MANTECH Publications

Journal of Advance Manufacturing System and Technology
Volume 4, Issue 2, July- December, 2019

Material Handling Equipment and their Applications

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Abstract

Material handling equipment (MHE) is mechanical equipment used for movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. Material handling equipment are divided into four major groups, such as transport equipment, positioning equipment, unit load formation equipment and storage equipment. Engineered system cover a variety of units that work cohesively to enable storage and transportation. They are often automated. A company's material handling system and processes are put in place to improve customer service, reduce inventory, shorter delivery time and lower overall handling costs in manufacturing, distribution and transportation. Toyota Industries meets diverse customers' needs in logistic by providing a diverse range of material handling equipment. Laxmi Steel offers a complete choice of products which includes material handling system, drum handling system and textile material handling equipment. A. T. E's products offered include platform trucks, hand pallet trucks, manual and electrical stackers, hand pallets, dock levelers, reach trucks, electric forklifts, scissor lifts, custom built trucks and racking systems. The material handling equipment followed by the spinning mills differ widely. Modern mills have been using appropriate material handling equipment. A right material handling system across the factory departments reduces material transportation time, waiting time at work and delays.

Keywords: *Conveyor, Forklift, Forecasting, Aesthetic look, Logistics, Scissor lifts, Fabric bags.*

INTRODUCTION

Material Handling Equipment is mechanical instrument used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. The different types of material handling equipment can be divided into four groups: transport equipment, positioning equipment, unit load function equipment and storage equipment. Transport equipment is used to move material from one location to another, like between work places, between a loading lock and a storage area, etc, while positioning equipment is used to manipulate material at a single location. The major sub-categories of transport equipment are conveyors, cranes, and industrial trucks. Materials can also be transported manually using no equipment. Unit load formation equipment is used to restrict materials so that they maintain their integrity when handled a single load during transport and for storage. Positioning equipment is used to handle material at a single location. It can be used at a work place to feed, orient, load/unload or otherwise manipulate materials so that are in the correct position for subsequent handling, machining, transport or storage. As compared to manual handling, the use of positioning equipment can raise the productivity of each worker when the frequency of handling is high, improve product quality and limit damage to materials and equipment when the item handled is heavy or awkward to hold or damage is likely through human error or in attenuation and can reduce fatigue and injuries when the environment is hazardous or inaccessible. Storage equipment is used for holding or buffering materials over a period of time. The design of each type of storage equipment along with its use in warehouse design, represents a trade-off between minimizing handling costs by making material easily accessible and maximizing the utilization of space [01].

Material handling equipment encompasses a diverse range of tools, vehicles, storage units, appliances and accessories involved in transporting, storing, controlling, and protecting products at any stage of manufacturing, distributing, consumption or disposal [02]. Storage equipment is usually limited to non-automated examples, which are grouped in with

engineered systems. Storage equipment is used to hold or buffer materials during down times or times when they are not being transported. These periods could refer to temporary pauses during long-term transportation or long-term storage designed to allow the build of stock. Engineered systems cover a variety of units that work cohesively to enable storage and transportation. Industrial trucks refer to different kinds of transportation items and vehicles used to move materials and products in material handling. Bulk material handling refers to the storing, transportation and control of materials in loose bulk form. These materials can include food, liquid or minerals among others.

Material handling application help with forecasting resource allocation, production planning, flow and process management, inventory management and control, customer delivery and after sales support and supply. A company's material handling system and processes are put in place to improve customer service, reduce inventory, shorter delivery time and lower overall handling costs in manufacturing, distribution and transportation [03].

Cargo Material Handling Equipment a leading manufacturer of a quality material handling equipment since last two decades. They not only fabricate the equipment but engineer them also. They have developed very sophisticated material handling equipment for spinning, weaving and processing by studying carefully various aspects of process materials to be transported, like space as well as environment. They process various materials for trolleys like aluminium and stainless steel. For better aesthetic look they use power coating for almost all designs in MS. They are one of the O.E suppliers of Material Handling trolleys to Swiss Company M/s Xorella AG for their yarn conditioning machine [04].

The smooth flow of goods, money and information links the world and enriches the lives of people and society. Toyota Industries meets diverse customer needs in logistics by providing a diverse range of materials handling equipment such as lift trucks, and offering advanced and highly efficient logistics services. Through these businesses Toyota Industries helps bring smiles to the faces of people of the world [05]. The material handling equipment segments develops, produces and provides services for a broad range of products from industrial vehicles centredon full line up of lift trucks (0.5 to 43 ton) capacity to material handling systems. Lift trucks

which capture the top global market share are delivered to customers around the world under the Toyota BT, Raymond and CESAB brands. Toyota Industries also strives to provide finely turned after sales services to that customers can always use their products in the best possible condition.

Laxmi Steel Products offer a complete choice of products which include material handling equipment including drum handling equipment and textile material handling systems. They are manufacturer of material handling systems with PLCI systems. These are offering as per the clients' specifications. The machines are widely used and appreciated by their clients' dependability and user friendliness. With their immense domain expertise they are manufacturing wide range of drum handling equipment. The equipment are manufactured and precision to ensure their long lasting performance and high manufacturing quality assure about the equipment, they are associated with their vendor base for the procurement of optimum grade raw material [06].

A.T.E. has tied up with Jost's Engineering Company Ltd to bring the best material handling equipment to the textile industry in India and Bangladesh. Jost's is a leading manufacturer of material handling equipment in India since 1920, and has carved out a formidable reputation in Indian Industries as an engineering company, focused on developing technology based solutions and services for specific needs. Jost's has expertise across segments such as textile, power, oil and gas, defence, aerospace and other critical sectors with customized solution. Products offered includes platform trucks, hand pallet trucks, manual and electrical stackers, dock levellers, reach trucks, electric forklifts, scissor lifts, custom built trucks and racking systems. A. T. E. With over 75 years' experience in the textile industry is a domain expert in textile processing providing end to end solutions [07].

While determining the choice of equipment the following factors should be taken into consideration: mode of arrival and dispatch of materials, type of materials to be transported, amount of materials to be handled in unit time, storage operations and the time materials remain in storage and details of the buildings and routes. Material handling in a spinning mill broadly involves handling of raw materials, intermediate products, wastes, finished goods, stores and maintenance of equipment and tools. During fibre to yarn

transformation, materials are stored at different places and transported between departments. Like any other manufacturing industry, spinning mills also require efficient materials handling system [08].

Material handling system plays an important role in improved material flow and increasing production performance in the readymade garment industry. Various kind of material handling equipment are used in the garment industry. At time of new garment factory set up or improving production system and factory layout, material handling system is taken into account for better factory performance and smooth material flow. A right material handling system throughout the factory departments reduces material transportation time, waiting time at work and delays [09]. For better material handling, equipment are engineered according to work place design. There are different types of material handling equipment based on processes requirement whether it is a new set up or an existing set up, factories have many options for choosing one out of available material handling equipment. Common manufacturing units can be discussed in details.

MATERIAL HANDLING EQUIPMENT CLASSIFICATION

Four major categories of material handling equipment are: transport equipment, positioning equipment, unit load formation equipment and storage equipment. Transport equipment is used to move material from one location to another, i. e between work places, between a loading dock and a storage area, etc. Positioning equipment is used to manipulate material at a single location. The major sub-categories of transport equipment are conveyors, cranes and industrial trucks. Materials also can be transported manually using no equipment [01].

Another classification of four categories of material handling equipment is such as storage,engineered systems, industrial trucks and bulk material handling. Storage equipment is usually limited to non-automated which are grouped in with engineered systems. Storage equipment is used to hold or buffer materials during down times or times when they are not transported. These periods could refer to temporary pauses during long-term transportation or long-term storage designed to allow buildup of stock. The majority of the storage equipment refers to pallets, shelves, or racks on to which materials may be stacked in an orderly

manner to await transportation or consumption. Many companies have investigated increased efficiency possibilities in storage equipment by designing priority packaging that allows materials or products of a certain type to conserve space while in inventory. Examples of storage and handling equipment include: racks, such as pallets, drive-through or drive-in racks, push-back racks, and sliding racks, stacking frames, shelves, bins, and drawers for mezzanines [02]. Engineered systems cover a variety of units that work cohesively to enable storage and transportation. They are often automated. A good example of an engineered system is an automated storage and retrieval system, often abbreviated AS/RS, which is a large automated organizational structure involving racks, aisles and shelves accessible by a shuttle system of retrieval. Other types of engineered system include conveyor system, robotic delivery system, automated guided vehicles, etc.

Industrial trucks refer to the different kind of transportation items and vehicles used to move materials and products in material. These transportation devices can include small hand-operated trucks, pallet jacks, and various kinds of forklifts. These trucks have different characteristics to make them suitable for different operations. Some trucks have forks as in a forklift or a flat surface with which to lift items while some trucks require a separate piece of equipment for loading. Trucks can also be manual or powered lift and operation can also be walk or ride, requiring user to manually push them to ride along on the truck. A stack truck can be used to stack items while a non-stack is typically used for transportation and not for loading. Various types of industrial trucks include: hand truck, pallet trucks, pallet jacks, walk stackers, platform trucks, order picker, side loader and many more types.

Bulk material handling refers to the storing transportation and control of materials in loose bulk form. These materials can include food, liquid or minerals among others. Generally these pieces of equipment deal with the items in loose form, such as conveyor belts or elevators to move large amount of materials or in packaged forms through of drums and hoppers. Some of the examples are conveyor belts, stackers, declaimers, bucket elevators, grain elevators, hoppers and silos. As a process, material handling incorporates a wide range of manual, semi-automated and automated equipment and systems that support logistics and make

the supply chain work. A company's material handling system and processes are put in places to improve customer service, reduce inventory, shorten delivery time, and lower overall handlingcosts in manufacturing, distribution and transportation [03].

MATERIAL HANDLING EQUIPMENT IN TEXTILE INDUSTRY

Industrial trucks are the major categories of equipment used for materials transportation. For safety and bulk movement of materials, industrial trucks play a vital role. They are used to move materials over variable paths with no restrictions on the areas covered by the instrument. These majority types of industrial trucks are: hand trucks, counterbalanced lift forks, warlike waste stackers, platform trucks, pallet trucks, pallet jacks, order pickers and tractor-trailers [08]. Material handling in a spinning mill broadly involves handling of raw materials, intermediate products, wastes, finished goods, stores and maintenance equipment tools. During fibre to yarn conversion materials are stored at different places and transported between departments. Like any other manufacturing industry, spinning mills also require efficient material handling systems.

Spinning mills receive raw materials both cotton and man-made fibres normally in the form of bales in lorries. Once arrive these bales are stored in go downs, up to 10 feet height, in multiple layers one above the other and then transported to the mixing departments. Forklifts, stackers, platform trucks, and dock levellers can be used to unload bales directly from the lorry, transport and stack them directly in go downs. Whenever required, suitable ramps must be constructed or dock levellers be used to unload of bales by forklifts form the lorry. If there is any space problem in the go downs bales are manually transported to the mixing department. Instead, mills can use platform trucks by which a single operator can transport up to 3 bales at a time and deliver them at the appropriate place in the mixing department.

To supply bales near the bale pluckers, mills can use platform trucks. In the case of stack mixing materials from bins is carried either in hands or by bamboo baskets/plastic crates and fed to bale openers. Use of lift or spring type pedal operated mixing trolley would help to eliminate the disadvantages of wastes. The material can be fed evenly on the long lattices of the bale openers. Many mills have been using trolleys to transport blow

room laps to carding section. However, in some mills laps are transported by workers keeping one lap at a time on the shoulders.

Sliver cans both full and empty are to be transported between cards, draw frames, comber preparatory machines, combers and fly frames. In many mills, can are transported manually by dragging them on the floor. Trolley can be used to carry 3 to 4 cans at a time. For easy transportation, cans fitted with casters are used in modern cards, draw frames and combers. Whenever there is any requirement for any single can and/or space constraint in the department for movement of multi can trolley, single trolley can be used. The laps are generally transported to the combers manually by carrying one or two laps in hands at a time. This system takes a lot of time and also results in wastage of materials. The trolley can transport 8 laps at a time and it can move easily along narrow alleys.

Trolley is more suitable for storing full bobbins during doffing. The trolley can be moved in between fly frames and up to 60 bobbins can be stacked easily. Empty bobbins required for doffing can be stacked easily. Empty bobbins required for doffing can also be placed on the top portion of the trolley. In many mills after doffing full bobbins are stored in racks from which they are transported to the ring frame section by using either a box type or open type trolley. The most important /appropriate trolley for carrying full bobbins to ring frames without causing any damage to the roving is porcupine type trolley. In this type of trolley each bobbin is placed separately on a peg.

Two types of doffing are being practiced by the mills, such as doffing and donning byseparate workers and doffing and donning simultaneously by the same worker. The latter is the correct method is presently followed by a large number of mills. To practice this method of doffing mills must use suitably designed light weight trolley. The doffing trolley suggested for simultaneous doffing and donning method, has two compartments one for carrying empty cops and another for keeping doffed cops.

Plastic crates can be fitted in the compartments. Each doffer must be given one trolley. In some mills, doffed cops are first transferred to bamboo baskets or big size metal or wooden containers and they are transported to post spinning department in trolleys. The baskets/containers with doffed cops are kept one above the other on the trolley. In

the winding department, the tenter has to transfer the cops from these containers/baskets either to the bins or to other small containers. Instead of transferring the doffed cops to the baskets, the plastic crates which are used for doffing with cops themselves can be loaded on the trolley and transported to the post spinning section.

In many mills, full cones are transported to the packing section by using baskets/box type trolleys. This method would cause damage to the cones. To avoid this, mills must use trolleys fitted with cone holder pegs. When the cones are kept in the trolleys, it is easy to inspect them for package defects. The trolley can be also used to transport cheeses from doubler winding machines to TWO twisting/ring doubling. In many mills, packed cone bags or cartons are transported to the finished yarn go downs by carrying them manually.

Instead a platform truck can be used. For stacking bags or cartons in go downs and loading them in lorry/containers, electric stackers can be use. For moving pallets to storage place and loading them in containers, either manual pallet truck or powered pallet truck can be used.

MATERIAL HANDLING EQUIPMENT FOR GARMENT INDUSTRY

At the time of new garment factory set up or improving production system and factory layout, material handling system is taken into account for better factory performance and smooth flow of materials. A right type of material handling system across the factory departments reduces material transportation time, waiting time at work and delays. The means used for transportation materials, works like fabrics cutting, bundling, finishing garments and general items like carrying from one place to another, storing materials and protecting materials from damage are known as material handling system. It may be an equipment, device or procedure. For better material handling, equipment engineered according to work place design. As mentioned earlier, there are different types of material handling systems based on process requirement. Whether it is a new set up or an existing set up, factories have many options for choosing one out of available material handling systems. Common material handling systems found garments manufacturing units are listed as follows [09]:

Cutting department is responsible for cutting of garment patterns/components

from the fabric rolls. Cutting department has to handle lot of fabrics and cutting bundles. Therefore they need material handling equipment and tools. Trolley is used for transporting fabric from store to cutting section and forklifts are also used for the same job. Baker's Trolley is used for stacking, cutting and transporting bundles to stitching floor. Plastic trays and trolleys are used for cut pieces to be placed on trays which are fitted with garment to certain number of pieces placed in trolleys. Fabric bags are used for cutting to be bagged into fabric bags or plastic bags and carried out to production sections manually. Racks are used for storing of cutting bundles.

Garment stitching department does stitching of garments from fabrics. Different types of line lay out for stitching line are found in the garment industry. Based on the production line lay out, material handling system is designed. In stitching department material handling system is needed for transporting bundles from one work station to next work station and for storing WIP. A side bench or a side table known as conventional side table with bin is placed for loading the cuttings and disposing stitched garments. This kind of lay out is normally found in group production system and make-through production system. Centre table is the most common material handle system used in the production line. A bench is placed in between two rows of machines. Trolleys are used to stack cutting bundles on it and the trolley is moved in the line. Some factories found difficult to assess WIP in the line by using trolley system. These trolleys are useful for trouser manufacturing.

Plastic crates and bins are used for disposing stitched garments. Plastic bins are used for transporting garments from one place to another. Many production units use overhead rail and hanger for transporting material. Factories found it easy to track WIP on the UPS system. Some factories experience issues in the line balancing. Difficult types of overhead hanger system are avoidable.

CONCLUSION

There are different types of material handling equipment, which are broadly classified into four categories. The major sub-categories of transport equipment are conveyors, cranes and industrial trucks. As compared to manual handling, the use of positioning equipment can raise the productivity of each worker when the frequency of handling id high, improve product quality and limit damage of

materials and equipment. Examples of unit load formation equipment include pallets, skids, slip sheets, tote pans, bins/baskets, cartons, bags and crates. The use of racks becomes preferable to floor storage as the number of units per item requiring storage decreases. Engineered systems cover a variety of units that work cohesively to enable storage and transportation. As a process, material handling incorporates a wide range of manual, semi-manual and automated equipment and systems that support logistics and the supply chain work. Cargo has developed very sophisticated MHE for spinning, weaving and processing for textile industry. Laxmi Steel Products are manufacturing a wide range of Drum material handling equipment. Jost's is a leading manufacturer of Material Handling Equipment in India since 1920. The material handling systems followed by the spinning mills differ widely. Modern mills are using appropriate material handling equipment. For better material handling, equipment are engineered according to work place design. Whether a new or an existing set up for garment units, factories have many options for choosing one out of available MHE.

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