



Automatic Bottle Filling and Capping Machine

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Abstract:

This Fabrication and analysis deals primarily with lower capacity bottle filling machines used by small to medium sized companies and excludes high speed rotary bottle filling machines typically found only in the mass market beverage industry. In contrast, the bottle filling machines discussed here are used throughout all industries including food, beverage, chemical, cosmetic and pharmaceutical but at lower speeds. In fact, most of the market for bottle filling machines in terms of units sold is for semi-automatic equipment that operates at normal speed. No one type of filling machine can handle all liquids in all industries. For example, a machine that fills bottled water cannot fill cosmetic cold cream. Nor would a chemical duty filler be used to fill pharmaceutical grade or dairy products. Although there are many different types of filling technologies, there are relatively few that are versatile, practical and cost effective to own and operate. The choice of filling machine depends on the range of viscosity, temperature, chemical compatibility, particulate size, foam characteristics, and hazardous environment considerations. Each one of the machines below is discussed with its strengths and weaknesses and range of best suited applications.

Keywords: Chemical filling, automation, bottle filling and capping, pharmaceutical, liquid filling.

I. INTRODUCTION

Filling machines are machines of the packaging industry used for filling of liquids, gases, paste or powder into containers. Capping machines are used to cap the bottles filled with material. So here we develop a system to demonstrate the filling as well as capping system used for bottles in industries using sensor and mechanical assembly. The system makes use of filling using piston and syringe arrangement along with a capping system using motorized arrangement all integrated in a single machine. The entire assembly consists of a conveyor that pushes empty bottles towards the filling head. The filling head is responsible for filling of bottles with water; later this assembly pushes the bottle in a circulating disc, which brings it to the capping station that places a cap on the bottle. The bottle that reaches the cap turning station which is a motorized arrangement responsible for spinning and tightening the cap on bottles. After this step, the assembly pushes the bottle over to the next point where it is rolled down the system as a finished product. We use a sensor-based system to control the entire system working using sensors and motorized assembly.

2. LITERATURE REVIEW

(1) PLC Based Automatic Bottle Filling and Capping System with User Defined Volume Selection -8th August 2012 In This Research Paper the researchers T. Kalaiselvi, R.Praveena at all. Have developed an automatic bottle, filling and capping system with a mechanism using sensors. Automatic filling process for all the bottles simultaneously with a user defined selection for volume to be filled.

(2) AN AUTOMATED BOTTLE FILLING AND CAPPING PROJECT FOR FRESHMAN ENGINEERING STUDENTS – June 2005 In this paper the researchers Kala Meah, Timothy Garrison, York College of Pennsylvania at all. The students work in small teams and have roughly 12 weeks to design an automated electromechanical system that first transports three empty bottles, three tennis balls. The machine must fill each bottle. of water, cap each bottle by covering the top with a

tennis ball, and then deliver the capped and filled bottles to an area outside of the operational zone.

(3) PLC (Programmable Logic Controller) BASED AUTOMATIC BOTTLE FILLING In This Research Paper the researcher Jaymin Patel Department of Physics and Electronics of Hemchandracharya North Gujarat University, Patanhas develop a bottle filling system based on certain specifications. More features can be added to this system as follows: Depending on the size, shape and weight of the bottles, Filling operations can be implemented. In This Research Paper the researcher MALLARADHYA H M, K R PRAKASH have Design and Develop an automated liquid filling to bottles of different height using PLC. A total control is made in a filling is achieved. The programming to this system developed is flexible, quickly and easily.

(4) PLC BASED AUTOMATIC LIQUID FILLING SYSTEM -March 2015 In This Research Paper the researcher S.Gowtham at all. From INFO Institute of Engineering, Coimbatore has developed a bottle filling machine for filling of same size of bottles. The Entire system is reliable and time saving.

III. METHODS AND EQUIPMENT'S

3.1 Traditional Methods of Bottle filling and capping

3.1.1 Manual Filling

This method involves Manual filling machines are hand operated and require no power. They are ideal for small scale production or laboratory use or areas where an external power source is not available or unreliable.

3.1.2 Screw Capping

A screw closure is a mechanical device which is screwed on and off of a "finish" on a container. Either continuous threads or lugs are used. It must be engineered to be cost-effective, to provide an effective seal, to be compatible with the contents, to be easily opened by the consumer, often to be enclosable, and to comply with product, package, and environmental laws and regulations.

3.1.3 Manual Weighing

In manual weighing the liquid is filled in the bottle using a

tank setup and the bottles weight is already pre Calculated. Now the liquid filled bottle is weighted and it is checked for accuracy each and every bottle, which is time consuming and costly due to labor involvement.

4. FABRICATION

4.1. Manufacturing Processes Used

No. of Mechanisms

- Rack and pinion
- Geardrive

Manufacturing Process

- ArcWelding
- CuttingOperation

Electronic Setup

- Arduino module
- Sensors Circuits
- Power supply unit

The complete assembly of the model is shown in the following figure 1 and the components are listed below

1. Conveyor
2. Motor Drive
3. Rack and pinion
4. SpurGear
5. Container
6. IR Sensors
7. Transformers
8. Relay

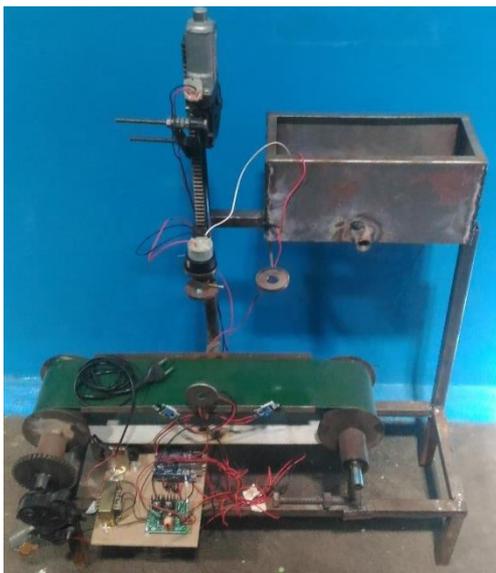


Figure.1. Assembly of bottle filling and capping machine

4.2. Components

4.2.1 Conveyor

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material handling and packaging industries.

4.2.2 SpurGear

In these two spur gears were used. One spur gear is attached to the shaft of the wheel and another spur gear is attached to the cam shaft which is located above from the base. Depends upon the teeth in the gear the chain is selected.

4.2.3 Rack and pinion

A rack and pinion is a type of linear actuator that comprises a

circular gear engaging a linear gear, which operate to translate rotational motion into linear motion. Driving the pinion into rotation causes the rack to be driven linearly. Driving the rack linearly will cause the pinion to be driven into a rotation

4.2.4 Electric Motor: An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

4.2.5

4.2.6 Sensors

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically.

4.2.7 Arduino Module

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control both physically and digitally. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL) permitting the manufacture of Arduino boards and software distribution by anyone.

4.2.8 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.

4.3 Working

Modern machines can have multi-lane inline equipment and can fill in both Ultra-Clean and Aseptic processes. The machine can receive product/s from one of many different UHT processors. Because it is multi-lane, it may be used to fill more than one type or flavor of product simultaneously. Production rates will vary, depending on the number of lanes, the size of the container and the viscosity of the product. Fill time is the major limit on cycle time, but the bottles can be filled in multiple stages to shorten the cycle time. The bottles after bottle washing machine are fed to the bottle filler by conveyor. The bottles are made to feed on to individually by a star wheel on to a Platform. The platform will rise and fall making it to meet the filler valve positioned above. The mouth of the bottle is pushed against the rubber seal of the filling device thus making it air tight. The air in the bottle is removed due to the vacuum which exists in the upper part of the filling vessel, which will also be rotating along with the platform of bottles. Simultaneously, the opening between the rubber seal and filling tube is released by the raise of the bottle against the rubber seal, and milk enters the bottle, due to low pressure existing in bottle.

5. CONCLUSION

The main objective of this project was to develop a bottle filling system based on certain specifications. The project presents an automatic filling system controlled by solenoid valve and different types of sensors as per the filling

requirement which has simple operation. The system has the advantages as simple structure and reliable operation. The system is controlled by various sensors. This was successfully implemented. We consider this project as a journey where we acquired knowledge and also gained some insights into the subject which we have shared in this report. By the installation of jet nozzle and strong solenoid valve can reduce the time to fill bottles and can efficiently increase productivity. A guide way could be used in case of vibration. A capping section could also be introduced. The nozzle positioning must be given more care and concentration. The system could be redesigned for increased bottle size and productivity.

6. REFERENCES

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