

# DEVELOPMENT OF A SMALL SIZE PACKET SEALING MACHINE

## Abstract

Small size packet sealing machine is a packaging machine processed by packaging machines found in packaging industry. Product packaging, especially for the food products, is done to extend the life of the product. Unfortunately, it is found that small entrepreneurs face difficulties in purchasing packaging machines due to the relatively high cost of the machines. There are many local products produced by small entrepreneurs especially food products such as chips, pastes and some other open plastic packs in houses which we need to seal. This generally results in damage of the food after some time because they do not use the correct packaging method. Therefore, the objective of this paper is to help small entrepreneurs to be able to buy packaging machines that are affordable and have quality. This machine will pack food quickly and it saves time. The main aim of this paper is to develop a small size packet sealing machine. During the designing, the main consideration is to avoid accidental chances as well as to hold the machine easily for any person. In this, wooden pieces of bamboo are used for making holders and wires are used for electricity flow and a switch is attached within wires to control the working of machine. Battery of 12V is attached as a source for supply of current. The machine is tested on some plastic waste wrappers and on small household items and the result obtained is satisfactory.

**Keywords**— Sealing machine, food products, bamboo, low cost, packet sealing

## Authors

### **Rashmi Arora**

Department of Mechanical Engineering  
Punjab Agricultural University  
Ludhiana (Punjab), India.  
rashmiarora@pau.edu

### **Simranjeet Kaur**

Department of Processing and Food  
Engineering  
Punjab Agricultural University  
Ludhiana (Punjab), India.

### **Saurabh Ratra**

Department of Electrical Engineering. and IT  
Punjab Agricultural University  
Ludhiana (Punjab), India.

## I. INTRODUCTION

Packaging is an important element of a product that is marketed in marketing and ensures product safety. Product packaging method is one of the elements that need to be emphasized in planning the production of a product especially for food products that are a daily necessity to consumers. In addition, the packaging method also reflects the quality of the product and the identity of the company that manufactures the product. Product packaging methods include how the product is packaged, materials used in packaging, the features, and specifications of the packaging. The process of selecting the best packaging method should be done so that the product produced easily gets a place in the market and can be marketed well. The best product packaging method is packaging that meets the needs of customers and can attract consumers to buy marketed products. Therefore, many sealer machines are sold in the market. Each machine has its own advantages and disadvantages depending upon the application. Before the existence of these machines, the way to attach the finishing plastic was to use the wax method. Those methods were less practical, and the result was less neat. There are many types of sealer machines widely sold in the market, but many machines are sold in large sizes and the price is also expensive.

As the flexible packaging sector undergoes growth, the range and diversity of heat-sealing equipment have expanded to cater to escalating needs. Amid the plethora of distinct sealing devices available, three primary techniques for heat sealing have emerged: Impulse sealing, direct or continuous heat sealing, and ultrasonic sealing. Gaining insight into the advantages and possible limitations of each approach significantly aids prospective buyers in selecting the optimal fit for their specific requirements.

Impulse heat sealing is a widely employed method for joining thermoplastic materials like Polyethylene and Polyurethane, requiring a moderate temperature for efficient sealing. This technique finds frequent use in sealing multi-layered, metalized, and oxygen barrier bags and pouches. Impulse heat sealers are equipped with replaceable heating elements (one or two, either round or flat) made of specialized material, usually a Nichrome alloy. These elements are strategically positioned in the top and/or bottom of the sealing bars. Upon placing the materials to be sealed within the sealer jaws, the jaws close and are secured via pneumatic or mechanical pressure. Subsequently, an electric current briefly heats the Nichrome element for a predetermined duration to achieve the required sealing temperature.

Impulse sealing offers inherent safety as high heat is generated solely when the sealing jaws are under pressure and the heating element is activated. This design ensures minimal risk of burns upon contact with the sealing jaws. Moreover, operating costs are reduced with impulse sealing. The energy consumption is minimized because the heating elements are activated for a very brief period during each sealing cycle.

This small size sealer machine is a packaging sealer machine used to simplify and speed up the adhesion of plastic finishes. Small entrepreneurs can use this machine because it can cover food packaging well and neatly. In addition, it can help to maintain the quality of food to avoid bacteria and air that can damage the quality of food. This machine has a very neat finish and can make food last longer. Not only dry food industries can use sealer machine, but wet foods also use it like paste.

A research study was carried out on wrap-around-machine (WAM) [1] To enhance productivity at Famifarm Oy, Finland, an analysis was conducted to assess the operational efficiency of the packaging machine. The study aimed to pinpoint potential obstacles and inefficiencies associated with the packaging machine's functioning, which were subsequently utilized as the focal points for the research. The outcome of this investigation offered systematic suggestions aimed at enhancing the overall performance and efficiency of the Wrap-Around-Packaging Machine. The strains packaging was mainly completed by hand in mushroom planting industry. In order to improve the low efficiency, an automatic packaging machine of the strains was designed [2]. The machine involved the auger delivery, heat-sealing and cutting mechanism. Theoretical calculation and numerical simulation was applied for the auger delivery unit. This packaging machine met the demand of the relative technical requirements, and suitable for promotion in the medium and small farmers. A design of an Automatic Wrapping Machine was proposed [3] using a PIC18F45X Micro-controller where the machine increased the efficiency of the packaging process which resulted in reducing the labour cost. That machine had 2 sections. One section was the wrapping mechanism, and the second section was the control system to control this mechanism. A Light Dependent Resistor (LDR) was used to detect the intensity of light on the feeder and give signals to the controller. A similar kind of system was developed [4] that supplied polythene bags through vacuum grippers and sealed these bags automatically and hence it was called an automated sealer. A homemade sealer machine [5] resulted in higher tidier in packaging and also was better. The sealer product successfully tested as more neat packaging, sealer was stronger, and conveyor could accommodate the weight of food products and could facilitate work during the sealer process is carried out. A simple and small packaging system was designed [6] to seal the plastic bags. The major components used were air compressor, double acting cylinder, air storage tank, 5/2 direction control valve, SMPS (Switch Mode Power Supply), a foot operated push button switch, a heat sealer, and tubes for air supply. The production rate was increased due to the use of pneumatic systems. An automated stamping machine [7] driven by pneumatic systems that consists of air compressor, directional control valves, air service unit was designed, fabricated, tested, and operated.

This invention must consider the characteristics and theory of origin while creating this small size sealer machine. The final design should be simple, lightweight, and portable. Component selection is based on studies and experiments to ensure that this sealer machine works flawlessly. In reality, safety and comfort are also prioritised.

The small size sealing machine was assembled with different materials collected from the market and assembled according to the requirement for holding the machine and to avoid electric shocks. Two bamboo wooden pieces having 3 inches length with round shape are used as a holder. Along with them the wires were connected for flow of current. A tactile switch having diagonal legs is also attached along with wires for controlling the machine. Battery of 1200 mAh is attached for providing electricity. A base made up of wooden sheet is also attached, where the whole machine is placed. It is a useful portable device called mini plastic sealer or mini heat sealer. It can be used to seal daily used small packaging for e.g., shampoo pouches, masala packets, chips packets, etc. Basically, this is used for small plastic packaging which we use in a small quantity and after that we have to preserve in another container or vessel. To avoid this, this mini sealer is used to seal once opened pouches or packaging to preserve and prevent them from deteriorating.

## II. CONSTRUCTION

Firstly, a bamboo stick of 1 inch diameter was taken and cut into half vertically with the help of wood cutter saw. Then two halves of 3 inch length were taken. The length of bamboo depends on the length of nichrome wire used. The length of bamboo was taken half of the length of nichrome wire. Accordingly, the battery size is also selected. For joining bamboos, simple rubber was used. Then 30 Awg nichrome wire was used along with 1200 mAh lithium-ion battery. After that nichrome wire is adjusted on the outer sides of bamboo of specific length. The wire is fixed with the help of small screws and rubber bands. The components used for making this small size sealing machine are:

1. **The holder :** The two pieces of bamboo having length and diameter of 3 inches and 1 inch respectively are used for making holder which seal the plastic bags.



**Figure 1:** Pictorial representation of Holder

2. **NichromeWire:** Nichrome refers to an alloy which is made from nickel and chromium. Nichrome wire is very useful as it resists heat as well as oxidation. The average wire diameter is 0.01 inches having resistance 6.68.



**Figure 2:** Pictorial representation Nichrome wire

- 3. Switch:** The tactile switch is an electromechanical device used to start or stop current flow along a circuit. The current rating of the switch is 50mA and having voltage 12v DC supply.



**Figure 3:** Pictorial representation of switch

- 4. Screws:** The screws should fit the nichrome wire so that the screws used do not damage the wood plate. Besides that, the finish can also be produced.
- 5. Rubbers :** Simple Rubbers are used for joining the holder.

### III. WORKING

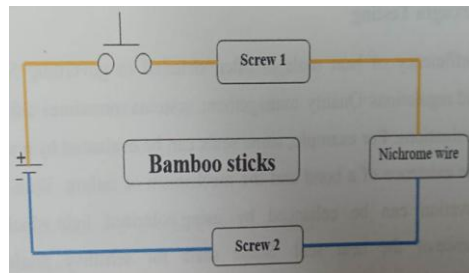
A heat-sealing machine is a type of sealer that encloses things using heat as the sealing agent. It functions by sending a high current impulse to the heater ribbon located on the device's surface. The heat wave created by this is powerful enough to melt and seal the bag or sheet that is sandwiched between the sealing bars. Most manufacturers will provide temperatures for sealing each film, and this provides a good starting point for the heat or time. It is generally recommended to start with a heat time of two seconds at 200° F and a cool time of two to three times the heat time. Heat sealers are used in many food packaging industries to seal the materials having thermoplastic layer. Firstly, sealing bar is heated to the required degrees of temperature, material melts and gets joined just like a zip liner bag.



**Figure 4:** Pictorial Representation of Small Size Packet Sealing Machine

Figure 4 shows pictorial representation of the developed small size packet sealing machine using bamboo sticks and lithium ion battery connected with nichrome wire and tactile switch. Firstly, when the tactile switch is pressed then the current starts flowing from the positive terminal of the lithium ion battery, then the current is passed through screw 1 and after that the current reaches nichrome wire. The negative terminal of the lithium ion battery

is connected to screw 2 to complete the circuit. When the current reaches the nichrome wire, it starts heating up and the bamboo sticks are being pressed by hand. The plastic bag which is to be sealed is placed inside the bamboo sticks. This results in sealing of that bag. The circuit diagram for the machine is shown in Figure 5.



**Figure 5:** Circuit Diagram of Small Size Packet Sealing Machine

Symbols	Name
	Tactile Switch
	Battery

### Calculations for Heat Generated

The heat equation used to calculate the heat generated during sealing of a shampoo pouch of 6 ml is

$$Q = I^2RT$$

Where Q is Amount of Heat Generated in Joules

I is Electric Current in Ampere

R is Resistance in ohm

T is Time in Seconds

Time taken to seal a shampoo pouch of 6 ml is 16 seconds.

Current (I) = 1200 mAh

As 1 mAh = 0.001 Ah

Therefore I = 1200\*0.001

$$= 1.2 \text{ Ah}$$

$$= 1.2*3600 \text{ Amp Sec}$$

$$= 4.32*10^2 \text{ Amp Sec}$$

Resistance of Nichrome Wire (R) = 6.68 ohm

$$\text{Hence } Q = (4.32)^2*(10)^4*6.68*16$$

$$= 19.94*10^6 \text{ Joules}$$

$$= 19.94 \text{ MJ}$$

### IV. CONCLUSIONS AND FUTURE SCOPE

The small size sealing machine provided good results during operating and there was no difficulty found. This advancement in sealing technology led to improved packaging hygiene and effectiveness. When utilizing the appropriate technique, such as employing a

tightly sealed machine that eliminates any possibility of air gaps entering or leaving the package. It can easily be handled by a person even by small children above the age of 6 years. The material is available at cheaper cost and is easily available. This machine is environment friendly as bamboo sticks are used and no plastic is used as per Indian government norms. Moreover, if plastic sticks are used instead of bamboo sticks, then it may burn due to the quick heating of nichrome wire. We can easily seal open packets with this mini sealer machine. This is more time saving than any other machine. The biggest advantage is that there are no accidental chances. The only disadvantage of this machine is that the battery life is short, and we need to recharge it after using twice. It takes ten seconds to seal a plastic packet. This cannot be used to seal large or heavy packets.

By scaling up the size of parts of machine and increasing the power supply, heavy plastic products can be used for sealing purpose. If we increase the length of bamboo pieces, we can use it on large scale. We can also use the battery having more voltage and use it on industrial level or big scale.

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