International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

DESIGN AND MANUFACTURING OF WOOD ENGRAVING MACHINE

Prof.Marnish Modi[1], Anshul Kothari[2], Deepan Doshi[3], Aditya Menon[4], Bhaumik Hariyani[5]

[1]Assistant Professor, Department of Mechanical Engineering, Indus Institute of Technology and Engineering, Ahmedabad, Gujarat, India
[2, 3, 4, 5] UG Student, Department of Mechanical Engineering, Indus Institute of Technology and Engineering, Ahmedabad, Gujarat, India

---

ABSTRACT- *"Wood engraving machine" is a machine used for woodworking in which Mechanical linkages connected in a manner based on parallelograms so that the movement of one object, in tracing an image, produces identical movements in a second object. Wood engraving machine is cost effective, exact scaling and can be used in present Modern age also. Here we are working on 2 Degree Wood engraving machine; via this we could engrave any design on wood.*

Key Words: Pantograph, AC motor, Drill Bit, Template, Follower.

INTRODUCTION:

In present technology, worker use hand operated tools for shaping and cutting which consumes human efforts. Most of workers are aged, so unable to take effort. If the wooden material has large area then hand operated tool consumes whole day.

As we took project title as "DESIGN AND MANUFACTURING OF WOOD ENGRAVING MACHINE". We have used router to reduce effort of workers. The wood engraving machine is a new technology developed that allows router to be powered by electricity and only use a minor amount of power for drilling process. We have used a handle which helps us to move router in any direction and for making the final model. We can make design in 3D parametric software (solid works) and then make actual prototype which will work faster and with less effort.

OBJECTIVES:

1. This machine can be used in wooden store to make the operation easier for the craftsman.
2. Cost effective to produce similar patterns
3. Various designs of wooden material can be obtained (e.g. wooden hinges mortise and tenon joints, finger joints, etc.)
4. Skilled workers are not required.
5. It is Time efficient.

LITERATURE REVIEW:

I. **Matti Stendahl (2009):** It is common advice from strategy consultants that companies in the wood industry should increase their rate of innovation in order to survive global competition. Neither consultants nor academics, however, provide much advice on how this is to be achieved. In this study, the product development processes of companies in this industry were examined. Product development was defined as the span of activities leading to products that are new to the firm, but not necessarily new to the market. The study combined the resource-based view of the firm and the organizational capabilities approach with innovation management theory. Thematic coding was used to analyze the comprehensive information obtained from semi-structured interviews with 19 product development experts in the industry. In addition, binary logistic regression, factor analysis and multiple regression analysis were used to analyze data obtained from structured interviews with 110 strategic business unit (SBU) managers in the industry

II. **Luiz Fernando de Moura, Roger E. Hernandez (2006):** Oblique cutting differs from orthogonal cutting by an inclination given to the knife edge, which induces several changes on tool geometry, cutting forces, as well as on the quality of machined surfaces. In this work, a pressure bar was used during oblique cutting to reduce the occurrence of torn grain. The effects of cutting depth, rake angle, and oblique angle on cutting forces and surface quality were studied. Surface topography, cell damage and wetting properties were used to assess surface quality. All force components were increased by increasing cutting depth and decreasing rake and oblique angles. The lateral force, however, increased as the oblique angle increased. The surface roughness increased with increasing the lateral cutting force. Higher cutting depths and oblique angles tended to provide higher surface roughness, while higher rake angles tended to reduce surface roughness. The pressure bar was not always able to completely prevent the occurrence of defects when cutting against the grain. The occurrence of machining defects increased at higher cutting depths and oblique angles. As the rake angle decreased, the type of machining defect tended to change from torn

grain to slight fuzzy grain. Moreover, the best wetting properties were obtained at lower rake angles, as they induced higher surface roughness. A 25° rake angle, a 30° oblique angle, and thinner cutting depths should be preferred to reduce dependence on ulterior sanding.

III. **Pratik P Bargode, Samir M Dhadve, Ajinkya K Gosavi, Harshal S Indulkar, Mangesh S Prabhavalkar (2015):** In this paper multipurpose machine having wood cutting, grinding and buffing wheels on single base is described. The practical measurement results have shown that the performance of this machine is better than the existing one. It requires less power for its operation. It is also convenient to move from one place to another, due to its compact size and being installed on the single frame. It is easy for the maintenance with low maintenance cost and requires very less skill for its operation. This machine causes the increase of production capacity. Thus this machine is better choice than machines performing those operations individually.

RESEARCH GAP:

In present technology, worker use hand operated tools for shaping and cutting which consumes human efforts. Most of workers are aged, so unable to take effort. If the wooden material has large area then hand operated tool consumes whole day. The automatic machines are usually single operation machines. The multi-purpose machines available in the market are very expensive.

As we took project title as "Design and Manufacturing of wood engraving machine". We will try to use alternate source of energy to run router to reduce effort of workers. The WOOD ENGRAVING MACHINE is a new technology developed that allows router to be powered by electricity and only use a minor amount of power to drilling or shaping process. We will use handle which help us to move router in any direction and for making of final model we will make design in 3D parametric software (solid works) and then make actual prototype which will work faster and with less effort.

WORKING AND MECHANISM:

- The wood engraving machine is a specific application of a mechanism called a pantograph, which is a general purpose linkage that can be used in two ways: to guide linear motion and to trace patterns while enlarging or reducing them. (The scissor lift is an example of the first use.)

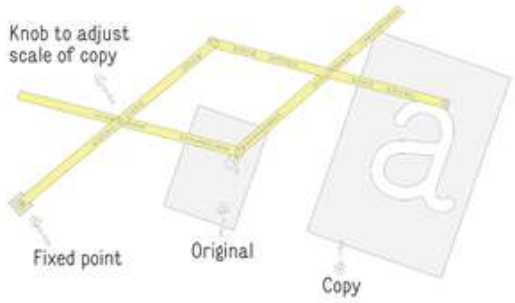
- A typical pantograph works by guiding one node around the perimeter of a shape to enlarge or reduce while another node follows along at a different magnitude. So an operator would guide one part of the mechanism around the template while the tool head follows.

- The Wood engraving machine is fundamentally a pantograph and it works in the same way. The user inserts a template of the shape they want to cut, turns on the router, and guides it through multiple passes removing stock until the stock matches the shape of the template and there is nothing left to cut.

- The Wood engraving machine's cutting head stands upright on its edge with the router bit extending parallel to the plane of the spoil board.

- Pantograph Mechanism:

The pantograph reduces 2:1 from the template to the router bit, so using a guide bearing that is exactly twice the diameter of your router bit will reproduce the shape of the template exactly.



CALCULATIONS:

-Cutting speed V_C: (m/min)

$V_C = (D_c \times \pi \times n) \div 1000$

[D_c = diameter of drill bit, n = rpm]

-Feed per revolution F_N (in/rev) = 0.07in/rev

-Specific cutting force K_C (N/mm²):

$K_C = (P_c \times 132 \times 1000) / (F_N \times V_C \times D_C)$

[Pc=net power of motor]

-Axial Thrust, F_t

$F_t = 0.7 \times D/2 \times F_N \times K_C$

$= 0.7 \times 0.25 \times 0.07 \times 106.45$

$=1.304$lbs $=4.448$N

-Torque, M_t

$M_t = P_c \times 5252/n$

$= 2.25 \times 5252/20000$

= 0.59085 lbs-ft

= 0.8 N-m

-Forces due to weights:

-Force F_P given as below:

$F_P = W_S + W_P + W_A$

[-W_S= motor weight with clamps (m × g) (N)

-W_P= pan weight (N)

-Mass of pan with workpiece = m×g

= 2×9.81

= 19.62N

-W_A = mass of drill bit × g /2

= 0.215×9.81/2

= 1.054 N]

-Total Force:

$F_P = W_S + W_P + W_A$

= 29.43+1.054+19.62

= 50.104 N

*All values of weight are approximate

MATERIAL SELECTION:

PART NAME	MATERIAL
FOLLOWER	S.S.
CLAMP	Mild steel
ROUTER	Standard
CUTTER BIT	H.S.S.
HANDLE	Mild steel
MOTOR	Standard Single Phase AC (20000 rpm,220V)

DESIGN AND COMPONENTS:

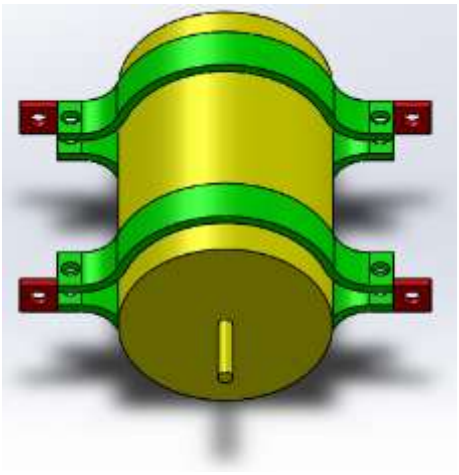
I. Template Holder:

II. Template:

III. Follower:

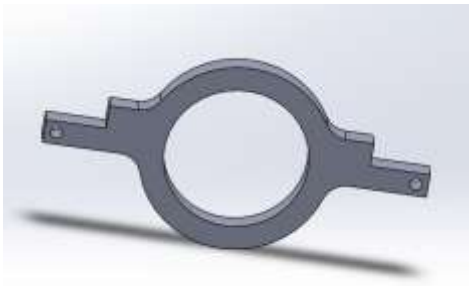
IV. Drill Bit:

V. AC Motor (20,000 RPM, 220V):

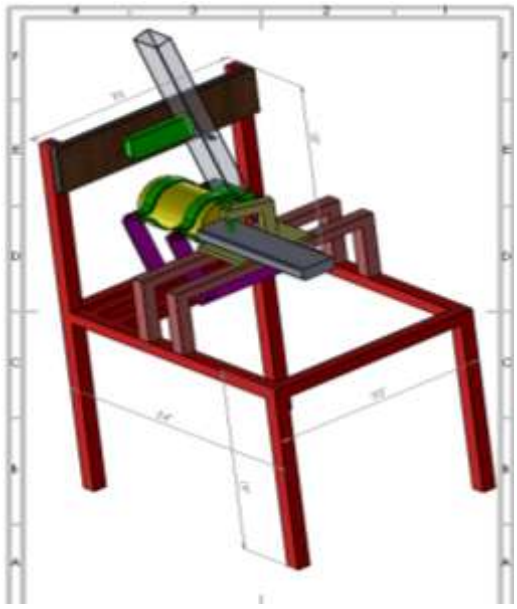


VI. Frame:

VII. Clamp:



VIII. Final Assembly:



CONCLUSION:

The wood engraving machine is a cheap and easy to use wood working machine. It can perform multiple operations such as cutting, carving, filleting, drilling, etc. But its main use is replicating specific and complex patterns with very less effort and skill. It reduces human effort in performing wood operations. The wood engraving machine is a precision woodworking machine that enables its user to do multiple types of operations with a single machine. Using it one can multiple precise copies of a pattern with very less skill. It can be used to create mortise and tenon joints, simple angle joints, compound angle joints and dove tail joints. The machine is fast, efficient, low cost and very versatile.

AKNOWLEDGEMENT:

Foremost, we would like to express our sincere gratitude to our guide Prof. Marnish Modi for the continuous support of our Project study and research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped us in all the time of research and writing of this report. We could not have imagined having a better advisor and mentor for our Project study.

Besides our advisor, we would like to thank Prof.Umang Patdiwala, HOD, Mechanical Engineering department, who gave guidance for the Project work.

We offer our special gratitude to all the **faculty members**, Mechanical Engineering Department, Indus University for their help and support.

We would like to express endless gratitude to "**Our Parents**" who gave us everything they could to enable us to reach the highest possible education level.

We only hope that they know how their love, support and patience encouraged us to fulfil their dream.

We would like to thank all people who have helped and inspired us during our Report study.

REFERENCES:

Dhanasegaran A, Dhilip Kumar H, Dinesh Kumar V T, Gopi Kumar K. and S.Gokul, International Journal of Current Engineering and Technology. "Design and Fabrication of Pedal Powered Circular Saw for Wood Working Applications".

[1] Prof. Zoeb khan, Mr.Sushil Dopekar, "Design and Fabrication of Human Powered Wood Cutting machine" International Journal on Recent and Innovation Trends in Computing and Communication. ISSN: 2321-8169
[2] J. Arai, K. Iba, T. Funabashi Y. Nakanishi, K.Koyanagi, and R. Yokoyama, "Power electronics and its applications to renewable energy in Japan," The IEEE Circuits and Systems Magazine, Vol. 8, No. 3, pp. 52-66, 2008.
[3] -S.O. Nkakini, B.E. Yabefa,European International Journal of Science and Technology, ISSN: 2304-9693, Vol. 3, No. 4 May-2014
[4] "PRODUCT DEVELOPMENT IN THE WOOD INDUSTRY",Matti Stendahl,ISSN 1652-6880, 2009
[5] "CHARACTERISTICS OF SUGAR MAPLE WOOD SURFACES MACHINED WITH THE FIXED OBLIQUE KNIFE PRESSURE BAR CUTTING SYSTEM" Author: Luiz Fernando de Moura, Roger E. Fernandez, 30 May 2006
[6] Google
[7] Wikipedia
[8] US patent
[9] IRJET