

# Design and Development of Low Cost Automation of Paper Plate Deep Dish Press Machine

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## Abstract:

In today's modern world we humans are in need of the products which are easy to use and readily available .One of them are, the disposable material .The concept of disposables came into existence in late 19<sup>th</sup> century where the various number of food packaging and storage components were invented, and now there are vast variety of products available in the market with ample usage. Paper plate is one such commodity which is widely used by people for a variety of purpose also they are non-hazardous to the environment. Simple punch and die techniques are used for the production of these plates. But now a days various other mechanisms are used which are more efficient and provide us the material with remarkable rate of production .But one of the few shortcoming of these machines is regarding their high cost which is due to their major advanced mechanisms. Therefore, a small approach towards the solution for the problem, this project comprise of one such machine which is constructed through simple mechanisms like belt-pulley, gears, etc. with a promising production rate at a reasonable cost .success on this project will provide us with a machine which can improve the market of the paper plate making machine and can become a source of employment.

**Keywords-** – paper, punching, slider crank

## 1. INTRODUCTION

In today's world people use various time saving techniques to win the race against time. Considering disposables is suitably the best example. Paper plate is one such widely used commodity which we use in our daily life. It is compact, lightweight , easy to carry. Although this simple product has a variety of techniques for production. From the raw material to the press machine all of them gained access advancement in technology. The paper used for manufacturing is recyclable and eco-friendly.

Due to which it can be used anywhere. The major problem faced is in the field of manufacturing of this product. Though there are a large variety of techniques available but somewhere they lack in efficiency of production or due to their overprized cost. Therefore the proposed model is designed in such a way that it finds a proper place between the high end machines and the basic manufacturing machines. The mechanisms are synthesized in such a way that it resulted in a highly compact and efficiently working machine and also at budget ranged prize. Hence the future of the proposed machine is very vibrant and will enroot towards maximum utilization of the product.

## 2. LITERATURE REVIEW

**“DEVELOPMENT OF PAPER PLATE MAKING MACHINES” MR. CHETAN P. SABLE1, PROF. P. D. KAMBLE2, MR. DHIRAJ D. DUBE3 IJPRET, 2014;[1] Volume 2 (9): 90-96**

A paper plate is a plate manufacture from paper and thin line size plastic is used to forestall the liquid material. Kraft is recycling paper. This Kraft is prevented with the thin layer of the film. After continuous stages of rolling it gets wounded on a roller. Then it is cut according to needed dimensions. Paper plates can be manufactured at high speed

rate with the present machines. Manufacturing usually requires hydraulic press machines to operate at a very high speed. But the problem is that they are used for preparing one or two plates simultaneously, which shows a low production rate.

**“AUTOMATIC PAPER PLATE MAKING MACHINE” SANCHIT GAIKWAD, AMOL KALOKHE,Late G.N Sapkal College of Engineering, Nashik Vol-02, Issue 01,APR 2016.[2]**

Disposable food service products were first developed to overhaul public health by improving practices in the food service industry. This requirement when fused with the environmental threat faced by us at the turn of the 20th Century and need of strong efforts in order to conserve the environment gave birth to the concept of PAPER PLATES. There are many inherent advantages in using Paper Plates as compared to cups of other materials. These Paper Plates are gaining popularity all across the globe as a beautiful and flawless way of minimizing exposure to food borne diseases. Paper plates have many advantages like; they are manufactured in a very simple process using Food Grade Raw Materials with least waste and are easiest to recycle and use again.

**“DESIGN, ANALYSIS AND MANUFACTURING OF HYDRO-PNEUMATIC PRESS MACHINE” Gaurav Pradip Sonawane, Gaurav Shashikant Udgirkar, Shailesh Vijay Shirsath, ManishSudhir Deshpande[3]**

Air motor, gearbox, eccentric, pump and oil reservoir are main components of hydro pneumatic pump. At the inlet, spring operated valves are provided. The system showed noticeable improvements in various sectors like operation time and cost of operation. It is noticed that operation time is reduced from 3 hours to 30 min per assembly and cost of operation is reduced approximately by 90 %. The further advantages of the system has covered the safety of operator and made operation more

comfortable and reduces fatigue, improved dimensional and positional accuracy of assembly.

**“DESIGN AND FABRICATION OF AUTO ROLL PUNCHING MACHINE” Kundan Kumar, UG Scholar, Department of Mechanical Engineering, PRCET, Vallam, Thanjavur, India Vol. 5, Special Issue 8, May 2016[7]**

A press or a machine press is a tool used to work metal by overhauling its shape and internal structure. A punch press is a type of machine press used to cut holes in material. CNC operated, with a multi-station turret and hold a much larger and difficult die set. The chain driver is used to transmit the power from the motor to the punching tool. The sprocket connected with the punching tool has CAM orientation and arrangement. The CAM arrangement is to convert rotary motion to the linear motion in the chain drive. The CAM has also started working and the punching operation will be done automatically with equal intervals of time.

**3. NEED OF DEVELOPMENT**

In the previous centuries, for storing and eating purpose costly metal plates were used, weighted to be used and need to be washed after every use. In the current growing world, using heavy metal utensils and washing them is waste of time, because of that paper plate came into existence. In the growing economy , ecofriendly plates requirement is more. So the demand of paper plate is increasing day by day. So to fulfill the demand a less expensive and automatic machine is a must need.

**4. WORKING OF TRADITIONAL MACHINES**

**I) Manually operated press machine:**

This type of machine is operated by the labor working on it. Which consist of wheel type that is manually operated, in which one person is required to rotate the wheel for applying the pressure, this pressure is used to cut the plates from the whole sheet. The pressure required to press 10 sheets manually is 1 ton. The working process is very slow and thus consumes more time.

**II) Hydraulic press machine:**

A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. the fluid does not absorb any of the supplied energy. Capable of moving much higher loads and providing much higher forces due to the incompressibility. This machine requires more power to operate and more expensive parts and equipment, like hydraulic, compressor and high toque motor and which consumes more power, which make machine more expensive. The working process is fast and thus produces more number of plates as compared to the manually operated machine.

**III) Proposed concept of paper plate making machine:**

In this machine, the punch is operated by cam follower mechanism; this mechanism makes the machine simple to operate. The raw material that is the paper roll is feed through the feeding rolls as an input and passed through certain rolls to make the sheet tighten before passing it to the punch and die which reduce the input time and increase the rate of production. when the paper sheet reaches the punch and die, the punch pushes the sheet in the die through cam operation and shape of plate is obtained by the punching action and heaters are mounted inside the punch and die which makes the paper sheet deform and stiffness is provided to it, simultaneously cutting of outer edge of the plate from the whole sheet takes place this reduce the risk of operator injury and removal of plate after punching is done in the idle time interval produce by cam follower Which reduce the wastage of time and increase the production rate which results in reduction of cost and maintenance and make machine easy to operate.

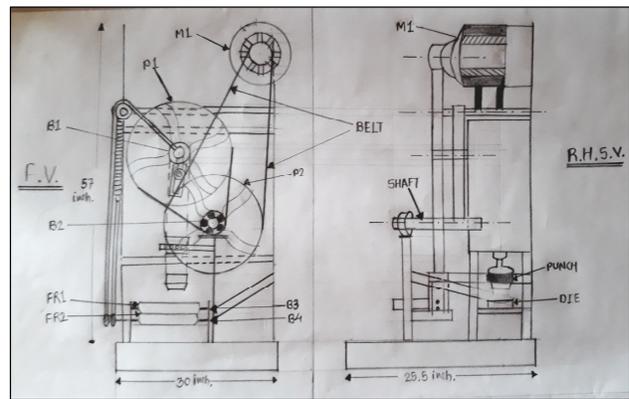


Fig 1: proposed model of paper plate making machine

Sr.no	Notation	Component	Specification
1	M1	motor	1HP
2	B1-B8	BEARING	6035
3	B9-B12	BEARING	6024
4	P1-P2	Pulley	24 & 22 inch
5	FR1-FR2	Feed Rollers	60 mm dia
6	Punch & die	Punch & die	7 inch

Table 1: Parts of paper plate machine.

## 5. CALCULATION:

Power : 746 watt  
Rpm : 1440  
Required speed: 15 rpm  
Speed ratio: 96  
Two step speed reduction  
Stage 1: 9.6  
Stage 2: 10

V belt of type A  
For design power =  $1.1 * 746 = \underline{820 \text{ watt}}$

For stage 1:

$N_2 = 1440 / 9.6 = 150 \text{ rpm}$   
Motor shaft dia = 60mm  
 $N_1 = 1440 \text{ rpm}$   
 $N_2 = 150 \text{ rpm}$

$$\pi * N_1 * D_1 = \pi * N_2 * D_2$$
$$D_2 = 57.6 \text{ cm}$$

No. of Belt = 1

Stage 2:

$N_2 = 150 \text{ rpm}$   
Intermediate shaft dia = 60mm  
 $N_3 = 15 \text{ rpm}$

$$\pi * N_2 * D_2 = \pi * N_3 * D_3$$
$$D_3 = 60 \text{ cm}$$

No. of Belt = 2

Cutting force = 2.06kg

## 6. CONCLUSION

Production rate of proposed paper plate deep dish machine is high as compare with the existing machines. Normally, The manufacturing requires hydraulic (fully automated) press machine, to be operated. But it is expensive so we have given a solution and reduce the cost of machine while maintaining its efficiency.

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