

Productivity Enhancement with Adoption of Advanced Automation Techniques: A case of Automobile Industry

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ABSTRACT

Today the industries are rapidly progressing because of new innovation and advanced technologies. The automation strategies allow the industries to adapt to the rapid changes in the markets demand, shortened product life cycles and offer high-quality products at competitive prices. Customers now want variety of products. Automation in the industry workplace provides the benefits of improving productivity and quality, while reducing waste, increasing safety and adding flexibility to the manufacturing process. So in this research paper a case of automobile industry is presented where productivity increase is shown by reducing cycle time by implementation of belt conveyor in assembly line.

Keywords: Productivity, cycle time, belt conveyor system, automation.

1. INTRODUCTION

2. Automated manufacturing systems operate in the factory on the physical product. They perform many operations like processing, assembly, inspection and material handling. They are called automated because they perform their operations with minimum human participation compared with the corresponding manual process [1]. In some highly automated system, there is virtually no human participation. Examples of automated manufacturing systems include [2]:

- Automated machine tools that process parts
- Transfer lines that perform a series of machining operations
- Automated assembly systems
- Manufacturing systems that use industrial robots to perform many operations and functions.
- Automatic material handling and storage systems to integrate manufacturing operations
- Automatic inspections systems for quality control.

So, in this research paper, after a thorough study of the various processes of automation systems, a belt conveyor system is implemented in the assembly line of an automobile industry for reducing cycle time and increasing productivity with minimal changes in the cost of product. By implementation of belt conveyor system product quality has also been improved. The organization of the rest of the paper proceeds with literature review in section 2, followed by methodology in section 3. The costs of implementation and the cycle times are also calculated in this section. Results and discussions are presented in section 4 followed by conclusions in section 5.

2. LITERATURE REVIEW

- **Thomas Robins** began a series of inventions which led to the development of a conveyor belt used for carrying coal, ores and other products. In 1901, **Sandvik** invented and started the production of steel conveyor belts. In 1905 **Richard Sutcliffe** invented the first conveyor belts for use in coal mines which revolutionized the mining industry. In 1913, **Henry Ford** introduced conveyor-belt assembly lines at Ford Motor Company's Highland Park, Michigan factory. In 1972, the French society REI created in New Caledonia the longest straight-belt conveyor in the world, at a length of 13.8 km.
- He discussed about the different types of conveyor belts that have been created for conveying different kinds of material available in PVC and rubber materials. Material flowing over the belt may be weighed in transit using a belt conveyor. Belts with regularly spaced partitions, known as elevator belts, are used for transporting loose materials up steep inclines. Belt Conveyors are mainly used in self-unloading bulk freighters and in live bottom trucks. Belt conveyor technology is used in conveyor transport such as moving

sidewalks or escalators, as well as on many manufacturing assembly lines.

3. METHODOLOGY

A conveyor is a mechanical system for moving items or bulk materials, usually inside a facility. Conveyors are used when material must be moved in relatively large quantities between specific locations over a fixed path, which may be in the floor, above the floor, or over head. Conveyors are either powered or non powered. In powered conveyors system, the power mechanism system is contained in the fixed path, using chains, belts, rotating rolls, or other devices to propel loads along the path. Powered conveyors are commonly used in automated material transport systems in manufacturing plants, warehouses, and distribution centers. In non powered conveyors system, materials are moved either manually by human workers who push the loads along the fixed path or by gravity from one elevation to lower elevation

So in this research, after the study of various types of conveyor systems a belt powered conveyor system is implemented in the assembly line for moving parts from one work station to another. By implementing this type of conveyor system the desired aim of productivity improvement is achieved. The aim was to increase productivity by reducing cycle time of product with small investment.

Further, a brief discussion of the belt conveyor system is presented. Belt conveyors consist of a continuous loop. Half length of belt is used for delivering materials, and the other half is the return run. The belt is made of reinforced elastomers (rubber), so that it possesses high flexibility but low. Flexible belt, which is supported by a frame that has rollers or support sliders along its forward loop. Belt conveyors are having in two common forms: (1) Flat belts for pallets, individual parts, or even certain types of bulk materials; and (2) troughed belts for bulk materials. Materials placed on the belt surface travelled along the moving path way. In the case of troughed belt conveyor systems, the rollers and the supports give flexible belt a V shape on the forward (delivery) loop to contain bulk materials such as coal, gravel, grain, or similar particulate materials.



Figure 1: The assembly line of the industry

3.1 Main elements of conveyor system

- BELT
- PULLEYS
- DRIVE UNIT
- SUPPORTING STRUCTURE

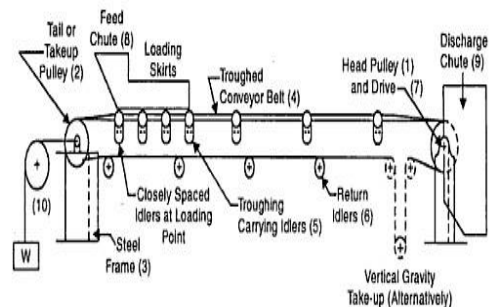


Figure 2: Belt conveyor system implemented in the industry

The conveyor system implemented in this research work is as shown in figure 2 above. The part is moving from one work station to another work station according to speed given to conveyor and after the complete cycle, assembled part fall in discharge chute by the help of gravity. So this process is repeated again and again. A belt conveyor system is installed in an assembly line and after that the production data before and after implementation of conveyor system is compared. The data was captured from one assembly line. By the implementation of conveyor system our aim was completed and benefits of this are as follows:-

- Quality of product is improved.
- High reliability of operation
- Can transport the material in any direction.
- Silent continuous transfer the part from one station to other.

- Require less manpower

3.2 Data from industry:

Calculation of the cycle time, productivity, and cost analysis:

Company Name: SANDHAR AUTOMOTIVES GURGAON

Company's Product name: Switch assembly combination and Fuel filler Cap for two wheelers.

Company turnover: 200 crore.

Before installation of conveyor

- **Cycle time** = 23.5 sec
- **Part/hour@100%efficiency** = 153

After installation of conveyor

- **Cycle time** = 20 sec.
- **Part/hour@100%efficiency** = 180

Hence productivity is increased by 18% by reducing cycle time of part and by small investment.

Cost analysis:

Conveyor cost = 150000/-

Labor cost = 15000/-

ROI (Return of investment = 10 months)

4. RESULTS AND DISCUSSION

The implementation of conveyor system results in:

- Productivity increases by reducing cycle time with small investment.
- It is one of the cheapest ways to move material long distances.
- There is virtually no degradation of product caused by conveying.
- Belt conveyors can have metal separators designed in. So quality of product is improved.

Although with so many advantages, some disadvantages of conveyor system has also been observed:

- If the material is sticky, belt conveying can be difficult and generally not very successful.
- There is almost always material carry over from the belt discharge and this becomes a house keeping problem.

5. CONCLUSION

Industrial conveyors are designed to withstand large workloads, extreme weather conditions as well as moving in different directions and at odd angles.

If it were not for conveyors, materials would have to be fed manually which involves hiring labor and

creates its own set of human resource challenges. Human labor is a loss efficient and not very cost effective in the long run. In this research a saving in the cycle time and hence enhancement in the productivity of the assembly line of an automobile industry is shown with the installation of an automatic conveyor system.

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