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Improvement in Material Handling Equipment-An Ergonomic Case Study

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Abstract - Ergonomics is the foremost concern in almost all the fields. In industrial cases, ergonomics has become important that works on reduction of human efforts. Material Handling Equipments (MHE) is designed to eliminate human efforts for storage and transportation in logistics.
The major components of steering company (Rane Madras Limited, Mysore Plant) are ball pins, sockets, bars, tubes and outer columns. In the present work, MHE's are devised for all these components so as to reduce human effort, elimination of unloading charges and optimizing the counting time that are incorporated during in-warding of materials.

Keywords**:** *Material Handling Equipment (MHE), Transportation, Ergonomics, Human effort.*

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I. INTRODUCTION

Ergonomics is defined as the applied science of equipment design, as for the workplace, intended to maximize productivity by reducing operator fatigue and discomfort. Safety and efficiency are the two most important factors in ergonomics to be considered when designing material handling equipment. It evaluates the interaction between humans and tools. Ultimate goal is to provide an injury-free, high productive labour force.

*Material-Handling Equipment (MHE***)** is the equipment that relate to the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. Material handling equipment is used to increase output, control costs, and maximize productivity.

*Logistic***s** is the management of the flow of goods between the point of origin and to the point of consumption in order to meet requirements of customers or corporations. The resources managed in logistics can include physical items, such as food, materials, animals, equipment and liquids, as well as abstract items, such as time, information, particles, and energy. Logistics is the process of planning, implementing, and controlling the effective and efficient flow of goods and services from the point of origin to the point of consumption.

A. Prime Components of Steering Assembly

This work is carried out in steering manufacturing organization of Rane (Madras) Limited, Mysuru Plant. Guiding get together comprises of numerous parts out of which significant components are ball-pin, socket, outer column, tubes of different diameter, bars which are shown in figure 1.

Fig 1: Major components of steering system. (1: Ball-Pin, 2: Socket, 3: Outer Column, 4: Tubes of different Diameter, 5: Bars)

II. METHODOLOGY

In this work, the structured process has been used for building ergonomically efficient and effective MHE for storing and transporting materials from origin to destination. Wastes like human burden, unloading time and cost are eliminated, with improved product and performance quality, increased productivity, Reduction in unintentional damage to the finished product and work area equipment.

The structured method in designing MHE is as follows:

- Gathering design of present MHE and documents required for it.
- Adjustments for the present MHE, if possible.
- Replacement of MHE design, if adjustments are not possible.
- Monthly review for the MHE status.

The present MHE's are analysed and required documents are noted. If possible, simple adjustments are made for the MHE, to overcome the problems associated in handling of the materials. If adjustments are not possible, the design of MHE is replaced.
The performance status can be reviewed on monthly basis by the stores Head.

III. RESULTS AND DISCUSSION

A. *Ball Pins and Sockets:*

The Present MHE was analysed for ball pins and sockets, same are shown in figure 2. Required documents are noted and found that the minimum lot size in issuing to production line is 240 Nos. Small adjustments were made to the present design. Trays are combined to form a unique structured design as shown in figure 3. Review is done on monthly basis. A simple calculation showing the bin quantity as per customer requirement is shown below.

Fig 2: Present MHE at the company (1: Ball-Pin, 2: Socket).

Present scenario,
Number of components/tray=5*6=30
Number of components required/shift=240
Trays for 240nos is 240/30=8

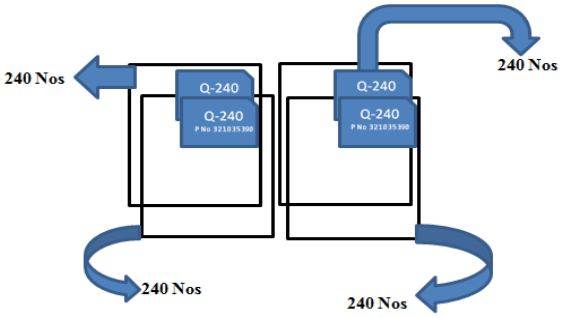

Fig 3: Modified outline of MHE for Ball-pins and Sockets.

Recommended,
Number of components required/shift=240
Number of components/tray=8*6=48
Trays for 240nos is 240/48=5
These 5 trays are grouped to form a single MHE/Bin.

B. *Bars / Tubes:*

Figure 4 represent the present MHE for handling and storage of circular components like bars and tubes.

Fig 4: Present MHE used in the company for handling circular components (1: Tubes and 2: Bars).

Presently, rectangular trolleys are used for transportation process, which is time consuming for counting of materials. Frequent counting mistakes were found during the process.

Use of V shaped trolley is recommended to overcome the problems that attained during transportation process. An equation has been formulated to overcome the mistakes and a pictorial view of recommended MHE along with chart is shown in figure 5. Photographs of the same are shown in figure 6.

Number of components at top row	Total Number of components
1	1
2	3
3	6
4	10
5	15
6	21
7	28
8	36
9	45
10	55
11	66
12	78
13	91
14	105
15	120

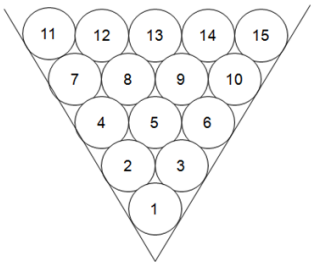

Fig 5: Pictorial view of Tubes/Bars arrangement in Proposed MHE.

Calculation,

Total No of Components = $\frac{n(n+1)}{2}$ .....Eq (1)

Where, n= No of components at top row

Eg 1; If top row consists of 5 components, then the total number of components is 15.

n=5, total number of component= $\frac{5(5+1)}{2}$ =15

Eg 2; If top row consists of 10 components, then the total number of components is 55.

n=10, total number of component=$\frac{10(10+1)}{2}$ =55

Charts can be placed at respective stores for fast recognition to eliminate the problems that are encountered during transportation

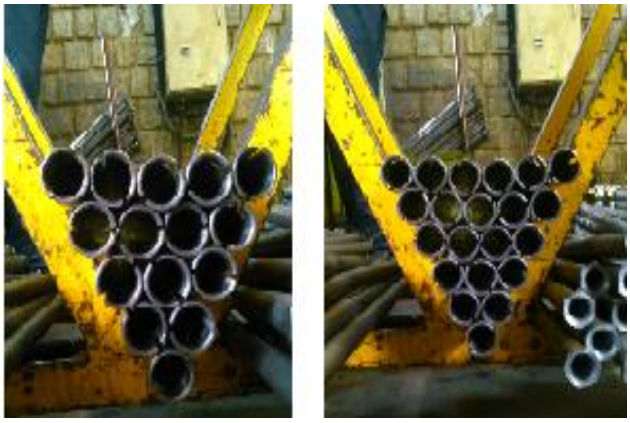

Fig 6: Photographs of MHE for Bars/Tubes.

C. Outer Column:

Presently, the Outer Columns are dumped haphazardly in containers without any guidelines in setting the materials

which is shown in figure 7. It is making transportation and storing of the materials difficult. The work men were getting injured during handling. To overcome these problems, a material handling system is designed which is illustrated in figure 8.

Fig 7: present MHE for handling outer column

Fig 8: Modified MHE for handling outer column

IV. CONCLUSIONS

The present paper dealt with reduction of human risk, elimination of unloading charges and minimization of processing time by replacing gunny bags, carton box, wooden boxes which are made from natural resources. In designing of MHE, ergonomic factors have been considered for enhanced productivity.

Improved MHE results in clear visibility of work place. Reducing worker's efforts by decreasing forces in lifting, handling, pushing and pulling materials had increased the productivity, product and service quality, and worker's morale.

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