

## A REVIEW ON WOOD ARTICLE DUPLICATOR CARVING MACHINE TECHNIQUE

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### ABSTRACT

*In this paper, review on design of three dimensional wood article duplicator carving machine by finite element analysis is carried out. Material properties i.e. hardness, yield strength, corrosion resistance, conduction properties plays important role in design structure and product life cycle. It is finding difficult to get a material with all required properties. Hence cladding is done for improving the required properties on the surfaces of base metal. Cladding is done by using method of arc welding and Laser welding. Here, arc welding method is used for cladding and the residual stresses produced during welding are estimated. However, a Finite element analysis finds better approximations and also used to analyze the thermo structural behavior of cladding process. So, an attempt is made to use the Finite Element Analysis for the same. SA508 (Steel) material is considered as the base material and cladding materials are varying to predict the nature of residual stresses ex. Aluminum, Brass and Zirconium. First the geometry is made using ANSYS 14.5 then block by block cladding process is carried out. Then coupled field analysis (i.e. Thermal and structural) is done to find residual stresses. The effects of thickness on residual stress are also analyzed and studied.*

**Keywords:** ANSYS 14.5, Steel (SA508), Cladding, Aluminum, Brass and Zirconium.

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### 1. INTRODUCTION

Duplicating carvers have been known for many years. Most have a router or other motorized cutting tool ganged to a stylus which is guided by the operator around a template. A master template is made up, which can be made of soft wood for ease of carving or from metal for longevity, and the template can be duplicated in hard Wood or other material using the duplicating carver. Two-dimensional carvers using pantographs (jointed parallelogram mechanisms) are familiar in the badge- and sign-making field. The stylus is traced around a path or groove in a template, and the router follows the same path to carve the letter or other design into Wood or plastic blanks. The use of a pantograph allows increasing or decreasing the size of the sign relative to the template.

Three-dimensional duplicating carvers are similar, but add another degree of freedom to allow the duplicating carver to duplicate a three-dimensional original such as a propeller, sculpture, musical instrument, etc. When one of the inventors herein was building an experimental aircraft, he found that the bored out, higher compression engine was significantly more powerful than a stock model an engine, putting out between 50 and 60 hp. This meant that he would have to experiment to get the optimum propeller. When the time came to acquire a propeller, he was faced with the following options:

1. Buy an inexpensive, lower quality, hand carved propeller.
2. Buy an expensive, high quality propeller.
3. Inexpensively carve a high quality propeller.

He decided to carve his own propeller. He was able to obtain the design for the original Pietenpol propeller (from the original propeller carver), along with recommendations on how to modify the design to pitch it correctly for the most efficiency. It would be very difficult to precisely carve two identical blades for a symmetrically accurate propeller. A one blade master propeller was carved, and it was decided to use a duplicator to carve two identical blades for the final propeller. This gave the option of modifying the master and easily carving additional props for changes in pitch, diameter, plan, form etc. Getting an acceptable duplicator turned out to be the hard part. The inexpensive, plan-built, plywood carvers were not rigid enough for the accurate duplication needed. The mass

produced general purpose duplicators were also too flimsy. An industrial duplicating mill was out of the question due to the extremely high cost. As a result, the present invention was designed to be the most accurate carver possible, but easy and simple to use, and less expensive than industrial mills.

## 2. LITERATURE SURVEY

Peter D'zimba, [1] New Jersey US, Date of Patent: Sept 21, 1943 by the title name: Combination Wood working Machine. This invention relates to improvements in a combination-wood working machine. Purpose of this invention is to provide a wood working machine which can be applied to a wide variety of wood working operations and to provide means whereby such conversion may be readily and effectively made.

Robert L. Babcosk [2] US Date of Patent: Apr. 4, 1972 by the title name: Pattern Duplicator. This invention relates to pattern making and more particularly to a pattern duplicating apparatus which may be manually operated to trace a model and simultaneously duplicate the model in a pattern stock.

Donald R. Laskowski [3] US Date of Patent: Jan. 15, 1980 by the title name: Apparatus for the Three-Dimensional Reproduction of an Object. It is an object of the present invention to provide an apparatus for the three-dimensional reproduction of an object which is simple to construct and to operate. Another object of the present invention is to provide an apparatus of the described type which may readily incorporate a router or similar device to act as the cutting means of the apparatus.

John O. Lenz [4] US Date of Patent: Sep. 8, 1981 by the title name Outboard Tracing Station for Carving Machine. The present invention relates to wood carving machines and more particularly to improvements in the frame and support tracks.

Jimmie B. Allred, Earl R. Holden, Stephen H. Blaisdell [5] US Date of Patent: Nov. 30, 1999 by the title name Three-Dimensional Duplicating Carving Machine. More particularly, the invention pertains to machines for duplicating three-dimensional designs and objects in Wood or the like using a carving router guided by a stylus.

Richard G. Pikna [6], Date of Patent: Dec. 10, 2002 by the title name Duplicator Device for Radial Arm Saw. The invention provides a Woodworking duplicator which is adapted to be attached to a standard radial arm saw. The device allows a rotating cutting tool and a stylus to be movably supported allowing the user to trace a pattern with the stylus While Cutting the pattern into a work piece with the cutter.

Keven C. Higgins [7], patented in Sep. 14, 2004 by the title name Three-Dimensional Mirror-Image Duplicating Carver. This invention relates generally to the field of carving or forming three-dimensional objects, and more particularly to a three-dimensional mirror image object duplicating carver which will easily and economically replicate a mirror or reverse image duplicate of a three-dimensional object.

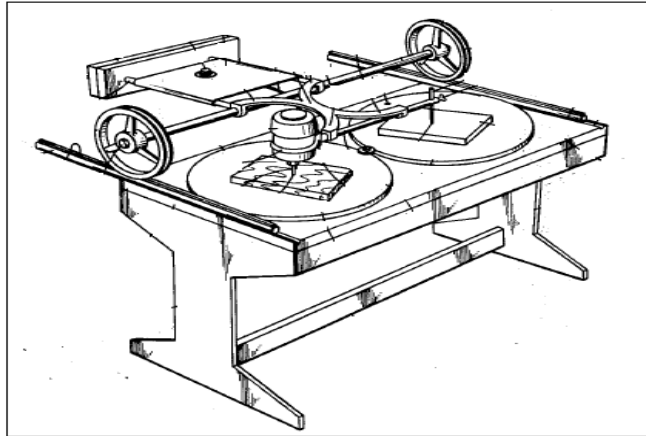
## 3. METHODOLOGY

1. Geometrical modelling or Designing of machine by solid works.
2. Design calculations and dimensions.
3. Finite element modelling using CAD software.
4. Results representation for variation in parameters
5. Results Analysis.
6. Results representation for variation in parameters.
7. Report generation.

### 3.1 PROBLEM FORMULATION

1. It is difficult to have mass production of wooden articles of same size and shape when the article is having complicated shapes.
2. It requires highly skilled labour for carving wooden article.
3. The available duplicator machines are unable to duplicate complicated shapes articles.

4. A variable duplicator machines system is complicated in design.
5. Hence there is a need for a machine which have simple construction and high effectiveness for duplicating the carved articles.



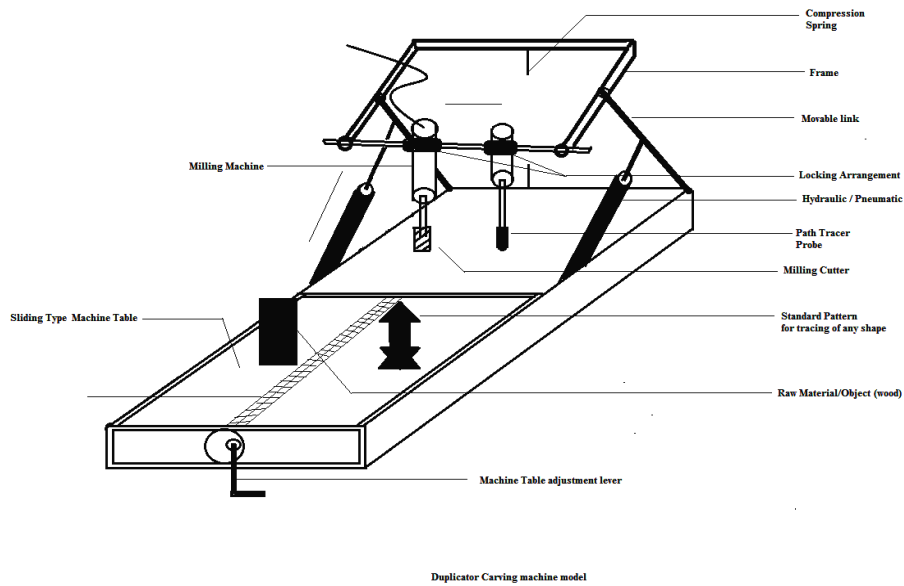
**Fig. no. 1: Model of Two dimensional wood duplicator machines.**

### 3.2 AIM AND OBJECTIVE

**Aim:** Design wood duplicator carving machine.

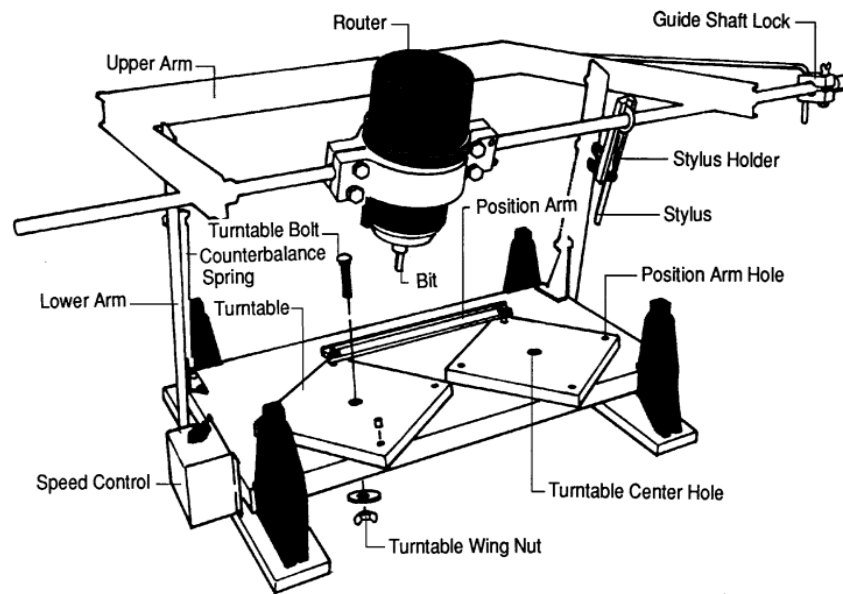
**Objectives:**

- To have simplified construction of Machine
- To cover three dimensional carving of an article for duplicator
- To improve precision in duplicating article.
- To incorporate multi station duplicator facility.

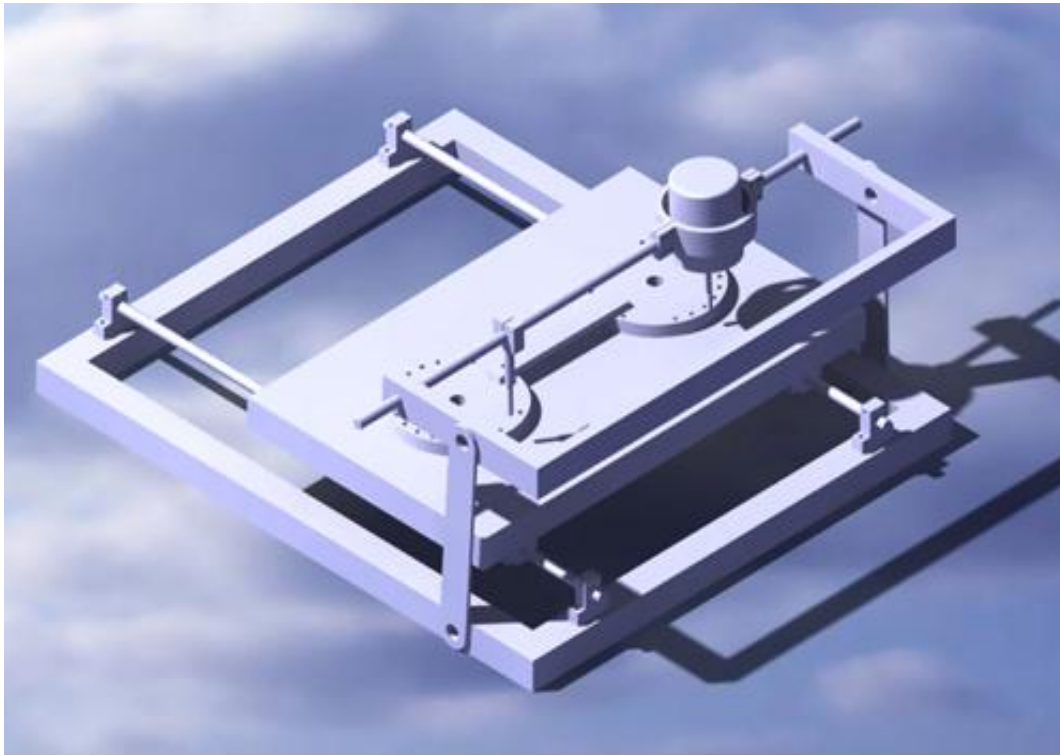


**Fig. no. 2: Model of Three dimensional wood duplicator machines.**

### 3.4 Project Model



**Fig. no. 3: Actual Project Model to design**



**Fig. no. 4: Working Model in CATIA V5**

#### **4. FUTURE SCOPE**

Based upon the above study on Three Dimensional wood Pattern duplicator carving Machine, few areas need further study:

- Here, small job pieces are taken for its operational work and designing and so the same design can be performed on the large size of jobs also for change in material of Three Dimensional wood Pattern duplicator carving Machine.
- Cost estimation and optimization regarding the total case study is required to be calculated.
- The present research work basically concentrates on a light duty construction work considering the wooden surface material only. So, there is a scope for doing the same for heavy duty construction work considering the metal or ceramic materials.
- The stresses analysis can also be done of various moving components, since there will be friction in the moving parts.
- Here, CATIA V5 is used for modeling. So, there is a provision to use some other software's to check for the accuracy of results.

#### **5. CONCLUSION**

The modelling of Three Dimensional wood Pattern duplicator carving Machine is done by using CATIA V5 software. The Three Dimensional wood Pattern duplicator carving Machine parts are created in the CATIA V5 first then the final assembly of all the parts are to be done. The all mating parts are mate with each other as per design specifications. As we design this model for simplicity to the carvers at the time of operations and it should achieved more efficiencies while performing on it with less attachments and settings and more reliable to it.

The working and machining in three dimensions is reduces the setting time for the jobs on machine table and increases the speed of duplicating work. The any semi skilled worker can be easily handled this machine while spending some time on it and learn the all settings and precautions at the time of operation. as the setting time will

be reduced the production time of the machine is deliberately increases as the job will finish in the less setting works. it helps to the economical hand carvers who create a job very limited in a day due to manually work and not afforded the CNC lathes or milling machines.

## REFERENCES

- [1] Duplication of Parts in Wood or Plastic by Harold Hoffman Publishers Action Book.
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- [4] Donald R. Laskowski, Date of Patent: Jan. 15, 1980 title name: Apparatus for the Three-Dimensional Reproduction of an Object.
- [5] John O. Lenz, Date of Patent: Sep. 8, 1981 title name Outboard Tracing Station for Carving Machine.
- [6] Jimmie B. Allred, Earl R. Holden, Stephen H. Blaisdell Date of Patent: Nov. 30, 1999 title name Three-Dimensional Duplicating Carving Machine.
- [7] Richard G. Pikna, Date of Patent: Dec. 10, 2002 title name Duplicator Device for Radial Arm Saw.
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