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Design and Fabrication of Semi-automatic liquid Filling Machine

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ABSTRACT: In this research, the project is about designing and fabrication of semi-automatic liquid filling machine using pneumatic actuator which is actuated by pedal which can be pressed by both foot and hand. This project combines the knowledge of Mechanical, Electrical and Pneumatic fields. The container of vessel to be filled and processed is placed manually because of which this is a semi-automatic machine. The action of actuation is done by operator which can be done by both hand or foot pressing the pedal which is operated by pneumatic action. The machine or process consists of several station where the several process of filling, bunk inserting, bunk placing and capping is done and this is done till the required production is achieved.

KEYWORDS: Pneumatic fields, Actuators

I. INTRODUCTION

In the world of fully automatic and expensive technology the small-scale industries cannot afford the expensive equipment like PLC for the production process. Due to such complexities in new technology industries have to hire an expert and it will add another expense to industries. To eliminate such expenses design of this semi-automatic liquid filling machine has been made. As we know that fully automatic and PLC setup have a large conveyor belt which occupies very large surface area so, this semi-automatic setup occupies less space than fully automatic machine. Here system has been developed to demonstrate work flow. In The entire system bottle is taken manually to every station. Then whisk is inserted into buck by jig and fixture arrangement. Then buck is inserted into bottle then it manually brought to the capping station where the cap is placed onto the bottle. The bottle that reaches to the capping s turning station which is a motorized arrangement responsible for spinning and tightening of cap on bottles and this process keep on repeating. It also has been considered that the arrangement of every part of the machine can get customized by the client with respect to their liquid and container dimensions. The machine is going to be work on pneumatic control system which is basically pedal operated. By any semi-skilled worker, it will be easily operated. The machine includes four station liquid Filling, wick pressing, bunk inserting and capping.

II. LITERATURE SURVEY

In this research paper the researchers T. Kalaiselvi, et.at have developed an automatic bottle, filling and capping system with the mechanism using different sensing devices. Automatic Filling process for bottles to be filled simultaneously with a user defined selection for measured volume to be filled. The researcher Deepika Saikia Et.at stated in her research paper Fabricated model of Automated bottle filling system. That can be used where high precision is not necessary and time limits are not bound. Hence it must be used application specific and must not be used in places where faster and more accurate methods of filling are available. The researchers Asst Prof. B. Kalidasan et.at stated in his paper 2018 This 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. Prof uday agashe et.at stated in his paper 2019 in this research paper the researchers kamble sandesh, mayur bhalekar developed a two head semiautomatic volumetric bottle filling and pneumatic crimping machine in that PLC is replaced by Arduino for controlling operation. This machine has been bifurcated into three parts viz. bottle filling, pneumatic crimping, round conveyor..

Vishwanath et.al stated in his paper 2019 in this research paper the reserarchers patwari nagnath, sabde manoharrao developed a pneumatic conveyor with bottle filling and placing machine in that there are different types of transmission system but they went through belt drive transmission due to minimal lubrication requirement. Nilesh vijaysabnis et.al stated in his paper 2017 improvement in productivity of bottle filling operation by using multiple nozzle PLC system. In this research paper the researchers sanjaykumar ingale ,pritishinde, sarvesh vade they used multi nozzle system for production with high accuracy. Ameer I. saleh et.al developed an PLC based automatic liquid filling system for different sized bottle in 2017.in this research paper the researchers lawahednaeem, mohammed j. mohammed they used and implemented the system is designed to working with different sized bottles by simply change th program by using PLC based system.

Sagar T.payghan et.at developed an automation of bottle filling with industry in 2016. In this research paper rani H.deshmukh,poojap. magar, vinodm.manure these researchers proposed an application of automation illustrating a PLC based fully automatic untouched liquid filling system with industry 4.0 which operated totally through cyber physical system. The researcher Deepika Saikia Et.at stated in her research paper Fabricated model of Automated bottle filling system. that can be used where high precision is not necessary and time limits are not bound. Hence it must be used application specific and must not be used in places where faster and more accurate methods of filling are available.

III. METHODOLOGY

A. objective

The fabrication and design of semi-automatic liquid filling, Wick Pressing, Bunk pressing and capping machine shall fill the liquid, Press the wicks and bunk in to the bottle and capping of the caps by roller capping. To design and supply the semiautomatic liquid filling , wick pressing, bunk pressing and capping machine as per cGmp guidelines, to be used for filling, Pressing and capping

B. Working Process

The Machines consist of number of assemblies which are liquid filling station, Wick Pressing station, bunk Pressing station and Roller capping station.

- The liquid filling station: - The bottle from the bottles tray is picked and held below the filling nozzle two at a time. The amount of liquid required can be set on the filling machine. The filling of the liquid through the nozzle begin as soon as the foot pedal is pressed. After releasing the foot pedal the liquid filling is stopped. After filling the bottle goes for wick pressing
- The wick pressing Station: - The wick is placed in to bunkmanually. The Combined wick and bung is placed in to the Fixture. After placing the combined wick and bunk into the Fixture press the foot pedal. The foot pedal operates the pneumatic cylinder and the jig and fixture assembly helps the wick and bunk to be at desired position
- The Bunk Pressing Station: - The bottle is placed in to the fixture manually and the combined wick and bunk is placed into the bottle. After placing the foot pedal is placed which

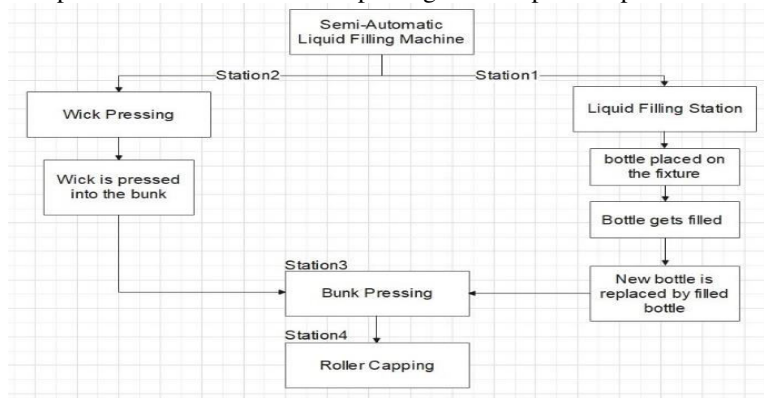


Fig. 1. Operational producer

operates the pneumatic cylinder and press the bunk into the bottle. .

- The Roller and capping Station: - Place the cap manually on the top of the bottle and place manually into the fixture. The capping is done by rollers which runs continuously by the motors. Press the foot pedal which operates the cylinders. The cylinder from top holds the cap and rollers rotate the cap for tightening purpose
- Safety's: - Do not placed the fingers or hand into the jigs or fixture will operating. Keep distance from rotating rollers
- Cleaning: - Turn off the power supply and air supply of machine before cleaning. Clean each and every station with water. Dry the machine completely before operating the machine again

C. Components Used

1. *Filling Unit machine*: The filling unit has two nozzles connected by silicon pipe for free flow of liquid. The flow of liquid can be controlled by the setting in the filling machine.

2. *Actuator*: The pneumatic Actuator is uses compressed Air for the cylinder for the movement which helps in the applying pressure for the inserting the wick into the bunk and the bunk into the bottle.

3. *3-Phase Motor*: 3-Phase motor is used to provide rotary motion to the gear mess attached with roller for the fastening of the capping of the bottle.

4. *Foot pedal*: It is the operate with the help of the foot. Which is attached to the pneumatic Actuator for the operation.

V. CONSTRUCTION

A. Filling unit

Fig.2 . shows that the filling unit has two nozzles connected by silicon pipe for free flow of liquid. The flow of liquid can be controlled by the setting in the filling machine



Fig. 2. Filling station



Fig. 3. Wick Pressing

B. wick pressing

Fig.3 . shows that the Machine of construction of the wick press is MS. The jigs and fixture arrangement are used for the pressing of the bunk into the bottles. The movement of the jig is controlled by pneumatic cylinder.

C. Bunk pressing

Fig.4 . shows that the Machine of construction of the Bunk press is MS. The jigs and fixture arrangement is used for the pressing of the bunk into the bottles. The movement of the jig is controlled by pneumatic cylinder.



Fig. 4. Bunk Pressing



Fig. 5. Roller Capping

D. Roller capping

Fig.5. shows that the Roller capping unit Machine of construction is MS. The movement of the roller is controlled by pneumatic cylinder.

VI. CONCLUSION

As it is focused on small scale industries where factors like compact in size and less power consumption and semi-skilled worker required for Process to complete the operation. The Filling of the bottle, inserting of wick and bunk in the bottle can be complete in 1-2 minutes.

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1.1. . BOOK FOR USE

- Strength of Material – Buckling of Column
- Strength of Material – Eccentric loading



- Machine Design I - Gear Design
- Machine Design I – Bearing Selection
- Production Process, production planning and control – Jigs and fixture
- Fluid Mechanics – Discharge Mechatronics- Actuator



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