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Washer Feeder for Engine Assembly Line

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Abstract: *Using a feeder-retriever mechanism consisting of a recess, funnel and guiding channels the production line comprised of a series of workstations can be automated. The goal of fixing washers over the cylinder head of various automobile vehicles can be achieved in a cost effective way thereby saving time of production line and increasing rate of production*

Keywords: Automation, Feeder-Retriever mechanism, Rate of Production

I. INTRODUCTION

An automated production line is comprised of a series of workstations linked by a transfer System and an electrical control system. Each station performs a specific operation and the product is processed step by step as it moves along the line in a pre-defined production sequence. The fixing of various parts of the engine as also insertion of nuts and bolts is done manually by the operators (line engineers) with the help of assistive tools and fixtures, conveyer belts etc. Our Job is to reduce effort of operator while fixing the washer on the engine head and to automate the process as much as possible in a cost effective way. Using a feeder retriever mechanism consisting of a recess, funnel and guiding channels this goal can be achieved in a cost effective way thereby saving time of production line and increasing rate of production. The Background and the Problem Whenever humans are involved in performing repetitive tasks countless number of times within a given time span errors happening due to fatigue are a high probability. On surveying and observing the assembly of a renowned 2 wheeler manufacturer from India we observed that the station where operator manually handed picked 4 washers from a storage box and placed them at 4 locations before the engine cover was bolted had a higher chance of delays due to the following factors 1. Operator at times ended up taking 3 or 5 or an inaccurate number of washers in his hand which forced him to either end up taking extra washers needed so as to reach the precise count of 4 or he ended up putting the extra number of washers back into the storage bin. 2.In all this process operator at times ended up dropping washers around the storage bin which violates with the step of 5S methodology. 3.Operator at times was bound to get distracted due to small teething issues mentioned above which resulted in a slight delay in locking the 4 washers in the needed places.

1.1 Need of Automation

Each of the operations on the assembly lines is usually simple involving perhaps a plain, linear or rotational motion. Around 20 to 30 operators are required a various stations at the assembly line and low cost automation to reduce effort of operator as also save time is given utmost importance by the design engineers. Our Job is to reduce effort of operator while fixing the washer on the engine head and to automate the process as much as possible in a cost effective way. Kaizen in Production Kaizen states continuous small improvements in any process or rather production process compounds and leads to bigger gains over a period of time. By trying to automate the process of washer feeding and retrieval of the same we aim to reduce time for a part of the cycle which when compounded for 2 -3 shifts of production during the entire day will result in a considerable amount of time being saved. For example lets consider a random 2 wheeler company XYZ running a production process involving feeding and retrieval of washers where each cycle of washer retrieval is taking 2.5 seconds and there are 500 such cycles performed in a day. If the automatic washer feeder and retriever helps to reduce the time of each cycle by a mere half a second, we are looking at a collective gain of 250 seconds during the entire span of the day which on an average is enough time for a high speed production line to assemble the engine of a bike completely or at least partially.

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II. OBJECTIVES

1. To build a system of Automatic washer-feeder mechanism for the vehicle assembly line of 2 wheelers.
2. To replace the current system, of manually inserting washer on engine which is a time consuming process.
3. To reduce time and effort of operator working on the assembly line
4. To increase rate of engines assembled per day so as to increase output and reduce cost of operation by saving time.

III. WORKING PRINCIPLE

Firstly we need to fill all the Cylinders with set of washers when we need washer then we press one button. After that First cylinder pushes washer through cylindrical Pipe. Washer get pushed towards direction of washer path with help of compressed air after that 2nd pneumatic cylinder get started and that cylinder pushes washer upwards. We will get single washer through dispenser on our working Height. These are the following components.

1. Cylindrical pipe
2. Front round plate
3. Bottom round plate
4. Path for washer
5. Pneumatic cylinder

3.1 Theory

Automated assembly line is a manufacturing process that assembles products station by station automatically. Each station adds components to the subassembly and transfers the sub-assembly to the next station through conveyors or motorized vehicles. Each robot or machine performs specific task at each station. Automated assembly lines are mostly used at automobile industries. There are varies types of automated assembly lines, for example: continuous transfer system, synchronous transfer system, etc. The current assembly line is batch assembly lines and we want to replace them with robotic assembly lines. In a normal assembly line, because of repetitive work, workers may have physical or mental fatigue that requires breaks during a day. While the robots can work continuously without breaking. 2. Flexible automation Automation is the use of various control systems for operating equipment such as Machines, equipment with minimal or reduced human intervention. When we say automation, we mainly mean production automation. There are different types of production automation: fixed (hard) automation and flexible (soft) automation. Fixed (Hard) automation is automation application customized to a single product or a specific task. While flexible (soft) automation is the ability for a robot or system to manufacture different products or different tasks. Flexible automation allows rapid re configurability of the production system in order to manufacture several different products, achieving high degree of machine utilization, reduction of in process inventory, as well as decrease in response times to meet the changing customer preferences [2]. It is typically composed of 6-axis robots to perform actions, sensors to inspect and detect, PLCs to provide the logics. Because it is flexible so the robot equips different grippers, sensors have a wide range and the PLCs should be applicable to different product operations. Flexible automation can evolve with your process and demand, reduce and fix production costs, improve quality and eliminate health and safety issues. When changing form one product to another one, all we need is just a change in the command to the PLC and change the components in the flex feeders

Line balancing Assembly line balancing studies how to assign production tasks to the different stations of an assembly line while optimizing different objectives like the number of stations, the cycle time or the cost of the line [3].Based on the order of project tasks, line balancing aims to divide or combine the different tasks to make all the work station have uniform load. So, the production equipment will be full use and the idle time will be reduced as much as possible. The line efficiency will increase at the same time. Line balancing is an important method in production process design. By line balancing, the efficiency of operator and equipment both increase; the cost and man-hour per piece both decrease.

3.2 Advantages of the Mechanism

1. Higher rate of production.
2. Reduces Time of assembly.
3. Flexible to handle.
4. Reduces work of operator.

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5. Standard size of washer ensures better adaptability

IV. CONCLUSION

Based on standard inputs from a company having a 2 wheeler engine assembly line the duration required to put together a 150CC engine was 240 seconds i.e. 4 minutes. Considering a 7 hour shift roughly 105 engines are made per shift. The operator at the washer placement station has a time span of 3 seconds at the moment to pick the washers from the storage bin and place them on the 4 locations. Automating this process would be able to save an additional 0.5 seconds. 0.5 seconds saved per cycle X 105 cycles saves a total time of 52.5 seconds in one entire shift. Considering the same company runs 3 shifts for the engine assemblies the additional time saved would be 157.5 seconds. This would almost be equal to half the cycle time required to assemble an entire 150CC engine. Additionally the company is also saving electricity consumed if the per engine cycle time reduces which is successful Kaizen.

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