Shop Floor Analysis of Slow Jet Process

[1]Shraddha Gaikwad, [2]Prathamesh Patil, [3]Gouri Gurav, [4]Jayesh Chopade, [5]Prof.N.I.Jjamadar

[1,2,3,4]B.E.Mechanical Engineering, [5]Professor
Dr. D.Y.Patil Institute of Technology
Pimpri, India

***Abstract*—Productivity improvement is an everlasting continuous activity in manufacturing. Continuous improvement is the need of the hours which can be achieved by incorporating flexibility in layout, design and processes. This project aimed to improving productivity of production system of manufacturing industry through shop floor analysis approach. The objective of the project work is to increase capacity/productivity of slow jet drilling machine. Present productivity of machine is about 80% and rest 20% includes machine stoppage, human losses time losses etc. It is proposed to achieve above 95% productivity of slow jet drilling machine by optimizing the mentioned losses effectively.**

Key words-Productivity, Capacity

I. INTRODUCTION (HEADING 1)

In this project, we are going to increase productivity of slow jet part of carburetor. The time required for the drilling of parts slow jet more including all losses and can be reduce considerably to increase the productivity. We are planning to reduce the losses by usingJapanese productivity improvement techniqueswhich will be ensuring faster operations. Also time required for bowl feeder to feed the jobs into escapement unit is higher as conventional bowl feeder is used. So there is chance of improvement which can be overcome by replacing it with new bowl feeder which is vibratory bowl feeder. We are also looking for changes in time line study as losses are during inspection and some component of slow jet drilling machines. Hence overall objective of project is to reduce the lead time by analyzing the processes and finding the area of improvement followed by the implementation.

II. PROBLEM FORMULATION

Slow jet is the main part of carburetor which meters the flow of fuel to the combustion chamber. The working of the carburetor depends on slow jet. Now a day due to increase in consumers demand of vehicle and increase in its productivity. To increase productivity there are many problems faced by the industry. Problems faced by industry are such as Bowl Feeder, Machine start up time, Sensor related problems.
Project aim is to increase the productivity on special purpose drilling machine of slow jet by overcoming the losses faced by the industry in current condition.

III. OBJECTIVES

Objectives are as follows:
1) To enhance the Capacity of production
2) To overcome the Losses due to Bowl Feeder, Sensor, Inspection,
3) To optimize cycle time.

IV. POSSIBLE OUTCOMES

1) Increase in productivity
2) Increase in Capacity
3) Maximum time utilization

V. LITERATURE REVIEW

S.R.Gawande, S.P.Trikal.This paper discusses the study of design of multi spindle drilling machine. In case of mass production where variety of jobs is less and quantity to be produced is large, it is very essential to produce the job at a faster rate.

Manish Kale, Prof. D. A. Mahajan, Prof. (Dr.) S. Y. Gajjal. This paper show the way of development of SPM for drilling and riveting operation. The concept of SPM is that the plate having different size and thickness are drill on drilling spindle first and then riveted on orbital riveting spindle.

Force Analysis of a Vibratory Bowl Feeder for Automatic Assembly Richard Silversides, Jian S Dai and LakmalSeneviratne.This paper investigates the vibratory bowl feeder for automatic assembly, presents a geometric model of the feeder, and develops force analysis, leading to dynamical modeling of the vibratory feeder. Based on the leaf-spring modeling of the three legs of the symmetrically arranged bowl of the feeder, and equating the vibratory feeder to a three-legged parallel mechanism, the paper reveals the geometric property of the feeder.

Gary P. Maul.M. Brian Thomas. This paper of a systems model and simulation of the vibratory bowl feeder gives information about Vibratory bowl feeders are the most versatile and widely used parts feeders in automated assembly. This work develops a mathematical model of a bowl feeder by using state-space methods to evaluate bowl feeder parameters.
Inventor Nicolas A. and Rodgers give a movable article carries a circuit including a normally OFF reed switch. In the ON state of the switch, the circuit is adapted to emit an audible or a visible signal.

Albert SnidermanThis paper gives the idea about the automatic vacuum grippercomprises a gripper member with a resilient seal coupled to a hollow piston andshaft. The piston is spring loaded downward in a cylinder coupled to a vacuumsource.

Inventor Prathamesh P. Kulkarni, Sagar S. Kshire, Kailas V. Chandratregives information about productivity improvement. The objective of this paper is topresent an overview on a new combined methodology for the efficient improvementin productivity with the help of various Work Study Methods associated with LeanManufacturing Principles & Tools.

VI. ANALYTICAL WORK

Productivity

Productivity describes various measures of the efficiency of production. A productivity measure is expressed as the ratio of output to inputs used in a production process, i.e. output per unit of input. Productivity is a crucial factor in production performance of firms and nations. Increasing national productivity can raise living standards because more real income improves people's ability to purchase goods and services, enjoy leisure, improve housing and education and contribute to social and environmental programs. Productivity growth also helps businesses to be more profitable.

a) Machine Productivity

Production system converts raw material into finished product through mechanical or chemical process with the help of machines and equipment. Machine productivity depends upon availability of raw material, power, skill of workers, machine layout.

Japanese Productivity Improvement Techniques

a) KAIZEN Techniques
b) Poka yoke technique
c) 5S Technology.

CALCULATED DATA

a) Current productivity
b) Potential productivity

Cycle time study

Cycle time analysis is a technique that examines the total length of time an activity needs to complete its cycle. It is measured by the amount of time that an input to a business activity requires to be transformed to an output. Where a process consists of multiple activities, the cycle time for any given activity is the time between previous activity completion and current activity completion including any time between the completion of one activity and the start of the next activity.

Purpose The purpose of cycle time analysis (CTA) is to identify opportunities for breakthrough and the achievement of continuous process improvement in value streams, using time as a core measure.

Benefits:The benefits of cycle time analysis are that it provides a structured method for identifying non-value adding activities in an activity work flow. It provides for the identification of current time-to-completion measures for an activity work flow, enabling a comparison of current to theoretical or desired measures.

Time Line Study

A timeline is a way of displaying a list of events in chronological order. It is typically a graphic design showing a long bar labelled with dates alongside itself and usually events. Timelines can use any time scale, depending on the subject and data. Most timelines use a linear scale, where a unit of distance is equal to a set amount of time. This time scale is dependent on the events in the timeline.

a) Ideal cycle time
b) Actual cycle time

Loss Time When a manufacturing process stops for an unplanned event (e.g., a motor failure) it accumulates loss time. While loss time is most often associated with equipment failures (breakdowns), it actually encompasses any unplanned event that causes your manufacturing process to stop.

a) Setup and adjustments
b) Reduced speed
c) Process defects
d) Natural fatigue

VII. **Experimental Validation**

Found out the problem details, distribution of these problems in terms of the percentages and reason for the particular problem.
Bowl Feeder Problem
Oily Jobs
Machine Start up time
Slide related problem
Gripper related problem
Sensor Related problem
Machine cleaning time
Job Fall Down

Bowl Feeder

Vibratory bowl feeders (VBFs) are widely used in industry for feeding and reorienting small parts in high volume production. Standard VBF tooling consists of various mechanical barriers inserted in the bowl path which are prone to jamming and limit the feeder to only one type of part.

Conventional Bowl feeder

They are configurable for many different components but they required huge setup time. They have severe limitation even where families of parts similar in size and shape but variable in weight are handling the system. Their unpredictability occurs largely due to vibrating nature of machine. This is considered as serious problem as it invariably affects overall performance.

Specification of old bowl feeder
Vendor ABC Automation Model 160
Capacity- 1000 jobs
Weight- 1 kg
Material – S.S fabricated
Only one type of job

Modern Bowl feeder

Modern manufacturing process that utilize VBF technology require reliable production feeders to reduce down time therefore cost but ideally feeder that can be easily reconfigured for future production run. A flexible VBF might adopt readily to change in parts production mix and label of outputs, providing multiple components in one bowl feeder.

Specification of new bowl feeder
Vendor ABC Automation Model 160
Capacity- 600 jobs
Weight- 0.75kg
Material – S.S coated with Teflon casting
Can handle different types of jobs.

Oily Jobs
Jobs coming for drilling operation were sensed by the color detector sensor. Due to whirling of jobs in bowl feeder, shining of jobs gets diminished due to which sensor is unable to detect jobs. Workers Detects that jobs as oily jobs and put red tag.

Gripper

Mechanical gripper Mechanical grippers are automation devices used in the productivity improvement technique. Robot mechanical grippers and its actuating mechanisms can be classified into several methods. The first method is based on the type of finger movement. During this arrangement, the opening and closing of the fingers can be actuated by either pivoting, or linear or translational movement.

Limitations:
- It can detect only metallic objects
- Operating range is limited
- Large size

Vacuum gripper Vacuum grippers are used in special purpose machine for grasping non-ferrous object. It uses the vacuum cup as gripping device. This type of grippers good handling if the objects are smooth, flat and clean. It has only one surface for gripping object.

Advantages
1. Broad model range for handling dense or porous products.

2. Suitable for short cycle time.
3. Simple installation and operation.
4. Contamination proof design ensures high level of availability and process safety.

Proximity switch
It is sensor able to detect the presence of nearby object without any physical contact. Inductive type of proximity switches use in special purpose machine. The sensing range of an inductive switch is dependent on the type of metal being detected. Sensor consist of an induction loop. Electric current generates a magnetic field, which collapses generating a current that falls toward zero from its initial trans when the input electricity ceases.

Disadvantages:
1. Accuracy is less**.**
2. Operating range is limited.
3. Large in size

Reed Switch
The reed switch contains a pair (or more) of magnetisable, flexible, metal reeds whose end portions are separated by a small gap when the switch is open. The reeds are hermetically sealed in opposite ends of a tubular glass envelope.

Advantages
1. Low operating power
2. Precise Magnetic Sensitivity Switch points
3. Compact in size
4. Simple in construction
5. Flexibility is better than proximity switch

Flow control valve
A flow control valve regulates the flow or pressure of a fluid. Control valves normally respond to signals generated by independent devices such as flow meters or temperature gauges.

Disadvantages:
1. Flow control adjustment varies from man to man.
2. Variation in speed of drill arm.
3. Failure of tool.
4. Machine stoppage.

Quick Return
The quick exhaust valve is used to exhaust of cylinder quickly to atmosphere. In many applications like single acting cylinder it is common practice to increase the speed of piston during retraction of cylinder to save the cycle time. The higher the speed of piston is possible by reducing the resistance to flow of the exhausting air during motion of cylinder. The resistance can be reduce by expelling exhausting air to atmosphere quickly by using quick exhaust valve.

By removing the flow control valve there is no restriction on return on drilling arm after drilling operation. Due to which there is no need to control on flow through valve.

CONCLUDING REMARKS

Productivity growth is a clearly fundamental measure of economic health and all of themajor measure of aggregate labour and the total factor productivity has shownimprovement.

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