

An Approach on Low Cost Automation For Paper Plate Deep Dish Press Machine

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Abstract- Paper plates are widely used disposable utensils in today's fast moving world. They are hygienic, easy to handle and low cost and are available in various shapes and sizes according to requirement. They are manufactured using punching technology and due to their simple construction they are manufactured using various punching technology. The existing technology comprise of old fashioned manual punching to latest automated hydraulic punching ,though there were advancements in punching technologies but they also went through several cons. Advancements also brought complexity in machines which increased the maintenance requirement and cost. Therefore there is a need of a technology which is simple and low cost. Some process which reduces the efficiency of machine can be eliminating by new techniques. This paper comprise of the information regarding the existing punching techniques and modifications which can be made for designing a new machine. a new model for this machine which comprises of an optimum automation for manufacturing and also the costs should perfectly fit into economic range.

Keywords- paper, punching, slider crank,

taking out the roller of coated paper, cutting it for required dimensions and then transferring it to the press machine are carried out manually; our aim is to automate this operation. So the paper consist techniques of modifying the old manual machine into semi-automatic machine by implementing the mechanical engineering. And maintaining the minimum cost of the machine, and ease to operate the machine , by rural development point of view, so that the even less skill person can operate the machine. Hammers were the tool of choice for any Blacksmith, until the turning point in 1784 when a man called James Watt (a Scottish inventor and Mechanical Engineer) described the Steam Hammer. James Watt had a keen interest in steam engines and the mechanics behind it, and his invention of the steam condenser helped other engineers evolve this principle into other industries. Eventually the steam hammer was built in 1840 based on a design by British Inventor James Nasmyth, which was revolutionary and a turning point for manufacturing with steel. As the steam hammer was used, people made improvements and in 1891 the Bethlehem Iron Company made an enhancement that meant the steam hammer could deliver a 125-ton.

I. INTRODUCTION

Historically, metal was shaped by hand using a hammer. Later, larger hammers were constructed to press more metal at once, or to press thicker materials. Often a smith would employ a helper or apprentice to swing the sledgehammer while the smith concentrated on positioning the work piece. Adding windmill or steam power yielded still larger hammers such as steam hammers. Drop hammers utilize an electric motor to lift the hammer, which then falls by gravity onto the work. Most modern machine presses use a combination of electric motors and hydraulics to achieve the necessary pressure. Along with the evolution of presses came the evolution of the dies used within them. Disposable food service products were initially developed to enhance public health by improving practices in the food service industry. This requirement when combined 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. The operations from

II. 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 made out of paper and it is coated with the plastic which prevent from the liquid and also prevent from leak out from the paper. The base is known as kraft and it is coated with the thin layer of silver film after the silver coating further paper is passed into the roller when paper is passed into the die manually. The aim of the project is to automate the process of punching and producing the plates with appropriate accuracy and high speed which lead to reduction of human effort and increase the productivity.

“AUTOMATIC PAPER PLATE MAKING MACHINE” SANCHIT GAIKWAD, AMOL KALOKHE, Late G.N Sapkal College of Engineering, Nashik Vol-02, Issue 01, APR 2016.[2] The concept of paper plate came into existence when

there was an enormous need of conservation of environment which was effected due to non-biodegradable waste. The paper plate has wide application such as in parties, picnic, public occasions, marriages, canteen, etc. they are also good mode of marketing, as advertisement can be easily printed on paper plate. For such an essential product a better manufacturing technique was required, which give better product at proper production rate.

“Design, Analysis and Manufacturing of Hydro-pneumatic Press Machine” Gaurav Pradip Sonawane, Gaurav Shashikant Udgirkar, Shailesh Vijay Shirsath, Manish Sudhir Deshpande[3] A hybrid punching machine which utilizes the mechanism of both hydraulic and pneumatic system is used the components are assembled in such a way that they provide an output similar to hydraulic mechanism and input similar to pneumatic mechanism. The desiging is done through various mechanical software like PRO-E and ANSYS. The design, provided us with optimum output with efficient consumption of time and power. Rf43Rf43

“REVIEW ON PAPER PLATE MAKING MACHINES” Mr. Chetan P. Sable, Prof. P.D.Kamble, Mr. Dhiraj D. Dube Vol.1 Issue.8, December 2013. [4] A paper plate is a plate made out of paper and often lined with plastic to prevent liquid from leaking out or soaking through the paper. The base paper for paper plates is called kraft. This kraft is coated with the thin layer of silver film. This paper is then pass through successive stages of rolling, and then gets wounded on a roller. Then it is cut for required dimensions (here 14x28 in). After then this paper of required dimensions is pass to the press machine for giving required shape of plate. The operations from taking out the roller of coated paper, cutting it for required dimensions and then transferring it to the press machine are carried out manually, our aim is to automate this operation. This project work deals with automating the above mentioned operation of the manually operated paper plate making machine available at “S.M. manufacturing and trading” company at Bhandara (M.S). Paper plates can be manufactured at high rate with the available machines. Manufacturing normaly requires hydraulic press machines to operate at a very high speed. But the problem is that they are used for making one or two plates simultaneously, which shows a less production rate.

“A SYSTEM CONCEPT IN METAL CUTTING” V.P.Astakhova. S.V.Shvetsb, Journal of Materials Processing Technology, Elsevier, Volume 79, Issues 1–3, 1 July 1998.[5] Pages 189-199 Orthogonal cutting mechanism is used as a system strategy under the cutting system process, tool chip and work piece component are used. The system show that the overall process depends on time than the collection of work piece. The dynamic reaction is seen in cutting of brittle and

electro plastic work piece. The system consider that due to combination of bending and shearing stresses chip formation takes place. This is a cyclic process, the bending stresses calculation and results of practical get brief existence of role and significance.

“THE EFFECT OF USING A SPRUNG STRIPPER IN SHEET METAL CUTTING” G.J.A.Bing , J.Wallbank, Journal of Materials Processing Technology, Elsevier Volume 200, Issues 1–3, 8 May 2008[6] Pages 176-184 Sheet metal cutting with punch and die is one of most fundamental processes in sheet metal presswork, and in many modern tools such as progression tooling a sprung stripper is used to help the punch withdraw from the strip after separation. The vast quantity of practical information which is available about the cutting process does not document whether the use of a spring stripper affects the cutting process. In this work, a tool with a sprung stripper was modified so that the sprung stripper was held back from the strip. Burr height readings were taken before and after the modification, as were electron micrographs of the cut edge. These were compared to determine the effect, if any, that a sprung stripper would have on the proportions of shear and tensile fracture and the burr height formed. When a sprung stripper was used, maximum burr was half as high as without. Process consistency was over twice as good with a sprung stripper. When a sprung stripper was used, burr was found to protrude into the hole, which did not happen otherwise. With a sprung stripper, there were more patches of secondary shear fracture than with no stripper contact. It is suggested that the use of a sprung stripper altered the path of tensile fracture and the amount of drawing in of the strip during cutting, thus altering the burr height and width.

“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] This project is based on fabrication of auto roll punching machine. It is specially designed for automation in punching. The DC motor , cam arrangement , conveyor mechanism and punching tool are the important component used. Two rollers are used for winding and unwinding purpose for sheets. DC motor supply power to roller and chain drive used for power transmission motor to punch tool. Sprocket and punching tool has cam arrangement for conversion of rotation to linear motion after placing work piece on roller, automatic motion for punching operation is provided with equal intervals.

III. NEED OF DEVELOPMENT

In the previous decades, metal utensils/plates were used for storing and eating purpose but they were costly,

heavy to use and washing is to be done after every use. Now in the fast growing world, there is no time for using heavy metal utensils and washing them. So paper plates has taken over this as a new alternative, eco-friendly and easy to manufacture. In this growing demand of paper plates in market, an effective, economic, and having high productivity rate machine is a must.

IV. COST-EFFECTIVE ASPECTS

Paper plate is one of the major paper product. The selling price of automatic paper plate making machine is about Rs1,00,000/- ,which vary from manufacturer to the traders. And the market price of automatic paper plate machine increases due to cost incurred in its complex mechanism and heavy motors and microprocessors. The traditional process which are used for making paper plate are

- Manual hand operated press
- Manual hydraulic operated press
- Automatic press machine

The hand operated press used for making paper plate is outdated now. The price of bearing used for punch shaft Rs 800/-, price of crank shaft Rs 600/-, Die Rs 4000/-, motor Rs 5500/-, pulley Rs 300, balancing plates Rs 1250/-.

The propose machine consist of light weight rollers costing upto Rs 400

V. WORKING OF TRADITIONAL MACHINES

I) MANUALLY OPERATED PRESS MACHINE: This machine requires one person to operate it. Figure shows a wheel type manually operated press machine, in which one person required to rotate the wheel for applying the pressure on sheets to make paper plates. The pressure required to press 10 sheets manually is 1 ton. The working process is very slow and consumes more time.

II) HYDRAULIC PRESS MACHINE: A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. Liquid 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 required the more power and more expensive parts and equipment, like hydraulic, compressor and high torque motor and more consumption of power, which make machine more expensive.

III) PROPOSED CONCEPT OF PAPER PLATE MAKING MACHINE: In this machine the punch is operated with the

help of cam follower mechanism, which reduce the mechanism cost and simple working parts, no need of hydraulic or oil or compressor. Which reduce the cost and maintenance and make machine easy to operate. The paper is feed into the machine between the punch and the die, with the help of roller with continuous feed and motion, which reduce the input time and increase the rate of production. And also reduce the risk of operator injury. The finished product is removed out of the die with the help of blower, which reduce the time and increase the rate of production. And also reduce the risk of operator injury. And all this process means feeding of paper 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. So the advantage of this machine is that, it has simple operating mechanism, so less power consumption and less expensive.

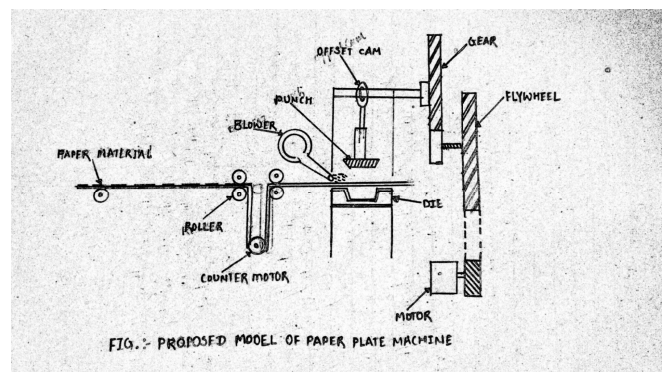


Fig 1: proposed model of paper plate making machine

VI. METHODOLOGY

6.1. RAW MATERIAL

A) Raw material is feed through conveyor mechanism with the help of chain sprocket mechanism. This will feed the raw material at the time of punching operation.

B) The paper used is of 120 GSM (gram per square meter) covered with thin plastic having combined thickness of 2.5mm. The 120 GSM paper is made for the food industry purpose and thin plastic coating is applied over the paper to make it water proof. This paper provides the best in class thickness and stiffness for plate making.

6.2. CONVEYOR MECHANISM

The conveyer mechanism is governed with the help of Geneva mechanism which is synchronized with punching operation. Stopper and double roller is used to maintain the tension in the paper and keep the paper stretched to properly fit in the punch and die assembly. This mechanism do not

need any additional motor power , as the power is taken from the main motor used to operate the punch.

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6.3. PUNCHING MECHANISM

Slider crank mechanism used for punching. Gear box is used to maintain the speed of punching. The punch mechanism is operated by gear reduction with gear box and it is powered by motor. It the only motor used in whole machine.

6.4. REMOVAL OPERATION

The Blower or horizontal placed punch and die assembly will make the finished plate to fall free from the die. Which reduce the work of removing the plate from the die And make this process more safe n power consumption free.

VII. PROPOSED CONCLUSION

Paper plates can be manufactured at high rate with the available machines. Manufacturing normally requires hydraulic press machines to operate at a very high speed. But the problem is this machine is expensive and complex to operate. Therefore the concept proposes is less expensive and easy to operate and less power consumption and more production rate.

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