

Automatic Cream Filling Machine

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Abstract:

The Automatic Cream Filling Machine represents a breakthrough in the food and beverage manufacturing sector, specifically in cream-based product production. This advanced machinery offers a highly efficient and accurate solution for the filling process. It exhibits automated functionality, ensuring precise dispensing of cream into various containers, promoting product consistency and weight accuracy. Its versatility allows it to handle a wide spectrum of cream-based products and adapt to different container types from jars to tubes. With its adjustable settings, the Automatic Cream Filling Machine streamlines operations, reduces waste, and boosts efficiency while minimizing manual labor. This innovation not only enhances productivity but also optimizes cost-effectiveness in the food production industry.

Keywords — accuracy, precise dispensing, consistency, reduce waste

I. INTRODUCTION

Cream filling machines are sophisticated pieces of equipment designed to streamline and automate the process of filling various cream-based substances. These machines play a crucial role in the food and pharmaceutical industries, where precision, efficiency, and consistency are important. The primary purpose of cream filling machines is to enhance production capabilities by automating the labor-intensive and time-consuming task of filling containers and food products with creams, pastes, or semi-liquid products. These machines can handle a diverse range of cream viscosities, ensuring accurate and controlled dispensing. Cream filling machines contribute to improved product quality, increased production efficiency, and adherence to hygiene standards.

Manual and semi-automatic cream filling machines come with their respective drawbacks, impacting efficiency and productivity in the food industry. Manual filling machines, being heavily reliant on human labor, are labor-intensive. This

can result in slower production rates, increased labor costs, and inconsistencies in filling quantities due to variations among operators. Additionally, manual processes are prone to operator fatigue, potentially affecting the precision of the filling operation. Manual cream filling machines require careful attention to operator training, as the skill and attention of the operators play a crucial role in reducing the drawbacks associated with these filling methods.

Our automatic cream filling machine is designed to overcome these drawbacks. This paper will explore in detail the design, implementation, and performance of the pilot scale automatic cream filling machine emphasizing its potential for widespread use in the food industry

II. COMPONENTS USED

A. DC Motor

In an automatic cream filling machine, the DC motor serves as the engine that powers the entire filling process. Its ability to control speed is crucial for adjusting the flow of cream accurately, ensuring

precise amounts are dispensed into containers. The quick start and stop capabilities of the DC motor contribute to the efficiency of the machine, allowing for rapid and precise control of the filling cycle. It also helps in minimizing any potential wastage of cream

B. Spur Gear

A spur gear is a type of cylindrical gear with teeth that are cut straight and parallel to the gear's axis. These gears are one of the simplest and most common types used in mechanical systems. The teeth of a spur gear project radially, and they are situated on the face of the gear, extending outward. The primary purpose of spur gears is to transmit motion and power between parallel shafts. Spur gears are used in mechanical applications to increase or decrease the speed of the device and to control power and torque.

C. Ultrasonic Sensor

An ultrasonic sensor utilizes ultrasonic waves for distance measurement or object detection. The sensors emit ultrasonic waves from a transmitter, which then travel through the air until they encounter an object. Upon hitting an object, the waves are reflected back to a receiver on the sensor. Ultrasonic sensors are used to detect the object to be filled in this device. When the object is in close proximity to the nozzle, the machine will start discharging the cream.

D. Screw Conveyor.

A screw conveyor is designed to transport bulk by using a rotating helical screw blade, also known as an auger. It can handle a diverse range of materials, including powders, granules, and semi-fluid substances. The screw blade, which is mounted on a central shaft inside a tube, facilitates the movement of materials along the conveyor's length. As the screw rotates, it creates a continuous flow, pushing materials forward. In the automatic cream filling machine, the screw conveyor transports the cream from the hopper to the nozzle.

E. Arduino UNO

The Arduino Uno is a widely used microcontroller board based on the ATmega328P microcontroller. The board has a set of 14 digital input and output pins and 6 analog input pins. It has a USB interface that facilitates easy connection to a computer for programming and communication. It has a clock speed of 16MHz and operates at 5 volts. The inputs and outputs of the circuit are connected to the various pins of Arduino for implementation of specific programs.

F. Relay

A relay switch is an electromagnetic switch that uses an electromagnet to control the opening or closing in an electrical circuit. It operates as a remote-controlled switch. A small amount of electrical current in the control circuit activates the relay. The relay switch is used in the design to start and stop the filling by controlling the motor.

G. Potentiometer

A 100k ohm potentiometer is used in the design. It is a variable resistor commonly used in electronic circuits. It is used for adjusting voltage in the circuit. By adjusting the voltage entering the Arduino, we adjust the duration of filling.

III. METHODOLOGY

The automatic cream filling technology is implemented with the help of sensors that detect the product to be filled and a variable fill time setting that controls the rate and duration of filling.

The entire machine is driven by the DC motor that converts the electrical energy from a 12V battery to mechanical force. This mechanical force initiates the rotation of the screw conveyor. The screw conveyor then transports the cream filled in the hopper to the nozzle only when the ultrasonic sensor detects the object at the nozzle.

When the ultrasonic sensor detects the object, it sends a signal to the Arduino which gives a command to the relay which will in turn power on the motor and rotates the screw conveyor.

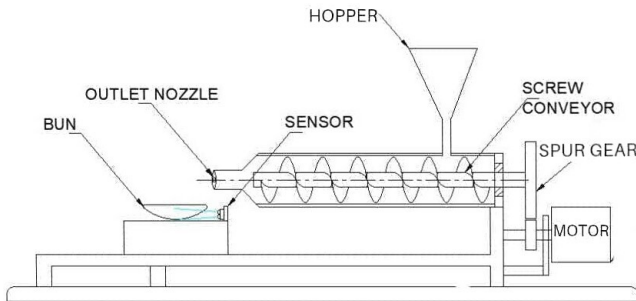


Fig. 1 Basic 2D design of the machine

The amount of cream to be filled is adjusted by a 100K ohms potentiometer. The adjustments made in the potentiometer will vary the voltage passing through the Arduino thus controlling the duration of the filling process. Once the cream is filled for the pre-set time, the Arduino sends a signal to the relay turning off the motor and this cycle repeats.

IV. CONCLUSION

A pilot scale automatic cream filling machine was successfully designed. This machine eliminates the shortcomings of manual filling such as spillage, non-uniform filling and causes huge wastage. This system ensures a uniform filling of cream in each product. It also contributes to waste reduction by ensuring precise and accurate filling.

A wide variety of cream and semi-solids can be filled by using a single machine. The design of the machine allows the cream to be filled in food products such as buns as well as bottles and jars. This machine is also user friendly and easy to operate.

V. LIMITATIONS

Although the filling process is automated, the design still requires manual help in placing the object to be filled near the nozzle. This might also lead to human errors and spillage and affect the overall efficiency of the machine.

Furthermore, the use of potentiometer as a variable fill time setter requires us to set time for each filling which is tedious process and results in time wastage.

VI. SCOPE FOR FUTURE WORK

The project can be transformed into a more effective tool by the incorporation of a conveyor belt or that transports the object to be filled to the nozzle without manual support.

Changing potentiometer as the variable fill time setting will eliminate the need for setting the time in each cycle.

The project can be further extended into a cream and liquid filling machine by making small changes in the design, thus transforming into a two in one system.

REFERENCES

- [1] Kiran Chaudhari, Aaqib Momin, Ritu Magare, Omkar More, Aniket Kantale, "Automated Filling Machine" International research journal of engineering and technology (IRJET). (vol 8, Issue 6, june-2021).
- [2] Kalidasan, B., Ben Ajai Raja, J., Giri Gowtham, M. and Kadeesh, M., 2018. Automatic bottle filling machine. *International Research Journal of Engineering and Technology*, 5(3).
- [3] Lu, Y. D., Zeng, L. C., Zheng, F. L., & Kai, G. S. (2015). Analysis and design of plc-based control system for automatic beverage filling machine. *Advance Journal of Food Science and Technology*, 7(1), 28-31.
- [4] Salah B, Alsamhan AM, Khan S, Ruzayqat M. Designing and Developing a Smart Yogurt Filling Machine in the Industry 4.0 Era. *Machines*. 2021; 9(11):300. <https://doi.org/10.3390/machines9110300>
- [5] Nainani, S., Rupawate, A., Sayyed, S., Poojary, S. and Bodhale, V., AUTOMATIC BOTTLE FILLING SYSTEM USING ARDUINO UNO.
- [6] Wankhade, P.S., Dabhade, R.R., Chavhan, G.K., Ade, K.P. and Jadhao, R.V., AUTOMATED WATER BOTTLE FILLING SYSTEM USING ARDUINO UNO CONTROLLER