

# Design and Manufacturing of Shape Pouch Filling Machine

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**Abstract**—The packaging industry has advanced over the few years. The pouch packaging machines also known as Form Fill and Seal Machines (FFS Machines) are available over a wide capacity range. In existing system the pouch packing process has been done using gear and cam system. This system requires frequent maintenance in magnetic clutch because of overheating. A low cost automated packing machine can use by small enterprises which would help to reduce their cost of the plant. This low cost automated machine uses simple pneumatic, mechanical and electrical systems. This project presents one such a low cost pouch packing machine and also an additional weighing and pouring mechanism has been added to increase the accuracy of the system. Various processes involved in the pouch packaging are neatly aligned and properly timed to get optimum production rate. A mechatronics system, developed for this machine, which takes feedback from this sensors and accordingly controls the manipulators has been introduced in this project. The expected outcome of the system is number of pouch packing is increased. A detailed cost comparison between a conventional machine and the one developed by us has been presented.

**Key words:** Pouch Filling Machine, FFS

## I. INTRODUCTION

In the current global scenario better quality, low cost with higher productivity are major factors for any small enterprise to flourish. To cope up with the ever increasing market competition, low cost automation is the safest strategy. Low Cost Automation comprises the use of standard components to mechanize or automate machines, processes and systems. These low cost automated machines can be operated by semi-skilled or unskilled labors as it requires limited human intervention.

Filling machines are set to fill up the cartons, plastic bags or pouch with the exact amount of product designated to each of them with accurately and effortlessly. There are several types of liquid filling machine are used in various packaging industry. The types which are commonly utilized in the production of goods are liquid filling machine, paste filling machine, powder filling machine and granular filling machine. Liquid filling machine is applied in the production of the liquid-based products such as carbonated drink, perfume, alcoholic beverages, and shampoo etc. It is convenient to use and easy to hold for any kind of operator. There are many of liquid filling machine which work on the different working principal according to the requirement. Only one type of filling machine is not suitable for all kind of liquid because of the viscosity. Viscosity is different for every liquid so we should have to consider it while designing the machine.

Mostly liquid filling machine working on the positive displacement of piston arrangement, some time we used

hopper mechanism to fill liquid or some time we used gravity force to fill the liquid in containers. There are so many type of liquid machine in the market we observed every type of liquid machine try to understand the behavior of every liquid machine and try to understand the working principal and mechanism of it and try to design a liquid filling machine which is easy to use for everyone and compact in size and also economical. We designed liquid filling machine are working on the pneumatic cylinder generated pressure. It is pneumatic cylinder based machine is working on suction and discharge principle. It is operated through nozzles arrangement which is connected with PLC unit and pneumatic cylinder. During suction stroke liquid is sucked in cylinder and during discharge stroke liquid is filled into pouch.

They are packing pouches from pack size of 50ml to 1000ml. So, it is required to do changeover as per the different packing size .As pack sizes are many, every time person has to set pneumatic pressure in cylinder to adjust volume . Each machine may have 2 to 8 nozzles and so all pneumatic cylinder pressure is to be set to get desired volume. This gives inaccurate volume and requires lot of time. So company is losing production and manpower. It has also a spare consumption like piston seal, which worn out due to continuously use and chemical corrosion. It is also having a lack of variable filling speed of material according to convenience, which may cause a foaming problem or otherwise we have to compromise with machine speed. There may be a possibility of miss operation and spillage problems, which can be completely avoided due to its redesign.

## II. PRESENT THEORIES AND PRACTICES

Currently there are 3 types of filling and sealing machines like SPFM-4N, SPFM-2N, and SPFM-2NB. Details are as below

Model	SPFM-4N	SPFM-2N	SPFM-2NB
Nozzle	4	2	2 Basic
Filling Range	50ml-1000ml	50ml-1000ml	50ml-1000ml
Product Output	750-1000 Bags/Hr	500-600 Bags/Hr	500-600 Bags/Hr
Power	1.2 KW	0.8 KW	0.8 KW
Supply	220v,50HZ	220v,50HZ	220V,50Hz
Price	2.5 Lacs	2 Lacs	1.5 Lacs

Table 1:

## III. APPROXIMATE EXPENDITURE

Shape filling machine will be approximate 2.50 lacs to 3 lacs. Below are the some components approximate prices

Sr.no.	Component Name	Approximate Cost
1	PLC unit	8850
2	Sensors	3000

3	Display	500
4	Pneumatic cylinder	6000
5	Casing	3000

Table 2:



Fig. 1: SPFM-2N

Firstly we discuss about the SPFM-2N, in this machine has 2 nozzles with sealing function. Also production rate of 500-600 bags/hr. and filling range is in between 50 to 1000 ml. This machine takes 0.8KW power of 220V with total cost of 2 lakhs. Because of using 2 nozzles the production rate of machine is less as compare to other machines.



Fig. 2: SPFM-4N

And the SPFM-4N, in these machine 4 nozzles with sealing function is used for the application and it has maximum capacity as compared to above machine of 750-1000 bags/hr. Also it takes more power i.e. 1.2KW and its cost is between 2 to 2.50 lakhs as its capacity is also high.

#### IV. MAIN COMPONENTS OF MACHINES

We will use various components in this SPFM-8N. But there are main components in this machine which are as follow

- PLC Unit

PLC is a solid state device. They are well-adapted to a range of automation tasks. All control operations (filling and sensing) are done using the PLC. The entire pouch filling process is automated by feeding the necessary conditions into the PLC using ladder logic. Ladder logic is one of the methods of programming a PLC. Thus, depending on the logic developed the various operations take place and the filling and sealing of pouches are done. PLC consists of an I/O unit, central processing unit, and a memory unit.

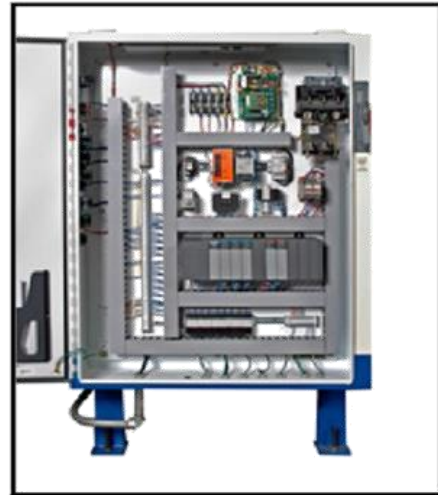


Fig. 3: PLC control panel

The input/output unit of the PLC acts as an interface to the real world. Inputs from real work are given to the input unit which is manipulated based on the programming, and the results are given back to the real world through the output unit of the PLC. All logic and control operations, data transfer and data manipulation operations are done by the central processing unit. The results and statuses are stored in the memory of the PLC. PLC's are used for a wide range of applications especially in the field of control and automation.

#### Pneumatic Cylinders:

Pneumatic cylinders sometimes also known as air cylinders are mechanical device which use the power of compressed gas to produce a force in reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction.

The piston is disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. We prefer to use pneumatic because they are quicker, cleaner, and do not require large amount of space for fluid storage.



Fig. 4: Pneumatic Cylinder

Because the operating fluid is a gas leakage from a pneumatic cylinder will not drip out and contaminate surrounding, making pneumatic more desirable where cleanliness is requirement.

#### Nozzles:

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe.

A nozzle is often a pipe or tube of varying cross sectional area and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and the pressure of the stream that emerges from them. In a nozzle, velocity of fluid increases at the expense of its pressure energy.

### V. FUTURE SCOPE

We can also use conveyor belts for large production in industries to fill large amount of containers easily without creating any messy environment. We can use the proximity sensors to control the flow of containers on the conveyor belts.

### VI. CONCLUSION

In this project we will design an Automatic shape pouch filling machine. It is different from old mechanism, because the operation of the system is totally different. This machine efficiently reduces the size of the machine because of the use of pneumatic system. Due to the use of pneumatic system maintenance cost of the system also reduces. The main advantages of this system are that it is easy to rectify the fault and increase the productivity of the system.

Using currently available information and data on flexible automation techniques and mechatronic systems the automation of the machine has been developed. Due to a simple design and the use of low cost reliable components, the machine is developed in lesser cost as compared to other conventional machines. Hence, the Low cost Automated Pouch Packing Machine is successfully developed which can benefit small industries or enterprises. Safety of the workers is achieved as the machine requires very less human intervention.

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