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Design and Implementation of Kitting Trolley for Just In Time Production in Textile Industry

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Abstract - *We see that in order to increase market share and sustain in industry, most of the companies continuously apply world-class manufacturing techniques like Lean Manufacturing, Just-in-Time(JIT), Kaizen, Six Sigma etc. Based on observation at a assembly line of a textile machinery manufacturer in Rieter India Pvt. Ltd., Wing, Maharashtra, India, it was found that the existing material storage system used initially was bulk storage called as wire mesh and rack trolley. Also, the material handling activities were run without referring to any standard or procedure. Therefore the aim was to design a new storage system considering Just In Time delivery of textile machinery parts from sheet metal department to the assembly line by using computer aided design software, CATIA V5R21.This method was found more useful in order to achieve good class assembly line status and helped to support production process.*

Key Words: **Just In Time, Kitting Trolley, CATIA V5, Textile, Material Handling.**

1. INTRODUCTION

In the industry, kitting is practiced as a method of materials feeding among others such as continuous supply, batching and sequencing. A Kitting Trolley is a storage trolley with metal shelves, equipped with rollers or wheels to move goods from the one end to another by using the force of gravity concept. At first the kitting trolley was designed to be inclined along the length of the rack and was introduced in the assembly line as a temporary storage in order to place the components or parts as close as possible to make it easy for the operator to pick up parts or components for the assembly processes.

In Production System, Kitting Trolley plays an important role in order to support the effectiveness of one of Production System principles which is Just-in-time (JIT) system so in order to make the flow from sheet metal department to assembly department it was more necessary to design a very new kitting trolley that would carry a whole list of components to assemble more amount of textile machineries in a single go.

This system helps to reduces the travelling period of the components between the sheet metal department and the assembly line, as more amount of components can be shifted in a single kitting trolley that would help to assemble multiple textile machineries.

1.1 Evolution of Just In Time

Toyota manufacturing plans were the first to create and prefer the just in time concept which focussed major at lowering down the flow times within production system as well as response times from suppliers and to customers.

In present years the concept of Just In Time process is implemented widely as it is easy to adjust the workforce in response to supply and demand conditions.

2. METHADOLOGY

This methodology is based on the PDCA cycle which means Plan, Do, Check and Action. In this project we started with understanding the existing storage system through a series of line observation, informal interviews with the workers in production line and assembly line and data collection at the study area. The next stage was to analyze the existing performance by analyzing the data collected. Then, plan for improvement was executed based on the calculation of demand, number of frequency and components of replenishment. The Kitting Trolley system for textile components in textile assembly line were designed by using CAD software i.e CATIA V5R21.

The production system at this company was practicing conventional Material Handling system with bulk of materials supplied to the line without any standard procedure or system to refer. Materials loading and unloading was carried out by material handlers according to the production order. For large components, wire-meshes were used as storage equipment in the assembly line. The wire-meshes were supplied by using pallet trucks. The material handler had to walk from welding section area and then hand carry the large cabinet doors, sheet metal parts etc. and other textile components piled one above the another, more than 5 at a time, periodically into the further line, where it gets powder coated and then to the assembly. While small components, were supplied in large quantity and then stored in one trolley, placed close to the assembly line so that the operators can load the components into small boxes by themselves whenever they need it. For the quantity of finished goods boxes, they were supplied according to the size of pallet where there were two pallets permanently located near the line for temporarily storing the finished goods boxes. The boxes then transferred to the outgoing area by the material handler. These conditions caused the

assembly area congested with large size of poly-boxes, pallets and wire-meshes which required extra space and using same operators movements as well.

2.1 Work Measurement - Time Study

Following time study shows the time required to move material from welding section to powder coating and then to storage area. The current trolleys carry B class and C class components separately, which occupied larger area in storage space and also was time consuming in transporting from one station to another. There is more manpower requirement and this consumes lot of time. The approximate time study before introducing kitting trolleys,

Table -1: Total cycle time before implementation of JIT

Workstation	Total cycle time (in minutes)					
	Kitting time	Transportation time	Halt time	Minimum time	Maximum time	Total time
Welding	35	10	30	75	80	80
Powder Coating	45	10	40	95	100	100

As observed in the line, for welding station , actual Cycle Time is of 80 min. The operator used 12.5% for walking (transportation time) and 43.75% for kitting i.e placing the components in the trolley from the Cycle Time . While for powder coating station , actual Cycle Time is of 100 minutes. The walking (transportation time) covered 10% from the total time with 45% is for the kitting time. Machine times for both workstations did not included in the actual Cycle Time due to no idle hand by the operators when operating the machines.

As per initial situation in the company, current trolleys carry B class and C class components separately which occupies larger area in storage space and also is time consuming in transporting from one station to another. It is necessary to introduce a kitting trolley that would carry B and C class components together in 3X times more that the current existing ones, so that it would help assemble three electrical cabinets, three foot stock and three main spindle drives at once that would help achieve high assembly rate.

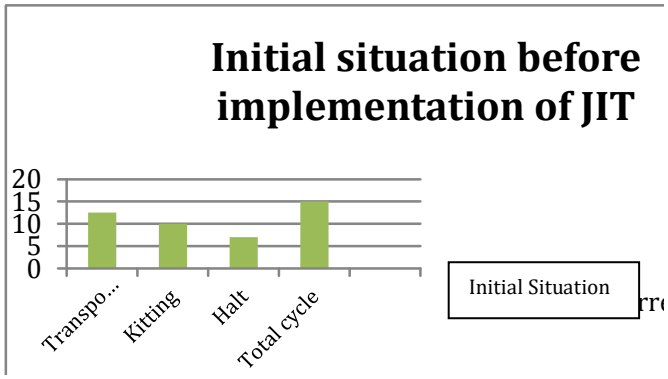

Chart -1: Initial situation before implementation of JIT

3. DESIGNING OF A NEW STORAGE SYSTEM

The bulk size of the existing trolley required a large space in the assembly area. During replenishment by material handler, short stoppages were frequently occurred as the operator was asked to help the material handler to rearrange the trolley at the line. Since the trolley was bulk in size, the operator required to take the part at a certain position. In this situation, the operator has higher chances to get back pain due to non-ergonomic design of the trolley and also the amount of time required for drawing the components from sheet metal to assembly line departments was not easy and difficult. Once the inventory runs out, the material handler had to walk further to the store room to replenish the inventory of the trolley. Due to this, the walking distance of the material handler had increased which in turn delayed the delivery time from sheet metal department to assembly line.

Before starting to design the new storage system, we thought of setting a target, and considered the following guidelines for designing the Kitting Trolleys. They are as follows-

- Reducing walking distance between the two departments by placing the parts and components nearest to the point of use of the operators so that they can use both hands at the same time.
- Reducing Labour cost and the amount of Labours.
- Designing the trolley that could carry 3X times the components with respect to initial condition and can be placed at the same time.
- Heavy weight textile components to be placed at the bottom of the trolley so that in order to achieve a good amount of centre of gravity.
- In order to avoid wrong parts being supplied to operators, the address system at the feeding in and feeding out section must be written properly and accurately where the material handlers can easily notice the components.
- Distribution of sections for ease of removal and inserting of textile components.
- The process of storage will be with a suitable degree of inclination.

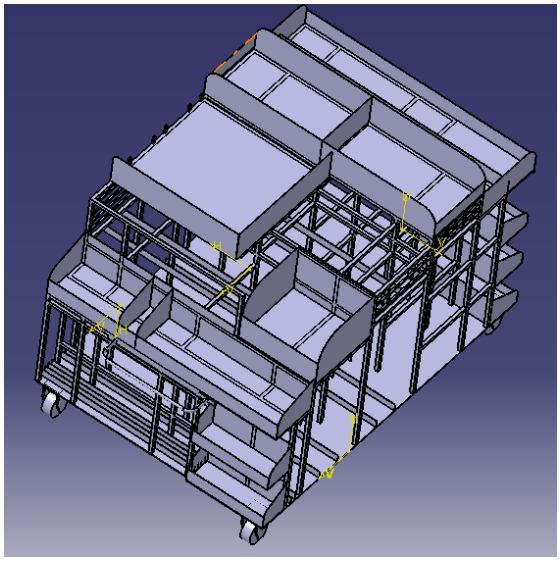

Fig -1: Kitting Trolley for carrying B and C Class components that can assemble Electrical Cabinet of Textile Machinery.

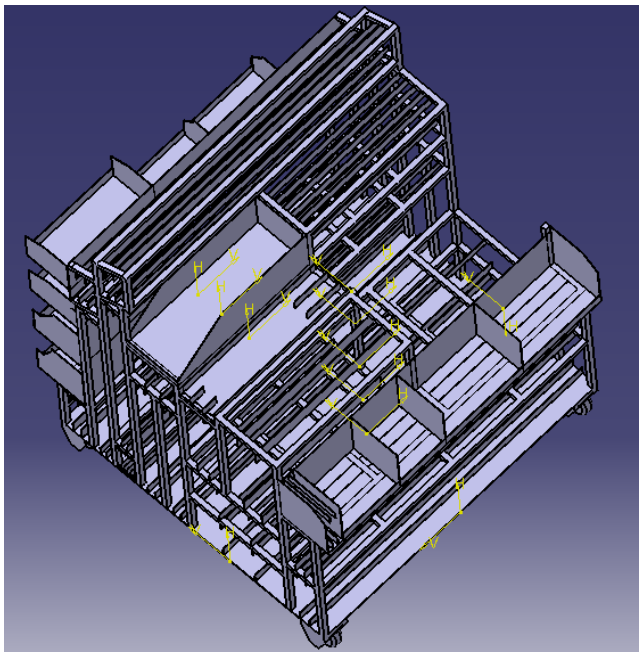

Fig -2: Kitting Trolley for carrying B and C Class components that can assemble Main Spindle Drive of Textile Machinery.

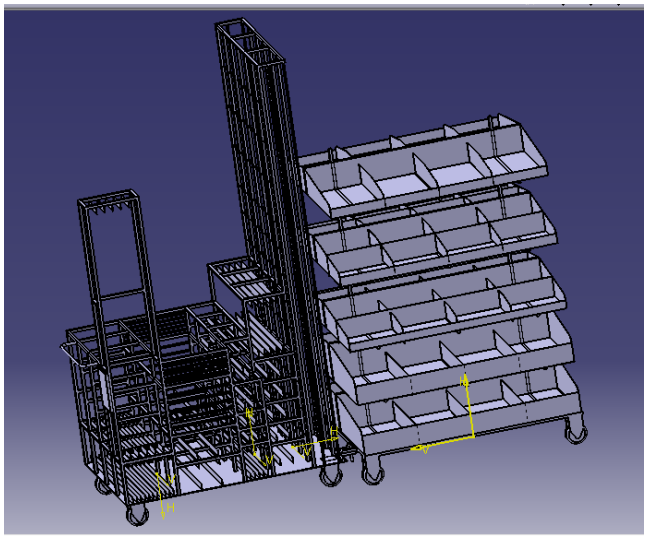

Fig -3: Kitting Trolley for carrying B and C Class components that can assemble Foot Stock of Textile Machinery.

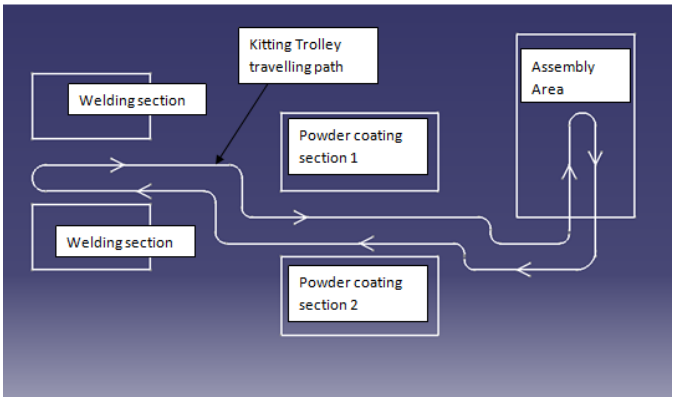

Fig -4: Actual travelling layout used in the plant for Kitting Trolley for carrying B and C Class components.

4. DISCUSSIONS AND RESULTS

Through approximate time study, new improved CT for both workstations are calculated and summarized as in table below.

Table -2: Total cycle time after implementation of JIT

Workstation	Total cycle time (in minutes)					
	Kitting time	Transportation time	Halt time	Minimum time	Maximum time	Total time
Welding	15	4	10	30	40	40
Powder Coating	18	4	10	35	45	45

It is observed that the actual Cycle Time of workstation 1 (welding section) is now 40 minutes with 50% reduction and 45% for workstation 2 (Powder coating section). This is as a result of the reduction of transportation by 2.5% and

6.25% in kitting for welding station and the reduction of transportation by 1.2% and 5% in kitting for powder coating station As a result , daily productivity increases per shift. With daily planning, the assembly line will be capable to fulfill their daily production demands and at the same time reducing operators overtime. While the shop floor area will reduce.

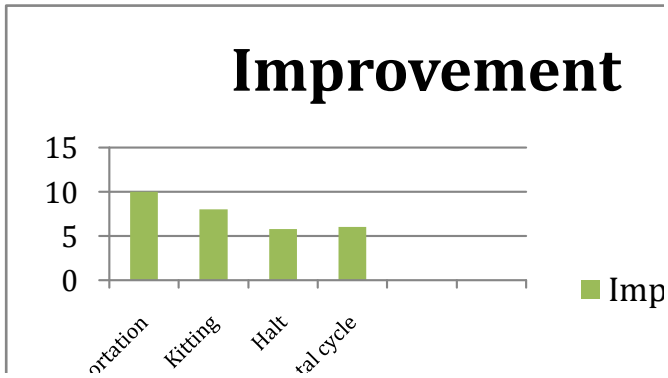

Chart -2: Improvement in the process after implementation of JIT

It is necessary to maximize productivity without sacrificing quality and reduction of walking distance by placing the parts and components nearest to the point of use of the operators so that they can use both hands at the same time. This is achieved by designing a kitting trolley that carries three times the components than the current trolleys. Thus, this improvement will help reduce the amount of manpower further reducing the cost of material handling .

The chart below shows that the improvement and designing of new kitting trolleys help reduce the amount of manpower.

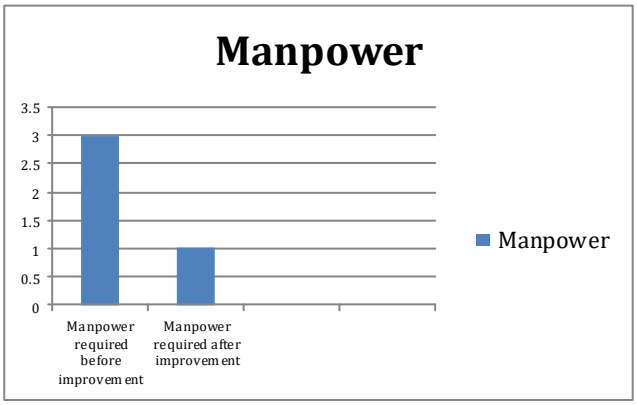

Chart -3: Improvement in the amount of Manpower after implementation of JIT

4. CONCLUSIONS AND RECOMMENDATIONS

This paper is based on how the implementation of newly designed kitting trolleys helped the company to achieve lean manufacturing ,less time travel between sheet metal department and assembly line which in turn also helped to reduce the manpower and the labour cost and this turned out to be beneficial for the Textile Machinery manufacturer Industry like Rieter India Pvt. Ltd. The result shows an improvement in the assembly line in terms of reduction in cycle time, kitting time, halt time, transportation time as well as space utilization. The implementation of the new storage system will offer advantages to the production line by eliminating waste of unnecessary motion, reduce man power and also waiting time when replenishing the product. By introducing this system in the production line, the material handling activities can be improved. Good storage system is crucial for effective material handling system in order to achieve on-time delivery and improve efficiency.

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