

Fabrication of Foot Operated Paper Plate Making Machine

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Abstract- A paper plate is a plate made of paper that is frequently lined with plastic to stop liquid from seeping through the paper or leaking out. Kraft paper is the type of paper used to make paper plates. This Kraft has a tiny layer of silver film applied to it. The paper is then coiled on a roller after passing through a series of rolling processes. Then it is cut to the necessary measurements, in this case 14x28 inches. The press machine is then given this paper with the necessary dimensions to give the plate the proper form. Our goal is to automate the laborious processes involved in removing the coated paper roller, cutting it to the necessary dimensions, and then transferring it to the press machine. The goal of this project is to automate the aforementioned function of the manually operated paper plate maker that is located at "School of Management Sciences Lucknow."

Keywords- Paper plates, Kraft, rolling silver film, press machine, automation.

1. INTRODUCTION

In home settings, paper plates are frequently used in place of metal plates. The fact that these plates can be thrown away makes them helpful. These plates can be produced for very little money. Making plastic plates is a tiny business that may be easily financed with the least amount of capital.



Fig.1. Paper plates

1.1. Press machines:

A press machine is a type of machine tool that uses pressure to alter the shape of a workpiece.

The line diagram of the press machine used in our industry is shown in the image below.



Fig 5.1.1. Line diagram of Press machine

There are different types of press machines

i) Manually operated press machine:

One person is needed to operate this machine. Figure depicts a manually operated press machine with a wheel that must be rotated by one person in order to apply pressure to the sheets in order to produce paper plates. One ton of pressure is needed to hand press ten sheets.



Fig.5.1.2 Image of manually operated press machine.

1.2. Types of Paper Cutters:

1.2.1. Rotary Paper cutters:

In rotary paper cutters, the cutting head is some kind of circular blade, sometimes just a plain razor blade. Paper is sliced by a cutting head that slides back and forth on a track. Rotary paper cutters are well renowned for their utmost accuracy and are widely used to cut photographs.

1.2.2 Guillotine paper cutters are excellent multi-purpose tools. They are also known as arm or lever cutters.

In most cases, they have a cutting blade and a long blade arm that can be lowered to cut material.

These cutters can be used to cut paper, card stock, and other materials, and they are typically highly accurate.

1.2.3. Stack Paper Cutters:

Paper cutters that can cut hundreds of sheets of paper at once are known as stack paper cutters, and they are monstrous machines. In print shops, these cutters are frequently used to trim prints and other materials. They are also widely used to cut larger sheets of paper into paper of a specific size. Stack cutters have a wide range of industrial and commercial applications. Typically, these are offered in manual, semi-automatic, and fully automatic versions.

1.2.4 Hydraulic paper cutters are arguably the strongest and most durable paper cutters on the market. These cutters are primarily used for high-volume cutting throughout the day and have a stack paper cutter design. These are frequently utilized in factories, print facilities, paper mills, and other establishments that deal with tens of thousands of sheets of paper per day.

1.2.5. Corner Cutters: To remove sharp edges from paper, use corner counters, also known as corner rounders. These practical devices can frequently round the corners of a stack of paper that contains more than 100 sheets at once. There are typically several various radius sizes available.

Form cutters, also known as paper slitters, are machines that automatically feed paper and slit it to the desired size.

In addition to slitting, many form cutters also give users the option of scoring and perforating. These kinds of equipment are excellent for creating marketing materials and can frequently perform multiple cuts at once.

2. LITERATURE REVIEW

Initially, the goal of the development of disposable food service goods was to improve industry procedures and hence, public health. The idea of PAPER PLATES was born as a result of this demand, the environmental peril that we were facing at the turn of the 20th century, and the necessity of making significant environmental conservation efforts.

When opposed to plates made of other materials, employing paper plates has a number of intrinsic advantages.

A paper plate is a plate made of paper that is frequently lined with plastic to stop liquid from seeping through the paper or leaking out. Kraft is the name of the base paper used for paper plates. This Kraft has a small layer of silver film covering it. The paper is then coiled on a roller after passing through a series of rolling processes. Then it is cut to the necessary measurements, in this case 14x28 inches. The press machine is then given this paper with the necessary dimensions to give the plate the proper form. Manual labor is used to remove the coated paper from the roller, cut it to the proper dimensions, and transfer it to the press machine. The goal of this project is to automate the aforementioned function of the manually operated paper plate maker that is located at "School of Management Sciences Lucknow."

Food is served on disposable plates since they are simple to use and dispose of. In the past, India utilized disposable plates made of leaves. In various states, several plant species have been employed to make plates. But paper and expanded polystyrene (foam) plates make up the majority of the disposable plate market today. Areca (Areca catechu), Siali (Bauhiniavahlii), and Sal (Shorearobusta) are the three varieties of leaf plates that were examined. The purchase of raw materials and labor costs accounts for more than half of the cost of making leaf plates. This shows that the manufacturing of leaf plates is a labor-intensive industry that generates jobs in rural areas. Paper plates (Rs 0.5/plate) and areca plates (Rs 7/plate) have the highest and lowest market prices, respectively. The production of Sal and Siali plates used about the same amount of energy as the production of paper plates, whereas the production of Areca leaf plates used the most energy. Nowadays, polythene sheets are inserted in Sal and Siali plates. Therefore, when examining the designs that are currently on the market, it was discovered that the only entirely biodegradable disposable plates were non-coated paper plates and Areca leaf plates.

A paper plate is a plate made of paper that is frequently lined with plastic to stop liquid from seeping through the paper or leaking out. Kraft is the name of the base paper

used for paper plates. This Kraft has a small layer of silver film covering it. The paper is then coiled on a roller after passing through a series of rolling processes. Then it is cut to the necessary measurements, in this case 14x28 inches. The press machine is then given this paper with the necessary dimensions to give the plate the proper form. The steps involved in removing the coated paper roller, cutting it to the appropriate dimensions, and then transferring it to the press machine.

"Excellent Paper Plate Engineering Company" was founded in 1972 and specializes in producing, supplying, and exporting Paper Plate Making Machine & Dies. Offering Paper Plate Machines, Paper Plate Making Machinery, Paper Plate Making Raw Materials, Paper Thali Making Dies, and Core Thali in this field of work.

2.1. Operating Theory:

A paper plate is a plate made of paper that is frequently lined with plastic to stop liquid from seeping through the paper or leaking out. In Indian villages, paper plates are typically manufactured by hand; our goal is to automate this time-consuming process and produce elegantly shaped paper plates. Kraft paper is the type of paper used to make paper plates. This Kraft has a tiny layer of silver film applied to it. The paper is then coiled on a roller after passing through a series of rolling processes. It is then cut to the necessary dimensions. The press machine is then given this paper with the necessary dimensions to give the plate the proper form. Manual labor is used to remove the coated paper from the roller, cut it to the proper dimensions, and transfer it to the press machine.

Instead of using a manual, labor-intensive craft, this project work uses a mechanically operated machine to make paper plates. These are reasonably priced, take up less time, and offer good dimensional stability.

A foot-operated controller for discrete inputs to a machine to be controlled is described. It consists of a base, a foot-receiving member for receiving a user's foot, which is movably secured to the base according to at least one degree of freedom and extends substantially within a plane, and at least two switches, each of which is located at a different location between the base and the foot-receiving member and each of which can be activated upon.

2. SELECTION & DESIGN CRITERIA

General requirements of machine design:-

- Simplicity of design
- Safety and easy to control
- Low cost
- Light weight

- Compact in size

3. DESIGN PROCEDURE

It is important to understand the project design before moving on to the production process. Before beginning production, it is crucial to design the project to avoid any negative impacts; the finished product contains of

- Product design;
- Functional design
- Technical design

3.1 Design procedure for a product:

A designer may take the following steps when creating a new product or its components:

Create a thorough description of the issue; it should be as clear as possible. Include information about the machine's intended use.

- Choose a potential mechanism that will move the desired object.
- Calculate the energy delivered and the forces operating on each component of the machine.
- Choose the material that fits each component of the machine the best.
- Calculate the permissible or design stress taking into account all the elements that have an impact on the machine part's strength.
- Define the machine's significance, necessity, and use.
- Issues with the demand and productivity of the machine as it is now used.
- Determine the dimensions of each component in order to avoid excessive deformation or breakage owing to the applied load.
- Modify the machine part(s) to facilitate manufacture and to be consistent with prior experience and judgment.
- Make assembly and detail drawings of the machine with detailed material and manufacturing procedure specifications, including accuracy, surface quality, etc.

3.2. ADVANTAGES

- This product can be used in place of plastic plates and mugs.

- A product that decomposes quickly.
- The use of more readily available and affordable materials.
- Eco-friendly goods.
- Rapid response is accomplished
- The design is uncomplicated.
- Simple to maintain and fix.
- The unit costs less.
- Overloading presents no fire threat.
- The cost of operating is lower in comparison.
- It is possible to operate continuously without pausing.
- It lessens manual labor.
- It cuts down on production time.
- Takes up less room on the floor.
- A less experienced operator is adequate

3.3. DISADVANTAGES

- It adds more manual labor.
- No high torque may be achieved.
- High initial cost.
- The lengthier production period

3.3. Where it can be used / it's Application

Restaurants, hawkers who sell food products on the side of the road, caterers (who are hired to provide meals for weddings and celebrations) who utilize paper plates, cups, and glasses, and manufacturers of ornamental things that use paper plates, Household uses.

3.4. MAIN COMPONENTS

- Punch
- Die
- Bottom plate
- Top Plate
- Rod

3.5. MATERIAL USED:-

3.5.1. MILD STEEL: -

Reasons:-

- Mild steel is widely accessible in the market.
- It comes in common sizes and is affordable to use.
- It has outstanding mechanical characteristics, making it simple to machine.
- It has a moderate factor of safety since a high factor of safety leads to excessive selection and unnecessary material waste. Low safety factor leads to unnecessary failure risk.
- It has a high tensile strength and a small thermal expansion coefficient.

Properties of Mild Steel:

M.S. contains 0.15% to 0.30% carbon. They can only be toughened because they can be easily welded. With regard to characteristics, they resemble wrought iron. With increasing carbon content, these steels' ultimate tensile and compressive strengths rise. They are easily arc, electric, or gas welded. Welding ability reduces as carbon content rises. Mild steel serves the function, hence it was chosen for the aforementioned reason.

3.5.2. BRIGHT MATERIAL:

It is a drowned machine. Mild steel plates and bars are forged in the forging machine using a process that is not forged, which is the primary fundamental difference between mild steel and brilliant metal. However, the materials are taken from the dies while still being plastic. For extrusion and creation of engineering materials, the material has a good surface finish compared to mild steel and has no carbon deposits on its surface, giving such materials a good surface finish and preserving their metallic qualities.

3.5.3. LIST OF COMPONENT

Table 01- List of components

S.O.	COMPONENT	SIZE	MATERIAL	QTY
1	Frame		M.S.	1
2	Punch		M.S.	1
3	Die		M.S.	1
4	Rod		M.S.	1
5	Die back spring		Spring Steel	1
6	Linkage spring		Spring Steel	1
7	Heating coil		STD	2
8	Nut bolts		STD	16
9	Washer		STD	16

3.5.4. MANUFACTURING PROCESS

The procedure of turning raw materials into finished goods employing the three resources of people, machines, and finished components.

Manufacturing refers to the process of transforming resources into useful items and services. Manufacturing is another term for the deliberate act of creating something useful. Below is a diagram of the transformation procedure.

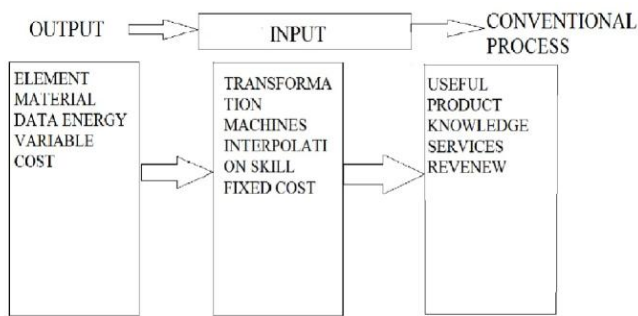


Figure 03- Flow diagram

It comes after the design phase. Hence, referencing those ideals that we intend to uphold the different procedures use the following devices:-

Power saws, drills, universal lathes, milling machines, grinding machines, and electric arc welding equipment.

3.5.5. FABRICATION AND OPERATION SHEET:-

NAME OF THE PART: - PUNCH

MATERIAL :- MILD STEEL

QUANTITY :- 1

FABRICATION AND OPERATION SHEET:-

NAME OF THE PART: - PUNCH

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QUANTITY :- 1

Table 02- operation sheet table

SR. NO.	DETAIL OPER.	M/C. USED	TOOL USED	ACCES	MEA.INST.
1.	Marking on rod	-	-	-	Scale
2.	Cutting as per drawing	Power hack saw	Hack saw blade	Jig & fixture	Scale
3.	Facing both side of shaft	Lathe machine	Single point cutting tool	Chuck	Vernier
4.	Turning as per drawing size	-	-	-	-
5.	Filing on both end	Flat file		Vice	-

NAME OF THE PART: - PUNCH

MATERIAL :- MILD STEEL

QUANTITY :- 1

Table 03- Punch sheet table

SR. NO.	DETAIL OPER.	M/C. USED	TOOL USED	ACCES	MEA.INST.
1.	Marking on rod	-	-	-	Scale
2.	Cutting as per drawing	Power hack saw	Hack saw blade	Jig & fixture	Scale
3.	Facing both side of shaft	Lathe machine	Single point cutting tool	Chuck	Vernier
4.	Turning as per drawing size	-	-	-	-
5.	Filing on both end	Flat file		Vice	-

COMPONENT: - FRAME

MATERIAL: - MILD STEEL ANGLE

QUANTITY: - 1

Table 04- Frame table

SR. NO.	DESCRIPTION OF OPERATION	MACHINE USED	CUTTING	MEASUREMENT
1.	Cutting the angle in to length as per dwg.	Gas cutting machine	Gas cutter	Steel rule
2.	Cutting the angle in to number of piece as per dwg.	Gas cutting machine	Gas cutter	Steel rule
3.	Filing operation can be performed on cutting side and bring it in perpendicular C.S.	Bench vice	File	Try square
4.	Weld the angles to the required size as per the drawing	Electric arc welding machine	----	Try square
5.	Drilling the frame at required points as per the drawing	Radial drill machine	Twist drill	Vernier calliper

4. RESULT ANALYSIS

Table 05 displays the bowl's development after applying various pedal forces. Therefore, it can be shown from the calculations above that bowls can form more effectively when moderate pressure is applied. The quality of the bowl improves as the pressure rises, but beyond a certain point, strong force will cause cracks to appear in the bowl. The outcome is attained at the heating coil's 150° C.

Table 05: Result Analysis

SR.NO.	Applied Force	Quality of bowl
1	15N	NOT FORMED
2	20N	LOW
3	30N	BETTER
4	50N	GOOD
5	60N	BEST
6	90N	CRACKS IN BOWL

The project involves working with mechanical devices. The project configuration is supported by a rectangular-shaped frame. This pedal is located in the middle of the frame and is attached to the shaft by a spring-loaded crank slider mechanism. One fixed die that is fixed at a movable die makes up the die pair, which is attached on the shaft by a rectangular plate.

As we press the pedal, pressure is applied to it, and as a result, the crank slider mechanism, which has a V-shaped shaft with lower and upper shafts that move upward and downward respectively, attaches a movable die to the fixed die and shapes the product as the upper shaft moves upward due to the spring extension.

The majority of the components of our machine are separate, making part replacement simple. In addition, another type of die may be used in place of the bowl's die. The hydraulic or pneumatic system might take the role of the manual system.



Figure 03: Complete Machine

5. CONCLUSIONS

With the equipment at hand, paper plates may be produced quickly. Hydraulic press machines often need to run at a very high speed for manufacturing. However, the issue is that they are only employed to produce one or two plates at once, which indicates a lower manufacturing rate. By concurrently punching a lot of sheets in a single pass, there may be a chance of increasing output pace.

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