



Design and Development of Hand Operate Milk Churn Machine

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Abstract: This paper is on the design of milk churning mechanism manually for the benefit of farmers. This efficient and affordable mechanism is expected to support most of the farmers in the rural areas in the country. It is learnt that most of farmers are depending on conventional tool which requires physical effort and not efficient in the production process. Although milk production provides economic value to farmers, demanding physical strength and consumption of time in the current practice of milk production has led to shortcoming in other daily farming activities. To mitigate this challenges and to strengthen economic of rural farmers, the design and development of this milk churning mechanism is initiated as research project. The outcome is intended to serve as resourceful tool in the milk production.

Keywords: churner, energetic, exponential, agriculture, robust.

I. Introduction

The milk churning mechanism is for the purpose producing various milk products such as cheese, curd and butter. Currently, much of the farmers use conventional tools in the milk production which is also one of the major source of their family income. In most of the rural areas, they are still using the traditional method, which is physically challenging to maintain quality and potency on daily basis. The issue is also owing to lack of electricity connection and financial burden. This mechanism although operated manually, it has enhanced features that will make the process much easier and it will also minimize the financial burden on the farmers. Further, farmers will also have scope in the extending their production to support their livelihood. The effort taken is considered to work force, which is major factor for contributing the success of any manual process [1]. To multiply the man force here with introduce of mechanism to easy operation and improve the lifeline of rural area.

II. Literature Review

(R.V.Paropate and Mahesh S. Gorde, 2016)[1] Work on 'pedal operated churner to improve efficiency and provides affordable rate to normal milkman'. Besides, it assist on inflating the production rate in rural area. It observed some parts in rural areas still using long process to churn the buttermilk. To resolve the issues it has been developed with robust mechanism to produce high volume dairy products in the market.

(Ahmad Aljaafreh, 2015)[2] 'Butter Churning Process Automating Based on Acoustic Signals'. In this paper, it discussed on automating butter churning process by utilizing digital signal processing techniques based on the sound from the churning process. The process involve three phases on the base of sound characterizes in each levels. In first stage, the team record churning phase, second stage with butter-begin phase, where the butter start forming, and final butter collection, where the butter particles gathered. Artificial neural network were used to classifier. It also describes the design and implementation of the system using dsPIC digital signal controller.

(Adarsh M. Kalla. et.al. 2016)[3] Work on 'Development and performance evaluation of frustum cone shaped churn for small-scale production of butter'. The team focus on churning performance. In the process, it alter churning temperature and churn speed of butter. In the process it record different parameters of temperatures 8°, 10° and 12 ° to the churn speeds of 35, 60 and 85 rpm respectively. The optimum parameters of churning time given to 40 minutes, and found moisture content is 16 % and overrun 19.42 % at the temperature of 10 °C with churn speed 60 rpm. The team found appropriate conditions of churning temperature and churn speed produce high quality of butter.

III. Methodology

A. Concept

The simple mechanism work on rotary motion to obtain reciprocationat final. Initially,the rotary motions produce through handcrankto convert reciprocating motion in the process of churning milk.

B. 3d model

The figure 1 shows a complete 3-dimension modelof drawing. It is essential to design a model to reveal its main function and reinstate the presentation of architecture drawing.

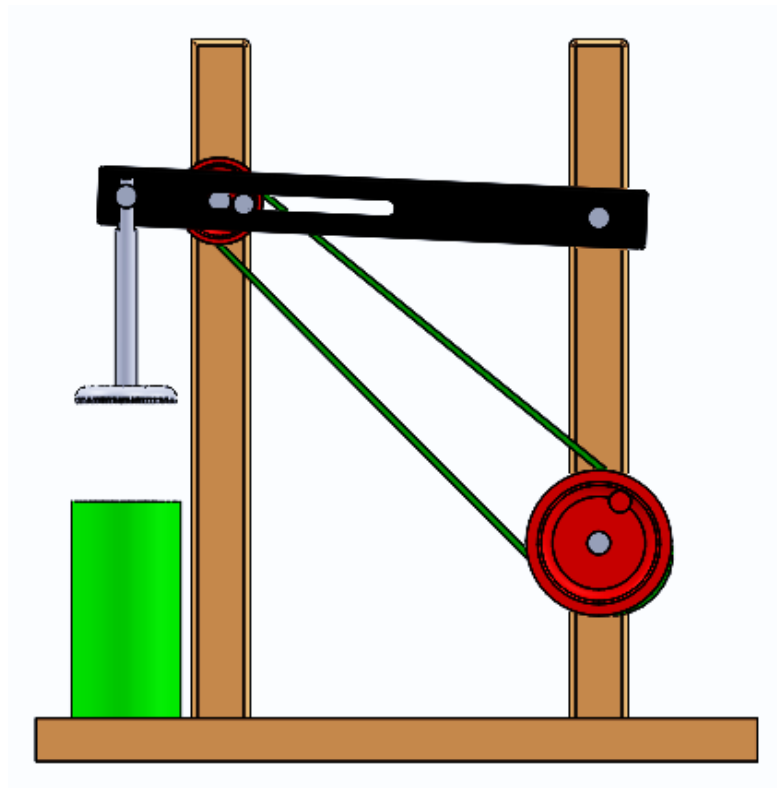


Figure 1: 3-Dimensional Model

C. Multi-view

Figure 2: Illustrate the orthographic views of a mechanism, which describes actualsize and shape of the features whereas in 3D model simply, it depicts the product and will not suffix in the process of developing products. Probably multi views provides all the dimensions aspects of the parts.

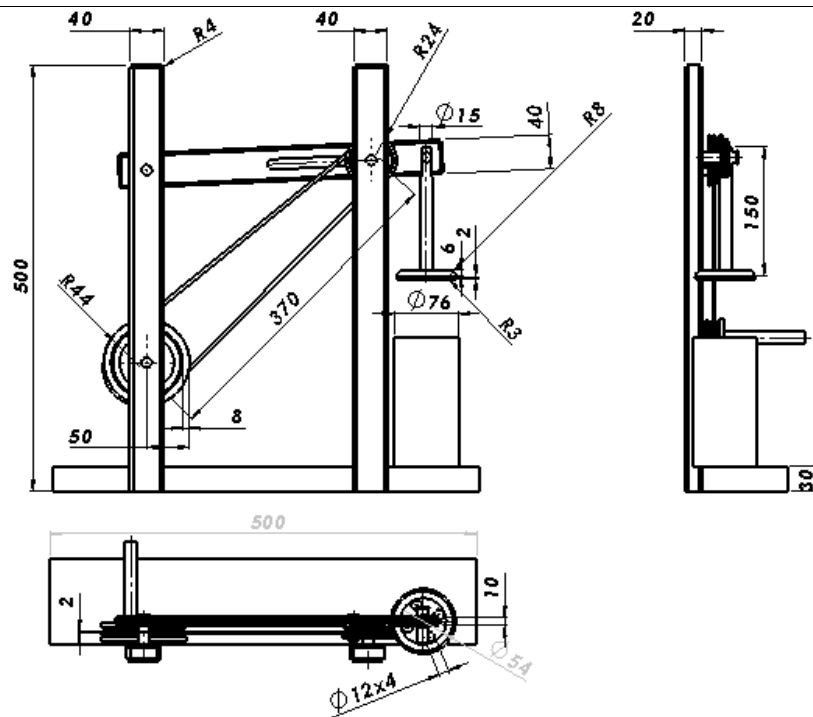


Figure 2: Multi views

D. Working mechanism

The manual milk churning mechanism involves steel jar, churning wheel, belts drives, pulleys, crank wheels and connecting rod as shown in Figure 3. It is operated manually through hand crank to produce rotary motion. The rotary motions further transmit to driven pulley via belt drive. In the driven pulley, it consists of a pin for link up with slotting bar. When the pulley rotates to its axis of shaft, the slider bar creates a swing motion. This swing motion from the slider bar converts reciprocating motion to connecting rod, in which it obtains the back and forth motion to churn the buttermilk by churning wheel.



Figure 3: Complete View

IV. Scope of the Mechanism

In the current mechanism, it has identical scope to improvisation in the area of size, parts and materials types. It can be enabled by motorized mechanism to cut the churning duration.



V. Conclusion

Design of hand-operated milk churn is expected to facilitate easy in operation and to improve efficiency in the farm productions. It observed churn wheel reciprocate twice in a rotation of the crank wheel. The numbers of reciprocating cycle depends on the pulley ratio used. Compare to traditional methods of works, milkman can save time as well as production performance.

Reference

- [1]. R.V.Paropate, Mahesh S. Gorde , "Pedal Operated Butter Churner: Design and Development for Rural Area," *International Journal of Engineering Science and Computing*, vol. 6, no. 5, pp. 5019-5021, 2016.
- [2]. A. Aljaafreh, "Butter Churning Process Automating Based on Acoustic Signals," *JOURNAL OF COMPUTING*, vol. 3, no. 5, pp. 38-41, 2011.
- [3]. Adarsh M. Kalla, C. Sahu, A. K. Agrawal, P. Bisen, B. B. Chavhan, Geetesh Sinha, "Development and performance evaluation of frustum cone shaped churn for small scale production of butter," *Department of Dairy Engineering, College of Dairy Science & Food*, pp. 2219-2226, 2016.
- [4]. TANNAZ AMINZADEH VAHEDI, MOHAMMAD HADI GIVIANRAD, YOUSEF RAMEZAN1, "Effect of Churning Process on Heavy Metals in Cream, Butter and Butter Milk," *ORIENTAL JOURNAL OF CHEMISTRY*, vol. 31, no. 2, pp. 1141-1146, 2015.
- [5]. A. Tsedey, Z. Bereket, T. Genene , "Implications of Introducing Improved Butter Churner on Churning Time and Butter Making Efficiency," *Journal of Food and Dairy Technology*, vol. 6, no. 2, pp. 1-7, 2018.
- [6]. Patrizia Buldo, Jacob J. K. Kirkensgaard , Lars Wiking, "Crystallization mechanisms in cream during ripening and initial butter churning," *American Dairy Science association*, vol. 96, no. 11, pp. 6782-6791, 2013.