

# Fabrication of pneumatically operated paper cup and dish making machine

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**Abstract**—This project is based on fabrication and assembly of pneumatically operated paper cup and dish making machine. The project is basically by considering the current problem of expensive computer controlled paper cup making machines. Paper cups are mainly consist of plastics. And plastic is an material which is very hazardous to the environment. With the help of this pneumatically operated machine paper cups are made from any kind of paper and leaves are also used for making cups. After researching how current paper cup making machine work, we are come up with low cost effective solution for manufacturing of paper cups and dish. This paper cup making machine size is comfortable to suit anywhere and very economical also. For this machine we are using very basic techniques to improve our project efficiency. Example: wet paper or paper pulp is use for making paper cup. So the paper or pulp easily gains shape of die and heater coils are used for evaporation of water from pulp or wet paper. Punch and die arrangement is use for actual manufacturing of paper cup. Pneumatic cylinder supply the air to the actuator by using direction control valve. Punch is operated with the help of direction control valve to control air pressure and by supplying air to the actuator, due to this punch is move down and exerts pressure on the paper pulp or wet paper. Paper gains shape of die and formation of paper cup or dish taking place. This project is very economical and reduce hazardous effects appeared from plastic used.

**Keywords** – Die, punch, machine, paper dish, pneumatic compressor.

## I. INTRODUCTION

Paper cup and dish are mainly used at special events, celebration, occasion to serve solid food such as fast food, salad etc. paper cup coated with plastic or wax its prevents the leakage of liquid from cup. The paper cup are used where the washing is unavailable and they throw out after used. So, the paper cup and dish are used in restaurants and hospitals to serve prepared food. The pneumatic press and hydraulic press are two methods which are mainly used for making paper cup and dish. But, the pneumatic method of formation of paper cup is preferred. Because, pneumatic method is more economical as compared to hydraulic method. Because, highly expensive fluids are used in hydraulic method for compression. Hence, pneumatic method of compressing air is select for making paper cup and dish. Any kind of paper can be used for making paper

cup and dish. For making of paper cup and dish we required numerous devices like double acting cylinder, punch and die of required shaped, direction control valve, flow control connector and hose, heater coils. Sanchit gaikwad and Amol kalakhe [1] the mainly focused on hydraulic press which is operated at very high speed and it increases production rate by pressing the number of paper at a time. Mohanraj K S, Vijaykumar P, Senthilkumar R, Gokul Karthik A [2] studied leaf container machine is designed having straight forward pedel work mechanism. It needs 300 watts of electric power to operate. Leaves are washed and dried and put on lower kick and pedal is pushed down. All operation like collapsing, trimming, squeezing into shape and drying done by squeezing the pedal lever. Vignesh K, Porkalan S, Pradhap Kumar M, Prasanna Venkatesh S, Packiyaraj M [3] a pneumatic system is used to compressed air. Direction control valve which control flow of air into the cylinder. The air flow into flow control valve and pressure to the double acting cylinder. High pressure air apply pressure on the punch & die and paper gets deform in different shapes. M.A.Olutoye [4] The raw material for production of paper is primary source mainly obtained plants. To provide alternative source of raw material there is need of invention of process of recycling. Saurabh R. Rathod [5] studied use of solid waste and recycle the material in construction. U.P.Singh [6] studied design analysis of various types of punches with special attention to there cutting profiles, using the finite element technique. P.Goyal [7] Review on pneumatic punching machine and modification in punch tool to reduce punching force required. Initially the waste paper mixed with the water produced the pulp, then by using heater coil we are removing water from pulp. This pulp now place in between die and punch of plate or cup shape. By using pneumatic cylinder air pressure can be applied on dry pulp by using actuator. The main application of this machine is to improve production rate and high uses of waste product and the maintain waste management system.

## II. EXPERIMENTATION/FABRICATION

For the fabrication of paper cup machine following types of equipment are used

### A) Pneumatic cylinder

Pneumatic cylinder having displacement of 126L/min, which has tank capacity of 9 liter and it can supply air pressure of 115psi (8bar). This pneumatic cylinder made up of cast iron, it works on motor of single phase ac supply and its speed is 2850rpm.

**B) Actuator**

Only one actuator is used for this machine of having specification of 20mm bore and 50mm stroke and which is used for the actual making of cup and dish. This actuator is situated at second unit connected with DCV for the pressure changes due to air supply.

**C) Direction control valve**

For the motion of actuator we use 5/2DCV. This valve work properly without used of continuous supply of air and it is used for pneumatic of double or single acting actuator.

**D) Motor**

We are using one motor which is having 600rpm of speed. This motor is used for rotating stirrer for making mixture of water and paper. Motor need 12V current supply.

**E) Pump**

There is one pump for water transmission from water tank to mixture tank for making mixture of paper and water. Pump need 6V current supply.

**F) Water tank**

We are using tank for store water which is having capacity of 9 liter. This water used for making pulp. It's dimensions are 6 inch diameter and 9 inch height.

**G) Mixture tank**

We are using another tank which has same capacity as that of water tank. It is made up of plastic material and it's dimensions are 6 inch diameter and 7 inch height.

**H) Heater coil**

There are three heater coils which is made up of iron coil used in this machine for removing water particles from pulp, in which two heater coils are place below the die of cup and dish, And another one is place in first unit.

**I) Frame**

Two frames are used which is made from material of mild steel in which one frame is used for making mixture of water and paper and another frame is used for making paper cup by using punch and die. The dimensions for the frames are 200\*200\*200 mm.

**J) Battery**

We require two batteries of 12V and 1.35amp for driving motor and pump.

**APPLICATION TECHNIQUE**

**Drilling**

Drilling process is to making circular section hole/drill on the metal surface. Spot drilling, center drilling, deep hole drilling, gun drilling, etc. are the types of drilling process. For drill, a rotary cutting tool is use. In this process we use pistol grip drill. Drilling has chuck capacity of 0.5 inch and no load speed is 1000 rpm and having electric frequency 60Hz.

**Welding**

Welding is fabrication process which is use to joints material or metals. In this material or metals are highly heated up to its melting point and after cooling it fusion will be taking place

and material gets joined. We are using arc welding, were arc welders can use alternating current (AC) or direct current (DC) and nonconsumable or consumable electrodes. Arc welding is process of joining metal to metal using electricity to create heat to melt the metal and when it is cool it result into binding of welded metal.

**Cutting**

It is use to cut raw material with specified dimension. Cutting processes include sawing, milling, turning, drilling, broaching. If apply to metal cutting, the ratio of depth of cut to thickness for a given shear angle. Multi edge cutting tools are used for milling and drilling operations. It has power consumption of 2000W and having speed 3800 rpm. We use saw blade diameter of 355 mm and bore is 25.4mm.

**Soldering**

For joining of two or more metallic parts together at lower temperature than the melting point of the metal. At molten form, solder chemically dissolves part of the metallic surfaces to be joined. Then solder cools and makes an alloy with the metal.

**Grinding**

Grinding machine also known as grinder is power tool use for operation of grinding which is kind of machining using cutting tool as abrasive wheel. Small chips are cut by each grain abrasive on surface of wheel from workpiece via shear deformation.

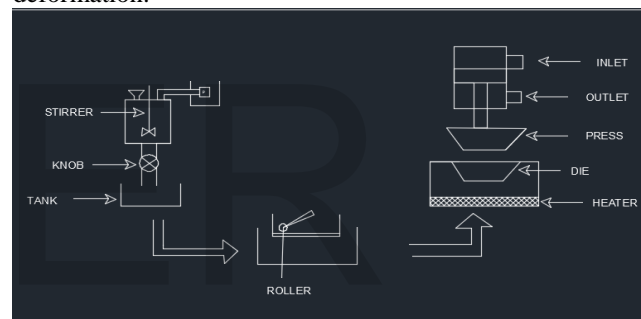


Fig 1. 2D Experimental setup diagram

**III. WORKING**

In our pneumatically operated paper cup and dish making machine consist of unit-1 and unit-2. Unit one consist of tanks, knob, heater coils, water pump, motor, battery and stirrer. In unit-1 the first tank contains water. It pass to the mixture tank by using water pump of 6V. Mixture tank mix the waste paper and water by using stirrer it makes pulp, after some time knob allows the pulp to spread on tray. Tray consist of net and cotton which removes water from pulp. Below this tray one heater is placed which remove the water from pulp. Now, the dry pulp sheet is place in between die and punch of required shape, pneumatic cylinder supply pressurise air to the actuator by using DCV. Actuator allows the punch to press the pulp sheet into the die of dish or cup shape. Due to the air pressure punch moves downward and it exert a pressure on pulp sheet, then it gain a shape of die after that we start heater coil which is place below to the die for removing remaining water contain from dish or cup. Now by using DCV punch moves upwards and dish or cup can be remove from die.

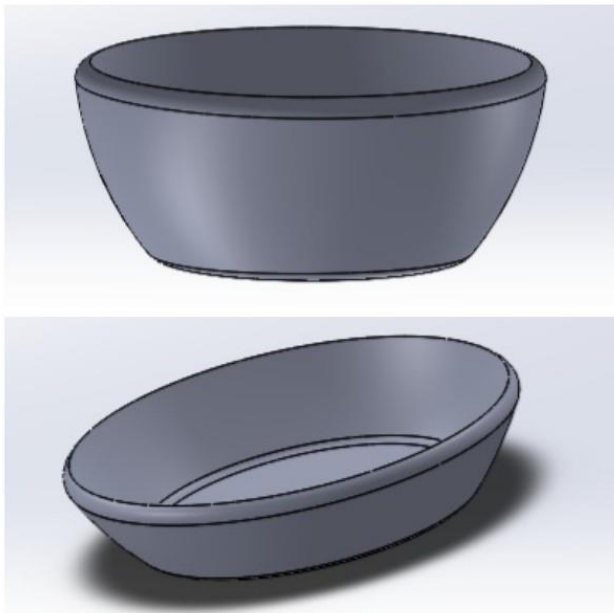


Fig 2. Cad Model of Die

#### IV. RESULTS AND CONCLUSIONS

This paper cup and dish making machine gives desire shapes of cup and dish as approximate efficiency of 80%. It is clearly seen that the project is economically possible in all aspect, and paper recycling unit has a potential to generate employment for many worker and can also act as an environment friendly initiative for the world.



Fig 3. Final product

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