. Wireless communication and smart sensors and actuators pose means to sustainably improve automation technology. To learn about Industrial Automation, a review process involving 2 stage approaches has been undertaken for 15 research papers which were published in the period of year 2000 to year 2013. After an exhaustive review process, four key issues were found “Controlling method of injection molding machine for new technologies, new trends in industrial Automation, Energy Storage in co-generation power plant & Wireless Data Transmission” which is mostly need to enhance of Industrial Automation aspects to get better solution approach. The outcome of the review was in the form of various findings, found under various key issues. The findings included algorithms and methodologies used to solve particular research problem, along with their strengths and weaknesses and the scope for the future work in the area.
3. Singh et al. [3] remarked Despite years of activity, truly open and intelligent control systems seem still to be a promise of the future. Agreement on common architectures and application objects is needed to raise open control systems from exchanging raw data to the level of real interoperability of off-the-shelf components. Future control platforms and programming languages should have new built-in mechanisms that support implementation of intelligent functions, such as flexible resource management and exception handling. This article argues that many of these challenges can be met by taking full advantage of emerging software engineering technologies. This also means that the modeling techniques and design practices of software engineering should be combined with the traditional ways of thinking in automation.

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4. Vincze et al. [4] explained that With the advance in technology sensors and processing power exist to achieve fully automated programming in industrial tasks. This paper reports on the EU-research Flex Paint, which devised a methodology to automatically generate robot programs for spray painting of unknown parts. The solution uses four steps: laser triangulation sensing, geometric feature detection, tool path planning, and the generation of the collision-free executable robot program. Demonstrations at industrial partners show the results.
5. Ismail et al. [5] explored the capabilities of genetic algorithms in handling optimization of the critical issues mentioned above for the purpose of manufacturing process planning in reconfigurable manufacturing activities. Two modified genetic algorithms are devised and employed to provide the best approximate process planning solution. Modifications included adapting genetic operators to the problem specific knowledge and implementing application specific heuristics to enhance the search efficiency

III. PROBLEM STATEMENT

Chemlock operation is used in manufacturing of automotive and industrial rubber moulded and rubber to metal bonded anti-vibration parts. The Number of bushes which are required to get packed per day are large in number, but target is not achieved, due to non-value added activities like buffing, manual flash removing and unbalanced production line. Also Bottle neck operation of manual adhesive application to raw material which needs to be automated to increase productivity and reduce manpower.

A. Objectives

- As Achieving Desired Output Rate with smallest number of workstation.
- Reduction bottle necks.
- Minimisation of imbalance between personnel while meeting required output.
- Reduction in production time.
- Reduction in wastage of material.
- Arranging stations in sequence for product to move from one station to next until completion at the end of line.

B. Methodology

Assembly line requires a set of compulsory procedures to be followed in order to achieve reliable results. First of all it is crucial to have complete list of operations of assembly lines because this data is basic reason for line to exist. As a next step it is important to evaluate the losses of existing line for determination of factors that causes this losses. Finally, after eliminating these factors, the assembly line is structured according to desired specifications.

IV. DESIGN

As per requirement, we decide the layout for Automation of Chemlock Operation. The sequence was decided based on objectives mentioned. After first visit to plant, we observed the operation in action. Then we started brain storming activity for obtaining various implementable solutions. First solution was to use Conveyor belt, but due to space constrain and availability of manufacturer and time, this solution was cancelled. This time we came with a solution consisting of use of Rotary Table. This solution was found feasible to requirements as well as other constrains.

A. Construction

It consist of six stations namely; Loading-Unloading station, Two Spraying Booths, Three Heating Elements like oven or Blowers.

Now next task was to decide the layout for operation. This required data and behavioral observations of Worker.

After this we came with a layout of six stations on a rotary table in which operator only has to do work was of loading unloading.

For carrying rubber bushes we designed a 55 cavity Bakelite fixture.

Following layout is consisting of following components:

- 0.5 HP motor: It is required for rotating the rotary table.
- 0.5 HP break motor : It is required for rotating the fixture shown (fig.2)
- Gear box: It is used as a reduction gear box.
- Chain sprocket: To rotate the fixture at spraying booth.
- Automatic spraying gun: It is used for application of primer as well as adhesive on the rotating fixture.
- Proximity sensor: They are used for sensing the position of fixture.
- Pneumatic valve: For pressure application for spraying gun.
- Rotary table: The rotary table of 1.5 m diameter having material MS can be used.
- Heater: 3 no's of Oven or blowers of capacity 1Kw for preheating, and drying in further processes. The temperature requirement is between 75-85°C.

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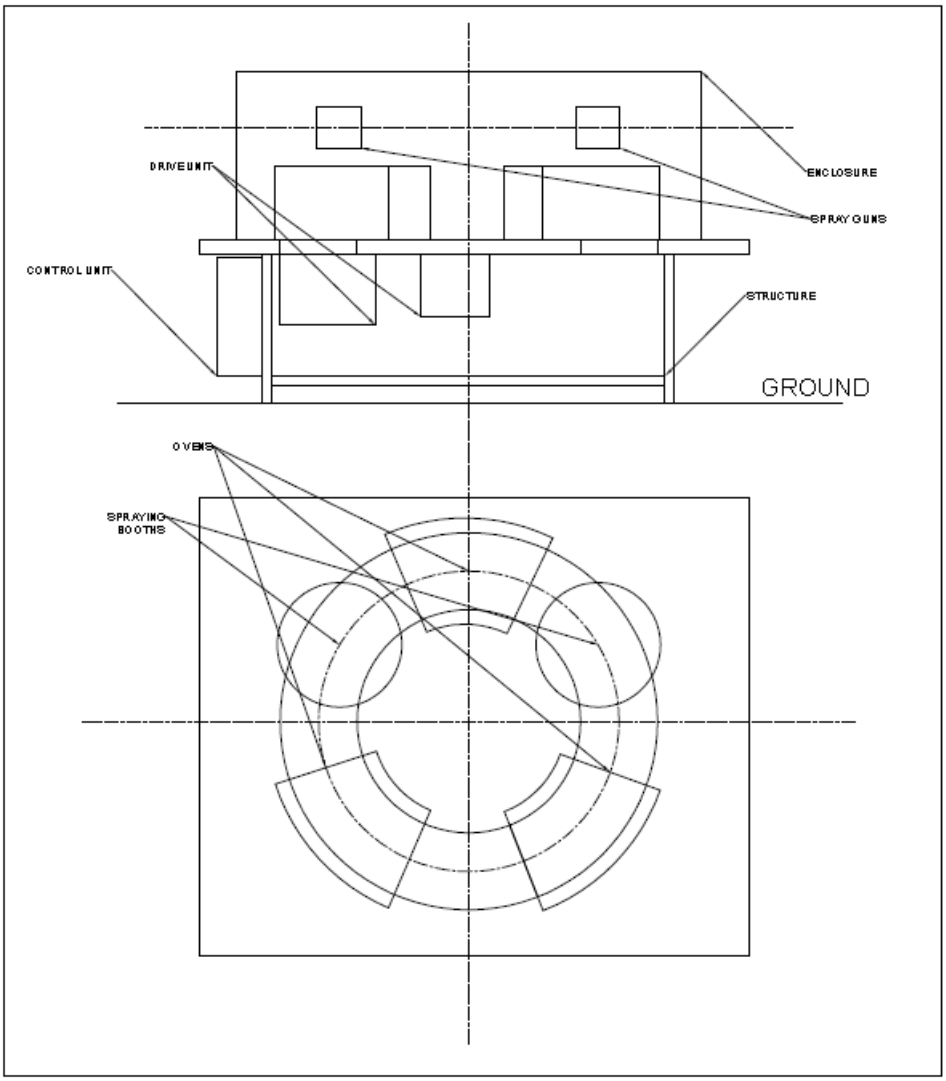

Fig.1 Chemlock Operation Layout

Fig.2 Fifty five Cavity Bakelite Fixture for Rubber bushes

B. Working

- The Bakelite fixture is fiiled with the 55 nos of parts i.e Rubber bushes.
- The fixture is to be loaded on machine in the preheater for heating.
- Then it is moved to the primer booth where application of primer takes place.

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- Then it is to be dried in the dryer.
- Next station is chemlock, where application of chemlock takes place.
- Unloading.

C. Advantages

- Reduction in Wastage of Adhesive in Chemlock Operation due to Automation.
- Reduction in Process Time of Chemlock Operation.
- Uniform application of chemical on the parts.
- Reduction in Cycle Time.
- Reduction in Man Power.
- Due to process optimisation, Productivity will get increased.

V.CONCLUSION AND FUTURE SCOPE

Process optimisation and Automation are most useful technic for conducting optimisation study on shop floor production layout. In today's technological production environment all organizations are striving to implement lean manufacturing on shop floor to achieve productivity enhancement to global benchmarks. Any trial and error approach may provide initial results but scope for improvement in future is also possible we can reduce cycle time and man power involved. This can also provide an opportunity on shop floor to better space utilization with better organized look. Automation for Chemlock operation is basically for a specific part, we can also develop a new system for different parts and according to respective parameters for same with existing setup.

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