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An Implementing and Applying Inventory Reduction for Rear Axle Storage Trolley in Assembly Floor Unit

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Abstract: The work is to design and develop efficient material handling system to reduce inventory for using it in the rear axle in an assembly unit. A concept was developed for Multipurpose Rear Axle Storage Trolley. In the conventional assembly plant, the system adopts two separate storage trolley for handling two rear axle models. This system has a considerable effect over processing time, storage space and cost. With the help of quality tools like cause and effect diagrams, control charts, in this work analyzed the causes for the problem that are present in the existing model. This process helped us in setting up counter measures for developing a new concept of Multipurpose Rear Axle Storage Trolley. In this new method, the two different types of rear axle models mounted on a single storage trolley by means which the problem prevailing in the existing method can be overcome in the proposed method.

Keywords: Space reduction, processing time, cost reduction, material handling.

1. Introduction

The main objective of the paper is to design and fabricate a multipurpose storage trolley for rear axle handling. It is executable at overhead subassembly section. The subassembly section holds the work of assembling the rear axle, the front axle, the engine dressing, wheel assembly and bumper assembly. The purpose of this report is to present the accomplishments that were made during the evaluation led by us [1]. The first goal was to provide proposals for improvement to the existing rear axle storage trolley, and the second goal was to fabricate multipurpose storage trolley. In all the three areas i.e. space consumption, cost reduction, processing time our goal is to evaluate the current situation, limitations and possibilities for improvements [2]. After investigation and evaluation, the next step was to come up with real improvement proposals.

1.1. Goals

The goal was to fabricate multipurpose rear axle storage trolley which can handle both rear axle models.

1.2. Scope

The scope of the work is proposed as,

- Space consumption in rear axle storage trolley section is reduced from 5.5 square meters to 2.7 square meters.
- Processing time of rear axle unit is decreased by 5 minutes during model change.
- All the three racks or shelves in the rear axle storage trolley are used.
- Cost of rear axle storage trolley is reduced from Rs. 1.4 Lakhs to Rs. 70,000.

1.3. Time Line of Investigation

The beginning of the investigation consisted of many studies and interviews in the hopes of gather information to provide better understanding of the present status of rear axle storage trolley. Following this period of information gathering, the concept analyzed the date concerned the investigation and to determine a good direction for our evaluation [3].

2. Existing Storage Trolley System

In the existing system, the user uses two separate storage trolleys for two rear axle models to introduce a separate storage trolley in developing the existing system. In the below picture, it is shown the existing system of rear axle storage trolley.

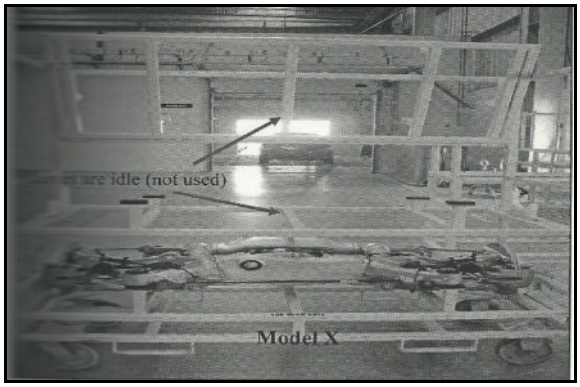

Fig.1. Model 'X'

The figure represents 'X' Model storage trolley, which consist of main frame, foldable racks or a shelf which is operated manually. The trolley is equipped with four blocks particularly suited for positioning of rear axle arms over it, and it also includes an arrangement placed on the ends of trolley frame, which is adapted to position the disc of the rear axle. This trolley has four wheels to support the motion. Front end wheels are routable wheels of castor type. Rear end wheels are of fixed type and their movement is constrained to only one direction while the front end wheels can be moved in all directions.

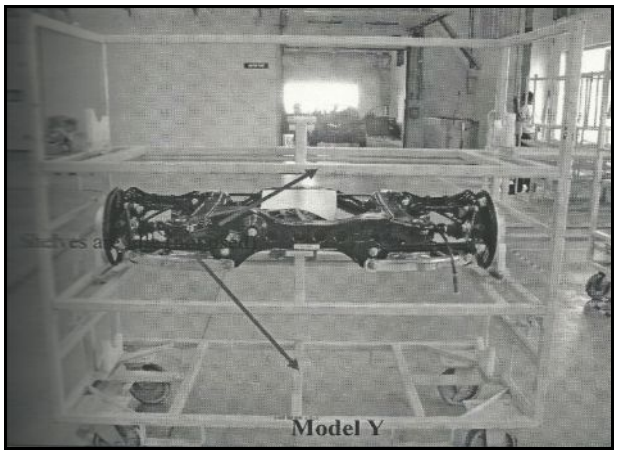

Fig.2. Model 'Y'

This figure represents other rear axle storage trolley used for the respective rear axle model. It features everything very close to other model of rear axle storage trolley with the exception of using two blocks in the place of four blocks.

2.1. Tasks of Rear Axle Storage Trolley

The basic tasks of rear axle storage trolley can be divided into two tasks.

- The first one is during offline of cars. During this, worker gets a storage trolley for a rear axle model which is not connected to the production line of cars. Using this trolley, offline rear axle model is stored and the general work process of the production line continuous.
- The next task of rear axle storage trolley happens when the rear axle model meets any major deficiencies.

2.2. Survey

In order to achieve the goal, the investigation has led to a survey on rear axle storage trolley users. The goal of the survey was to allow users to report on the problems they were experiencing and generating ideas on how to deal with them [4]. The survey was distributed through repeated brainstorming sessions to have an efficient process, which would allow variety of workers to fill out the survey without major impact on their usual work flow [5]. The survey is intended not only for the personnel using rear axle storage trolley, but also for people who have never used the trolley. Our team wanted to know what people, who have not used the trolley and tried to distinguish their preconceptions about the trolley system.

Separated the survey groups into the following division:

- Personnel who have never used storage trolley.
- Personnel who have used storage trolley but without any knowing about it.
- Personnel who have sound knowledge on storage trolley.

The survey questioned the users about how the trolley is used to accomplish their tasks.

2.3. Observations on Rear Axle Storage Trolley

Table 1

Approximate time spend for replacing a storage trolley (in minutes)
5

*-For existing model

This approach is to see how much time the user needs to replace the trolley for other rear axle model during model change. The average time is 5 minutes, means the user is spending 5 minutes for replacement of trolley during model change.

Table 2

Total number of racks available	Average number of racks used
3	2

*-For existing model

This approach is to look into design to see how many shelves or racks in the trolley are being utilized. The average is 2 shelves or racks are used out of 3 shelves.

Table 3

Total area of trolley storage unit (in meters)	Area of four rear axle storage trolleys (in meters)	Area of two rear axle storage trolleys (in meters)
31.86	5.4	2.70

*-For existing model

This approach is to see how much the space is consumed by the rear axle storage trolley. The above table shows the space consumed by the storage trolley. In the table the space consumed by 2 trolleys, the space consumed by 4 trolleys and the total area occupied by all the storage trolleys are observed. These observations were used in the construction of fish bone diagram.

2.4. Cause and Effect Analysis

A cause and effect analysis is to generate and sort hypotheses about possible causes of problems within a process, by asking the team to list all of the possible causes and their effects for the identified problem. This analysis tool organizes a large amount of information by showing links between events and their potential or actual causes and provides a means of generating ideas about why the problem is occurring and possible effects of the cause [6]. Cause and effect analysis allow us to broader our thinking and look at the overall picture of a problem. Cause and effect diagrams can reflect either causes that block the way to the desired state or helpful factors needed to reach the desired state.

The fish bone diagram helps the team to brainstorm about possible causes of a problem, accumulate existing knowledge about the casual system surrounding the problem, and group causes into general categories.

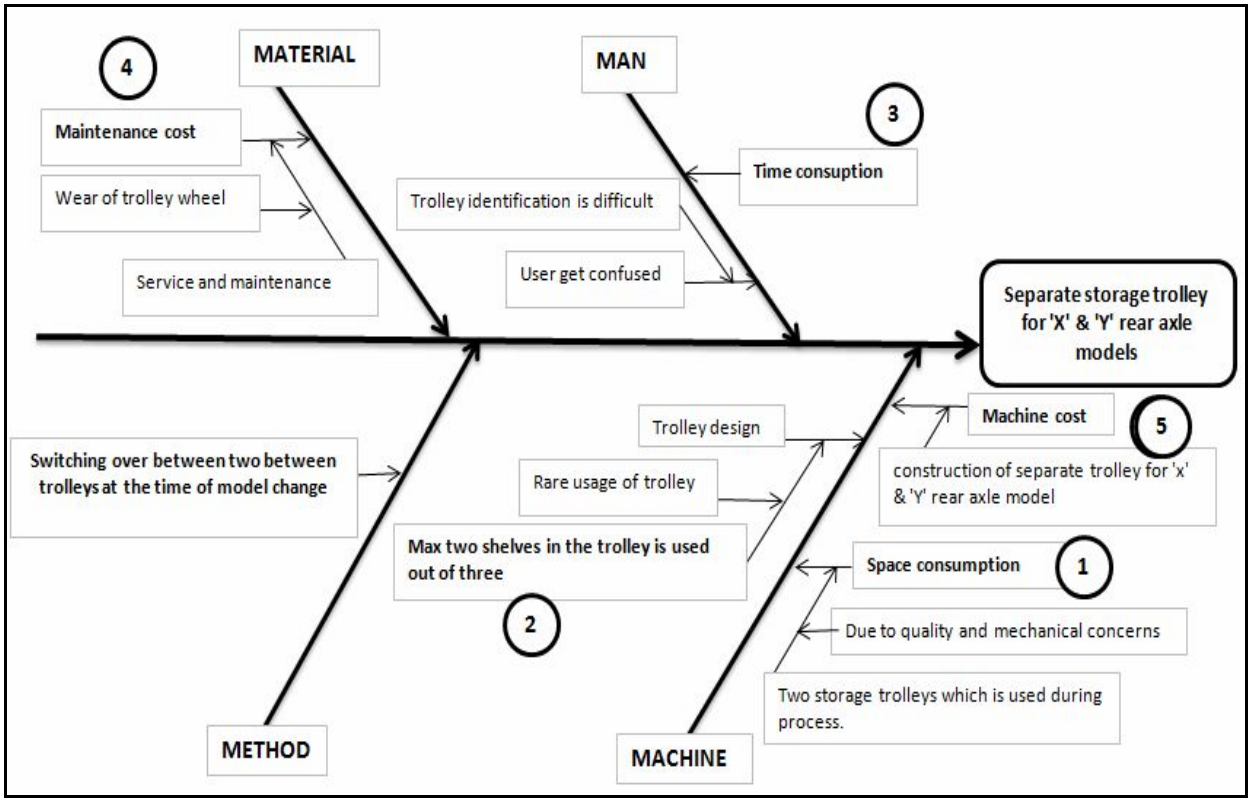

Fig.3. Cause and Effect Diagram

It displays the layers of causes, looking in depth for the root cause. This tool can be used to obtain cause for the problem and its effect which helps in prioritizing.

For instance:

Question 1: Why separate storage trolley for rear axle models?
Answer 1: Because of their variation in design.
Question 2: What happens in using two separate trolleys?
Answer 2: Space is consumed.
Root Cause: Space Consumption.

Likewise problems such as maintenance cost, processing time, machine Cost and their possible causes of the problem are analyzed through this fishbone diagram.

3. Prototype

The work carried our investigation to fabricate a multipurpose rear axle storage trolley for effective material handling system. As such the focus shifted more towards researching possible improvement to the existing storage trolley. It's divided our tasks among two teams, one team focused on modifying on existing rear axle storage trolley by taking its accurate measurements, profile and its design. Another team commenced by gathering information for improving ideas. It was decided that, the best course of action would be to go out and see exactly how the workers were working with current system, and why it is not being improved. The principle objective of the design is to provide an improved rear axle storage trolley. Accordingly, the objective is to provide a storage trolley.

3.1. Ideas for Counter Measures

Table 4 First idea

Counter measure ideas	Evaluation item				
	Expected Effect	How Much	How long	Influence on others	Comprehensive evaluation
Flip Flap method	Large	Few	Short	Nothing	Possible
	Average	Average	Average	Average	
	Small	High	Long	Influence on others	Impossible

Flip-flap is first counter measure idea which works on the concept of rotating the horizontal rack about the horizontal axis. The result of evaluation is described in the above table and the comprehensive evaluation shows this method is impossible for the development of multipurpose rear axle storage trolley.

Table 5 Second idea

Counter measure ideas	Evaluation item				
	Expected Effect	How Much	How long	Influence on others	Comprehensive evaluation
Tilting of block using Plunger assembly	Large	Few	Short	Nothing	Possible
	Average	Average	Average	Average	
	Small	High	Long	Influence on others	Impossible

Tilting of T-Block using plunger assembly is the second counter measure idea, which work on the concept of using a plunger type T-Block, in which the block is tilted for the use in multipurpose storage trolley. T Block is a seating arrangement for rear axle arms shown in Fig 1&2. The result of evaluation is described in the above table and is found to be impossible for the development of multipurpose storage trolley.

Table 6 Third idea

Counter measure ideas	Evaluation Item				
	Expected Effect	How Much	How long	Influence on others	Comprehensive evaluation
Upward or Downward lifting of block using plate assembly	Large	Few	Short	Nothing	Possible
	Average	Average	Average	Average	
	Small	High	Long	Influence on others	Impossible

Upward and downward lifting of T-Block using sliding arrangement, is the third countermeasure idea which works on the concept of lifting and lowering the block by means of engagement and disengagement of bolt and nut assembly. This method is evaluated as shown in the above table and since this method is feasible, finally concludes as our countermeasure idea for the development of multipurpose rear axle storage trolley.

3.2. Design of Rear Axle Storage Trolley

In the existing trolley, for a model X of rear axle, the storage trolley has four welded blocks in it, and for the model Y, the storage trolley has two welded blocks in it, which is basically the design followed in the existing system. The idea decided to modify a storage trolley keeping in close to its existing form. The use of six adjustable blocks is one of the steps taken for new design of storage trolley. The main objective of the design is to provide an adjustable T block, a locking arrangement using Bolt and nut assembly.

In accordance with it, explore an opportunity to integrate, both the rear axle models in a single trolley. These and other object, aspects, features and advantages of design will become apparent from the following detailed description of the preferred embodiment taken in conjunction with the accompanying sketches [8].

Brief description of the drawings

Fig.4: Isometric view of sliding arrangement with Bolt and Nut assembly.
Fig.5: Isometric view of complete assembly of multipurpose rear axle storage trolley.
Fig.6: Front view of storage trolley with two rear models.

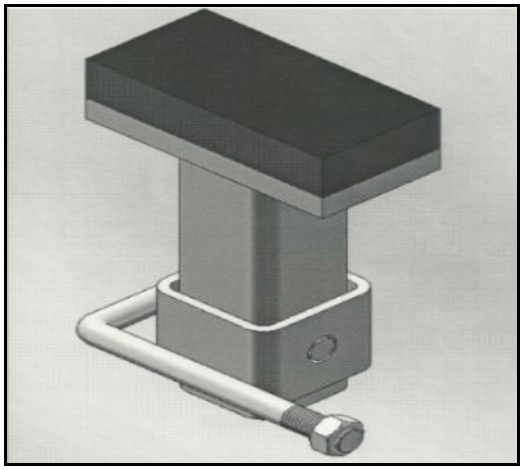

Fig.4. Isometric View of Sliding Arrangement

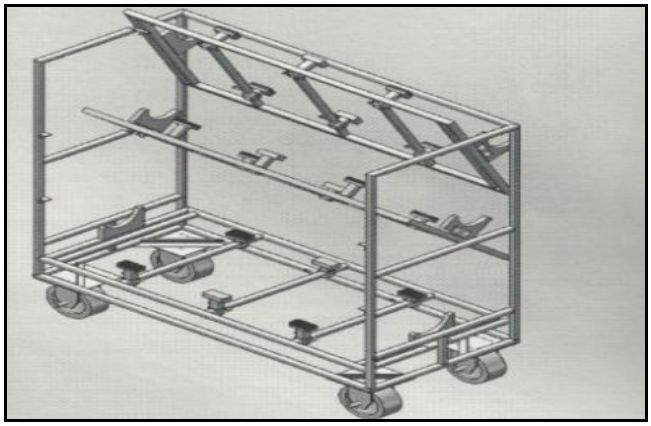

Fig.5. Isometric View of Multipurpose Storage Trolley

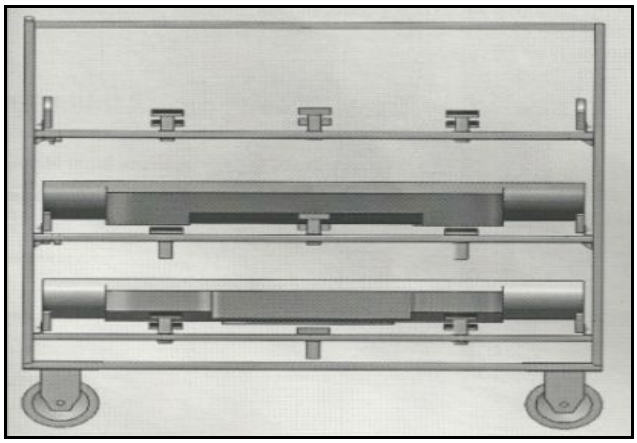

Fig.6. Front View of Multipurpose Storage Trolley with Two Rear Axle of Model X and Y

Fig.7. Fabricated Model

The above figure shows the combination of both 'X' and 'Y' model.

4. Benefits Achieved

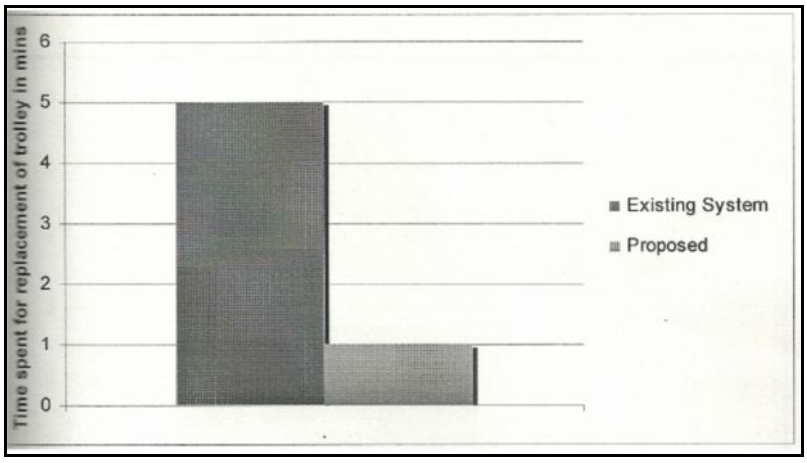

Fig.8. Processing time (during model change)

From the above chart can see using our system of storage trolley, the processing time for the rear axle assembly is improved by reducing 4 minutes during model change for every lot. It means, during model change the processing time of 4 minutes is saved, in which by utilizing this available time, productivity is improved.

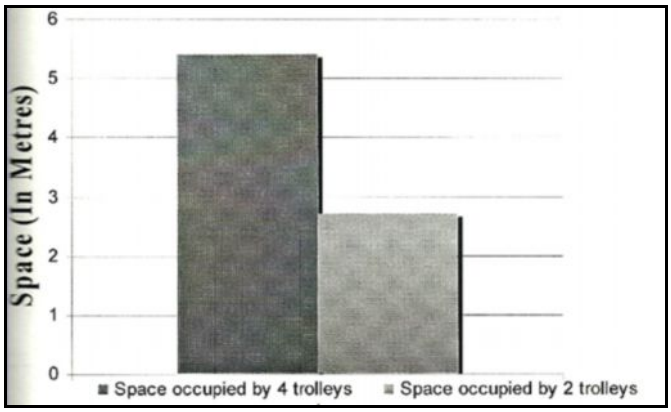

Fig.9. Availability of space (with reference to trolley)

From the above chart, infer that with the use of our new system, the number of rear axle storage trolley is reduced to 2 numbers. By means of which, the space can be minimized from 5.54 to 2.75 square meters. This available space can be used for other purpose.

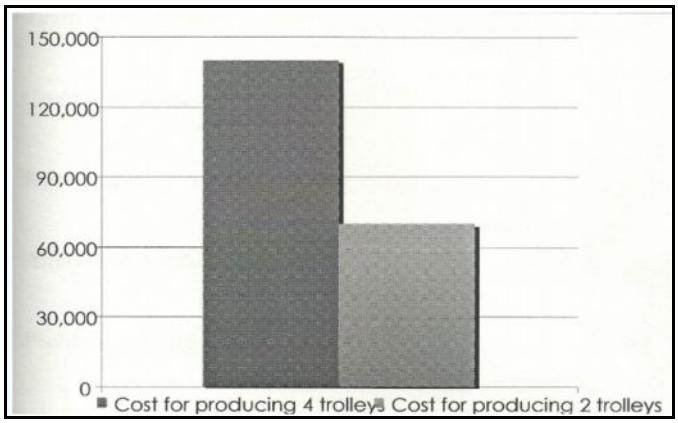

Fig.10. Production cost (with reference to trolley)

From the above chart see, in future the cost of producing four trolleys can be considerably reduced to two trolleys. With the invention of new system it is essential to construct a single storage trolley for 2 rear axle models.

5. Conclusion

By implementing this method, which enabled an effective space reduction and help in productivity improvement by decreasing the processing time and also the cost of storage trolley. This model allows the user to use both the rear axle model in a single trolley. This also reduces the cost of trolley. This model also increases the effectiveness of the model through active participation and continuously strives in achieving excellence in areas like quality, cost, and safety.

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