Design and Development of A Semi-Automatic Milk Can Tilter Mechanism

Nagargoje Urmila S [1], Aditya Anil Shirke 2, Abhishek Eknath Pilgar [3], Matkar Somnath Machindra 4, Sandip Appasaheb Dudhade [5]
[1] *Assistant Professor, Adsul's Technical Campus, Ahilyanagar India*
[2,3,4,5] *Department of Mechanical Engineering Adsul's Technical Campus, Ahilyanagar,India..*

***Abstract*—Material handling plays a vital role in improving productivity in dairy industries. Manual tilting of milk cans involves significant physical effort, increased cycle time, and risk of injury to workers. This paper presents the design and development of a semi-automatic milk can tilter mechanism aimed at reducing manual effort and improving operational efficiency. The system consists of a conveyor frame, tilting fixture, electric motor, and belt drive mechanism. The proposed mechanism reduces manpower requirements, improves safety, and enhances productivity in dairy processing plants. Experimental results show reduced cycle time and improved ergonomics compared to manual handling systems.**

***Index Terms*—Material Handling, Milk Can Tilter, Semi-Automatic System, Conveyor Mechanism, Ergonomics, Dairy Industry**

I. INTRODUCTION

Material handling is an essential activity in industrial production systems, particularly in dairy processing industries where large quantities of milk are transported in containers. Manual handling of milk cans is labor-intensive and leads to worker fatigue, musculoskeletal disorders, and reduced productivity.

In many dairy industries, milk cans are manually lifted and tilted into storage tanks. This process requires multiple workers and leads to physical strain and risk of injury. Additionally, improper handling may result in milk spillage and contamination.

To address these issues, semi-automatic systems are widely being adopted. The development of an efficient milk can tilting mechanism helps improve safety, reduce operational time, and increase productivity. This paper focuses on the design, fabrication, and testing of a semi-automatic milk can tilting system suitable for small and medium-scale dairy units.

II. LITERATURE REVIEW

Material handling systems have been widely studied to improve industrial efficiency and safety.

Gupta et al. (2013) studied the selection of material handling equipment for various industrial applications and highlighted the importance of selecting proper equipment based on load and environment conditions.

Kumar and Raj (2016) presented methods for selecting flexible manufacturing system equipment using analytical techniques.

Kulkarni and Gudhatbe (2016) discussed conveyor-based material handling systems and analyzed their performance in industrial operations.

Patidar and Tiwari (2016) reviewed robotic arm technologies and their applications in automated handling systems.

Kay (2012) described principles of material handling equipment design and ergonomic considerations for safe industrial operations.

These studies emphasize the need for automated systems to improve productivity and reduce worker fatigue.

III. PROBLEM STATEMENT

In dairy industries, milk cans must be lifted manually and tilted into storage tanks. This manual process creates several operational problems:

- High manpower requirement
- Worker fatigue and back pain
- Increased cycle time
- Risk of injury

- Milk wastage due to improper tilting
- Possibility of contamination

These issues demand the development of a semi-automatic mechanism to improve efficiency and safety.

IV. OBJECTIVES

The main objectives of the project are:

1. To reduce manual effort in milk can tilting
2. To minimize worker fatigue
3. To improve productivity
4. To design an efficient tilting mechanism
5. To fabricate and test the prototype
6. To reduce operational cost

V. METHODOLOGY

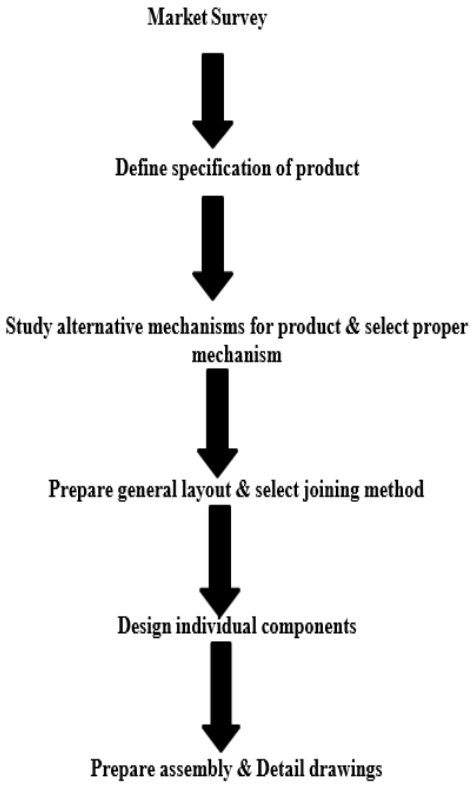

Fig .01 Flow Chart

VI. SYSTEM DESIGN

The semi-automatic milk can tilter mechanism consists of the following major components.

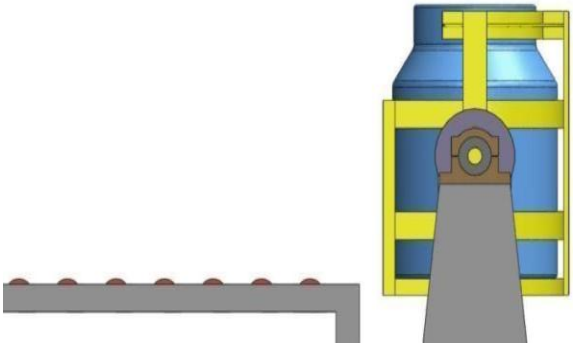

Fig 02 System Mechanism

6.1 Conveyor Frame

The conveyor frame provides structural support to the system. It is fabricated using mild steel square tubes to ensure rigidity and durability.

6.2 Conveyor System

The conveyor transports milk cans from the receiving area to the tilting position. This reduces manual handling effort.

6.3 Can Fixture

The fixture holds the milk can securely during the tilting process. The fixture is designed to prevent slipping and ensure proper positioning.

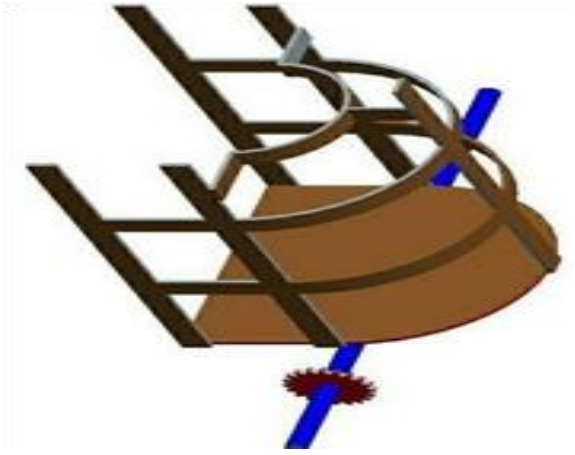

Fig 03 Can Fixture

6.4 Tilting Mechanism

The tilting mechanism consists of:

- Electric motor
- Shaft
- Belt drive
- Rotating fixture

The motor rotates the shaft, causing the fixture to tilt the milk can up to approximately 120°, allowing complete milk discharge.

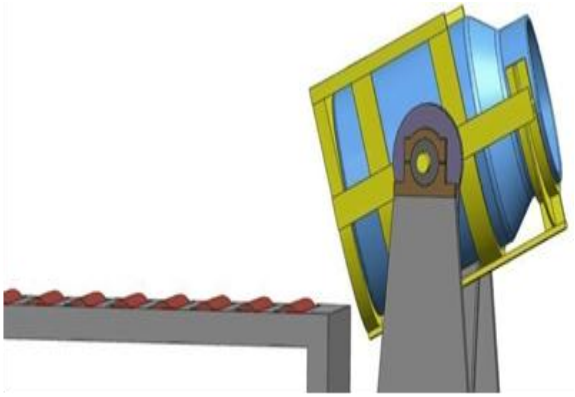

Fig.04 Tilting Mechanism

6.5 Power Transmission

Power is transmitted using a belt drive system connecting the motor to the rotating shaft.

Fig 05 Final Working Project

VII. MANUFACTURING PROCESS

The fabrication process involves several standard machining operations:

1. Material measurement
2. Cutting
3. Machining
4. Drilling and tapping
5. Welding
6. Grinding
7. Assembly

These processes ensure dimensional accuracy and structural strength.

VIII. RESULTS AND DISCUSSION

The fabricated semi-automatic milk can tilter mechanism demonstrated efficient operation during testing. The tilting motion was smooth and controlled, minimizing milk spillage.

Compared to manual handling:

- Manpower requirement reduced
- Worker fatigue decreased
- Cycle time reduced
- Productivity improved

The system proved to be effective for small-scale dairy operations.

IX. ADVANTAGES

- Reduced manpower requirement
- Improved worker safety
- Reduced fatigue
- Increased productivity
- Reduced cycle time
- Cost-effective operation

X. APPLICATIONS

The developed mechanism can be used in:

- Dairy industries
- Milk collection centers
- Food processing industries
- Liquid handling plants
- Packaging industries

XI. CONCLUSION

The semi-automatic milk can tilter mechanism provides an efficient solution to manual handling problems in dairy industries. The system reduces worker fatigue, improves productivity, and enhances safety. The design is simple, cost-effective, and suitable for small and medium-scale industries.

XII. FUTURE SCOPE

Future enhancements may include:

- PLC-based automation

- Sensor-controlled operation
- Hydraulic actuation system
- Integration with automated conveyors
- IoT-based monitoring systems

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