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IMPLEMENTATION OF LEAN TOOLS AND EGONOMIC ASPECTS IN THE DESIGN OF A CARAVAN

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Abstract - *The project aims to overcome major challenges like improving the efficiency, productivity, and Ergonomics based caravan designing company. One of the biggest problems for the implementation of lean is the voluminous nature of work and various types of resistance in the early stages. If we ignore such resistance and plow ahead with implementation, the result is likely to be nothing more than superficial improvements. Thus, we have implemented the concept of Lean by providing both flexibility and comfort to the end consumer. Some of the major lean tools are implemented like Poke Yoke, single-minute exchange of die, Kanban, kaizen, standardized work, and takt time.*

1.INTRODUCTION

Lean assembling is an administration reasoning zeroing in on the decrease of the seven squanders (Over-creation, Holding up time, Transportation, Handling, Stock, Movement and Scrap) in fabricated items. By disposing of waste (Muda), quality is improved, creation time is decreased, and the expense is diminished. Lean is tied in with getting the right amount while limiting waste and being adaptable and open to change. Lean assembling is a strategy which center around client needs and satisfies it by conveying the necessities at less time with top notch and less expensive expense through taking out a wide range of stowed away squanders that present in the organizations by nonstop improvement

1.1 EVOLUTION OF LEAN MANUFACTURING

The idea of Lean was created by the Toyota leader, Taiichi Ohno (1912-1990). Mr Ohno initially distinguished the seven sorts of MUDA (squander). Mr. Ohno's convictions were formed by his investigation of the Model T Portage (1913) Ceaseless stream in definite gathering, as well as his interest with American grocery stores. In 1913 Henry Portage planned the Model T Mechanical production system so that'll the cycle was in a similar grouping as the form. Preceding these all-assembling processes (stepping, welding, and so on) were assembled making clump producing. While in the US Mr. Ohno understood that the American Store loading and restocking strategies were infinitely better to the techniques utilized in weighty ventures.

2. LEAN IMPLEMENTATION

2.1 POKA YOKE

Poka Yoke is a Japanese term that means "mistake-proofing" or "inadvertent error prevention". A Poka Yoke is any mechanism in any process that helps an equipment operator avoids mistakes. Its purpose is to eliminate product defects by preventing, correcting or drawing attention to human errors as they occur.

In this company before welding, the pipes are bent as required. It takes more time to mark the pipe and check for accuracy every time they bend it. Therefore, introduction of Poka Yoke will help in reducing the time taking to complete the process.

Thus, a stopper is introduced in the pipe bending machine at particular length. This avoids the errors that are made by humans. As pipe to be bent is of constant length in the most cases. This acts as a perfect method of Fool Proofing and has immediate effect on time, as it reduces the time taken to bend the pipe from 250 seconds to 100 seconds.

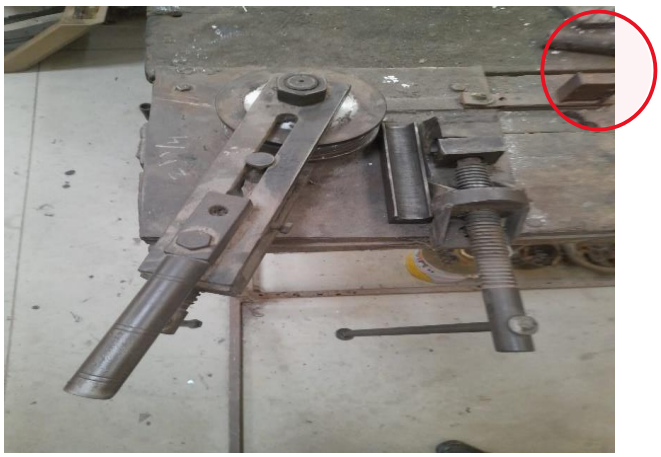

Fig. 1 Vice

2.2 5S CONCEPT

2.2.1. SET

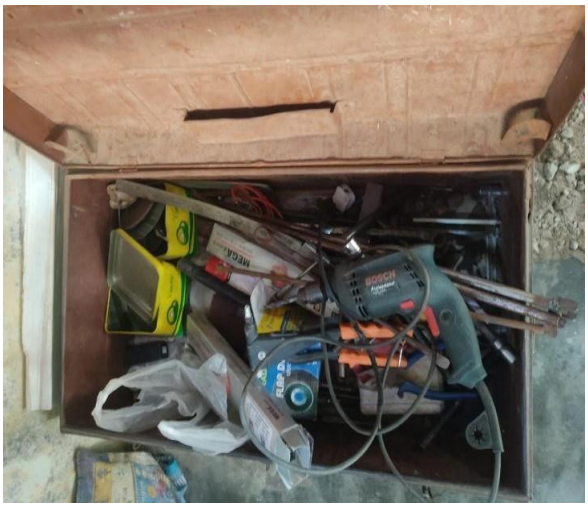

Fig.2 Before arrangements

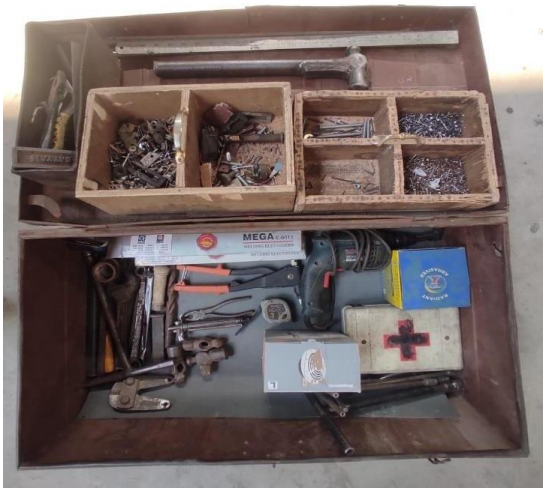

Fig.3 After arrangements

Objective:
Arranged tools in the tool boxes according to the shape and sizes

Description:
Tools such as bolts, nuts, steel nails, drilling machines, spanners, welding electrodes, etc., are arranged properly in a tool box based on their shapes and sizes. This results in saved working time.

Difficulties faced:
Improper arrangement of tools can cause more time consumption.

Suggestions:
To solve this issue, separate boxes are needed for tools such as steel nails, bolts, and nuts, based on their shapes and sizes.

Implementations:
We have separated various tools into separate boxes based on their sizes. This has helped us save time.

2.2.1. SHINE

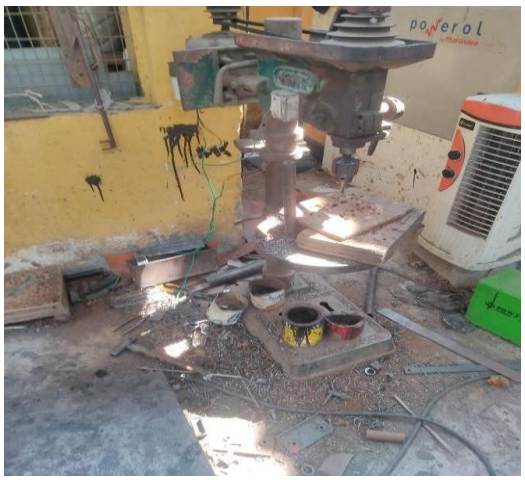

Fig. 4 Before Shine

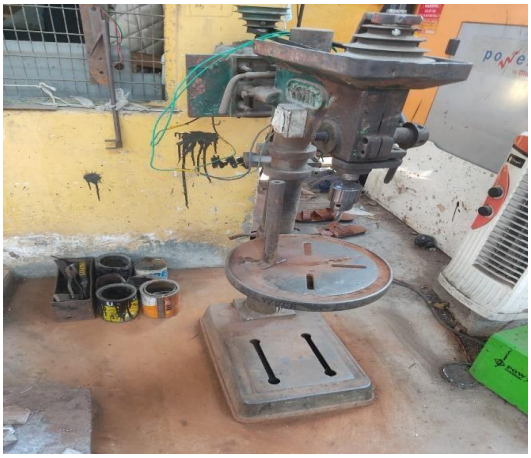

Fig. 5 After Shine

During the drilling process, various tools were scattered around the machine and the burs on the circular plate were sticky, which could lead to problems during the drilling process. To ensure smooth operation we cleaned the area around and arranged the tools. This helped us to work without problem.

2.3 KAIZEN

Kaizen is a Japanese term that refers to the practice of continuous improvement. The word "kai" (change) and "Zen" (Good), which together mean "change for the better" or "improvement". The Kaizen philosophy has been implemented in organizations around the world as a way to improve production values while also improving employee morale and safety.

2.3.1 Kaizen improvement in Pipe Bending Manual Machine

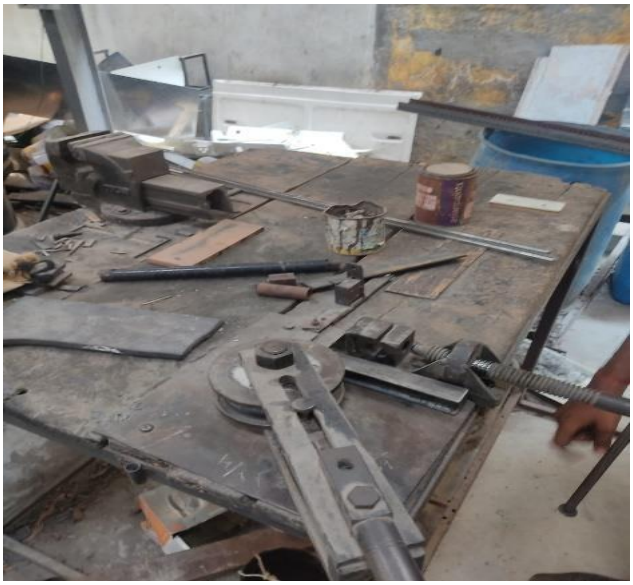

Fig. 6 BEFORE KAIZEN

Problem Definition:
The current setup of the pipe bending machine involves fixed it on a table, but the tools and pipes are not located nearby. which the workers spending more time searching for the necessary tools and pipes.

Why -why Analysis:
Why: the tools and pipes were not located near the pipe bending machine caused a problem for workers. As they had to spend more time searching for these items

How: place the pipes and tools near the pipe bending machine it reduces the time workers spend for searching.

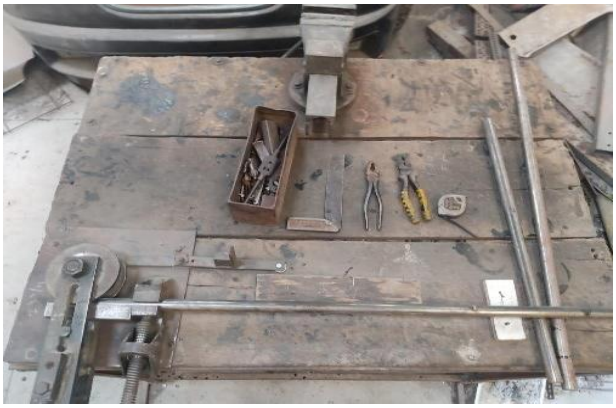

Fig. 7 AFTER KAIZEN

BENEFITS:
To reduce the time workers spend searching for them, which can lead to delays, frustration, and decreased productivity. so, we have placed the pipes and tools near the pipe bending machine to reduce the time workers spend searching for them.

2.3.2 Kaizen improvement in Drilling machine

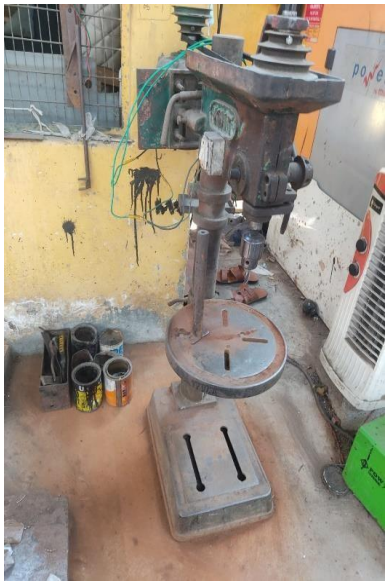

Fig. 8 BEFORE KAIZEN

Problem Definition:
The use of a fixture plate for holding pipes during the drilling process presents a vibration that can cause the pipes to move during drilling.

Why -why Analysis:
Why: due to drilling process, the machine generates vibrations, which cause the pipes to shake.

Why: holding the pipes manually may not provide sufficient stability, resulting in movement and misalignment during drilling.
How: the support plate was attached to the fixed plate using bolts and screw, ensuring a secure and stable setup.

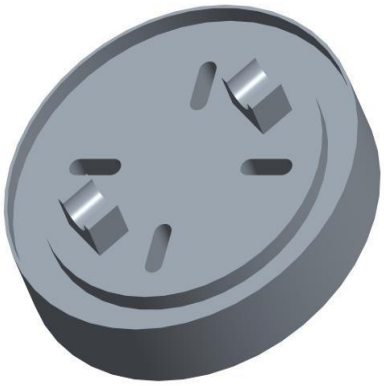

Fig. 9 AFTER KAIZEN

BENEFITS:
We have suggested a support plate onto the fixture plate to hold the pipes during drilling, the pipes can be securely held in place, reducing the need for manual holding and minimizing the mismatched holes. This effectively prevents vibrations from occurring and results in higher accuracy and precision.

2.4 TAKT TIME:

Takt time is defined as Maximum allowable time which you need to produce a one product in order to meet customer demand

$$\text{Takt Time} = \frac{\text{Net operating time}}{\text{Customer requirement}}$$

Data taken:

Total working hours/day = 8 hours

Lunch = 30 minutes

Breaks = 30 minutes

Startup meeting = 20 minutes

Net operating time per day = Total working in min - (Lunch, Startup meeting and Breaks)

= 480 – (30+30+20)

= 480 – 80

400 Min/day.

Average working Days in a month = 25 days

Net operating time per month = Average working days × Net operating time per day

= 25 × 400

= 10,000 min/month

No of seats required per month = 55 seats

$$\text{Takt Time} = \frac{\text{Net operating time}}{\text{Customer requirement}}$$

= 10,000/55

= 181 Minutes/unit

Every 181 Minutes we really want to deliver no less than One seat to meet customer necessity.

3. CONCLUSIONS

Improved quality, enhanced productivity, shorter lead times, and more customer satisfaction are just a few advantages that organisations that effectively use lean manufacturing concepts may enjoy. It is a continuous process that needs constant development and adaptability to shifting conditions to maintain success over time. By implementing the lean tools we achieved 10 – 15 mins reduction of overall production in a day.

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