Material Handling Systems in Casting Industry- A Review

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Abstract— Material handling is define as the function of moving right material at right time, at right amount through a convenient way. It is the vital part of factory and industrial processes. It covers the entire detail of functions such as waste handling, assembly line management, storage and material transport. This research is based on the improvement of material handling system in Kapilansh Dhatu Udyog Industry, Nagpur. During a visit at the industry, we came to know that there are many issues with the production line within the factory premises.

Key words: Material Handling, Automated systems, Pipe, SPG Casting Machines

I. INTRODUCTION

Material Handling involves short-distance movement within the confines of a building and a transportation vehicle. It utilizes a wide range of manual, semi-automated, and automated equipment and includes consideration of the protection, storage, and control of material throughout their manufacturing, warehousing, distribution, and disposal. There are two types of material handling

Manual Handling- Manual handling refers to the use of a workers hands to move individual items by lifting, lowering, filling, emptying, or carrying them.

Semi-automated Handling- Whenever technically and economically feasible, equipment can be used to reduce and sometimes replace the need to manually handle material.

Fig. 1: Overhead Crane Used in Material Handling

II. LITERATURE REVIEW

A. *Guilherme Bergmann Borges Vieira, Alberto Pandolfo*

The highly competitive environment, linked to the globalization phenomena, demands from companies more agility, better performance and the constant search for cost reduction. Materials handling is intrinsically associated with production flow. Because of this, it has direct influence on transit time, resources usage, and service levels. The objective was to evaluate, in a systematic way, the impact of implemented changes in materials handling management on the internal customers' perceptions of cost, safety in service, service reliability, agility and overall satisfaction. A literature review preceded a case study in the company's manufacturing unit and the questionnaires were completed by 26 employees directly involved in the process. Analysing the answers, it was possible to suggest that internal customers understood that the new materials handling management system enlarged service agility and reliability and reduced costs, which caused an improvement in overall satisfaction. [8]

B. *Prof. A.V. Gaur, Prof.Dr. M.S. Pawar*

Material Handling involves the movement of materials from one place to another for the purpose of processing or storing. According to American Material Handling society,' Material Handling is an art and science of involving the movement, packing and storing of subsystems in any form. Thus material handling function includes all types of movements vertical, horizontal or combination of both and of all types of material fluid, semi fluid and discrete items and of movements required for packing and storing. The material handling function is considered as one of the most important activities of the production function as out of total time spent by the materials inside the plant area, about 20% of the time is utilized for actual processing on them while remaining 80 % of the time is spent in moving from one place to another, waiting for processing or finding place in sub-stores. Moreover about 20 % of the total production cost is traceable as material handling cost. The relative percentage will vary according to the type of product, plant layout, production method, availability of resources like men, machine etc. In most manufacturing systems, the material handling system plays a critical role since it is primarily responsible for providing the right material at the right place, and at the right time. A poorly designed material handling system interferes with the efficient operation of a manufacturing concern and in the long-term it may lead to a substantial loss in productivity. [6]

C. *A. Daniyan , A. O. Adeodu*

In the process or manufacturing industry, raw materials and products need to be transported from one manufacturing stage to another. Material handling equipment are designed such that they facilitate easy, cheap, fast and safe loading and unloading with least human interference. For instance, belt conveyor system can be employed for easy handling of materials beyond human capacity in terms of weight and height. This paper discusses the design calculations and considerations of belt conveyor system for limestone using 3 rolls idlers, in terms of size, length, capacity and speed, roller diameter, power and tension, idler spacing, type of drive unit, diameter, location and arrangement of pulley, angle and axis of rotation, control mode, intended application, product to be handled as well as its maximum loading capacity in order ensure fast, continuous and

efficient movement of crushed limestone while avoiding halt or fatalities during loading and unloading.[2]

D. Michael G. Kay

Material handling (MH) involves "short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and a transportation agency." It can be used to Create "time and place utility" through the handling, storage, and control of material, as distinct from manufacturing (i.e., fabrication and assembly operations), which creates "form utility" by changing the shape, form, and makeup of material. It is often said that MH only adds to the cost of a product, it does not add to the value of a product. Although MH does not provide a product with form utility, the time and place utility provided by MH can add real value to a product, i.e., the value of a product can increase after MH has taken place. [7]

E. Prof. (Dr) V.V.Sople

Material handling cannot be avoided in logistics, but can certainly be reduced to minimum levels. The productivity potential of logistics can be exploited by selecting the right type of handling equipment. The selection of material handling equipment cannot be done in isolation, without considering the storage system. Investment in the material handling system will be sheer waste if it is not compatible to the warehouse layout plan. The layout will create obstacles for free movement of equipment and goods, resulting in poor equipment productivity. Recent trends indicate preference for automated system with higher logistics productivity to enhance the effectiveness of human energy in material movement. [5]

III. DATA ACCUMULATION

Images of pipes being moved manually at Kapilansh Dhatu Udyog.:

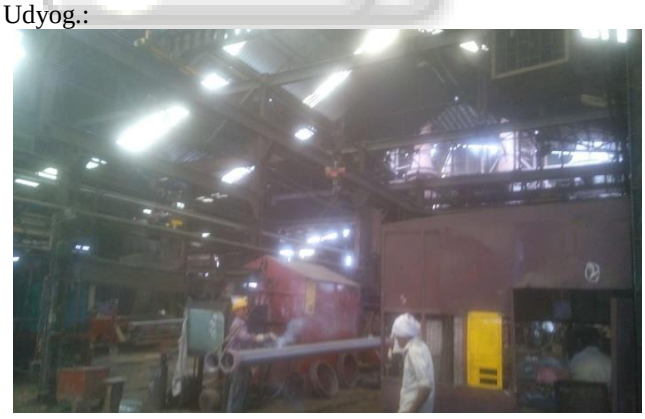

Fig. 2:

- Total lengthof the area: 30 Meters
- Total width of the area: 10 Meters
- Total area to be covered under material handling system: 300 SQ. Meters
- Maximum weight of the pipe: 667 Kgs
- Minimum length of the pipe: 5.5 m
- Mode of operation: Semi automated
- Number of labor: 3 persons at one time lifting.
- Maximum production capacity of casting machine : 60-100 pipes per hour
- Maximum annealing capacity: 50 pipes per hour.

IV. PROBLEM FORMULATION

- Visiting the Kapilansh Dhatu Udyog, we came to know that there are many issues with the production line within the factory premises. The main problem they face in the production line is of transportation of pipes from one section to another section of the production line. After the pipes are casted using molds they are heated in a furnace to alter their physical and chemical properties to increase its ductility and reduce its hardness this heat treatment process is also called as annealing.
- The problem that is being faced by the Kapilansh Dhatu Udyog is that the area between the pipe casting machine and the annealing furnace is about 30 meters long and 10 meters wide. Each of these pipes weighs about a 667 kilogram so overhead cranes are employed to move the pipes from the casting machine to conveyor of the annealing machine. Using of overhead cranes increases the number of workers at the shop floor. There are two operators to operate the two cranes, two workers one at each crane to make sure the fixture is properly in place to lift the pipes. One workers manually pushes the pipes onto the conveyor of the annealing furnace as the crane cannot reach to the exact point of unloading. One worker is at the other end of the conveyor where the annealed pipes are received from the annealing furnace. One supervisor is present at all the times to keep this process going on smoothly.
- The other problem is of managing the production line. The overall capacity of the casting machines is to cast 120 pipes per hour, the annealing machine can also process 120 pipes in an hour. Now the problem is that they can't maintain a continuous flow of casted pipes into the annealing furnace because of the present setup that they have which limits the speed and accuracy. Hence they stockpile about 400 pipes.
- Once and they fire the furnace so that the furnace receives the pipes in continuation as the company can't afford any downtime of the furnace. The problem with stockpiling is that they stockpile the pipes right in the center of that 30m X 10m space which obstructs the free flow of the cranes
- The production manager at Kapilansh Dhatu Udyog want to eliminate the overhead crane system and wants me to design a system which can continuously Feed the casted pipes from the casting machine into the annealing machine with the least number of workers.

A. The Casting Arena Layout

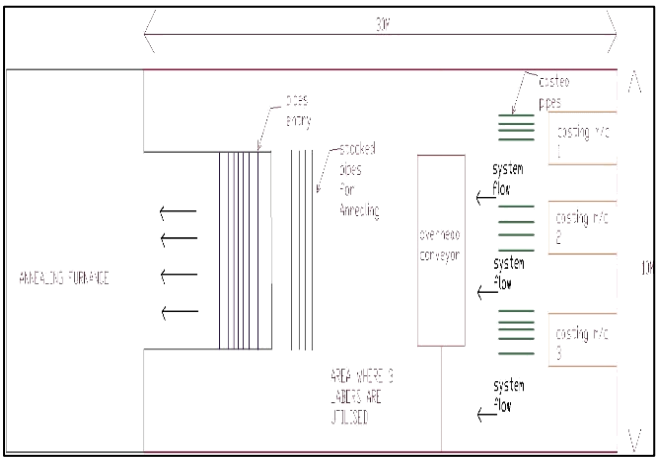

Fig. 3:

V. PLAN OF WORK

- Data accumulation
- Literature survey
- Design calculation of Material handling system.
- CAD modeling of the Material handling system.
- Analysis of design in FEA.
- Modification of the design if needed.
- Analysis of modified design in FEA.
- Result discussion
- Design finalization
- Conclusion

VI. CONCLUSIONS

With the completion of this study, number of improvements pertaining to the material handling systems as well manual operating operational delays can be minimized & the company Kapilansh Dhatu Udyog, will be benefited from the advancements of computer aided design technologies and thus will be able to increase production with the help of improved material handling system.

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