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DESIGN AND FABRICATION OF WOOD ROUTER MACHINE USING PANTOGRAPH AND FOUR BAR MECHANISM

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Abstract - *This project "design and fabrication of wood router machine are using pantograph and four bar mechanism" is a designed and is used mainly to cut wood, plastic, mild steel plates in to any shapes with desired accuracy and correctness. This machine consists of the traditional cutting equipment along with a pantograph which is a mechanical linkage connected in a manner based on parallelogram and which is further used for copying and scaling line drawing and complex images. The working principle of four bar mechanism in which one link is fixed and other are pivoted. These other links move according to the movement of the tracing link. This is a low cost and high valuable apparatus. In this project, a model of "design and fabrication of wood router machine using pantograph and four bar mechanism" will be designed using CAD packages like AutoCAD, pro-e, solid works etc. taking into consideration of the commercially available components would lead to a diminish aped performance of the machine resulting into a poor surface finish.*

***Key Words*: pantograph, four bar mechanism, router machine, engraving, carving.**

1. INTRODUCTION

The pantograph is one of the fascinating mechanisms of engineering equipment ever invented and in some form or other; it should be part of every engineering shop's equipment. Engraving lines in two dimensions are just one of its functions, more sophisticated versions work in two dimensions and will copy complicated two-dimensional designs and engineered components, enlarging or reducing them in size as required. A pantograph is a simple and powerful tool, which can broaden the scope of artwork and crafting. We can scale the images with a pantograph depending on how the parts are measured and assembled. The pantograph calculates the distances between its pivot points and resizes the image as the "algorithm" for creating the final copy. The pantograph in the analogy would produce a copy smaller than the original. The percentage of enlargement of the pantograph was provided by changing the distances between the pivot points.

2. AIM AND OBJECTIVE

The pantograph mechanism is used to design and fabricate a milling machine which could traverse on any contour provided that stylus is moved along the same on any already existing object. Using such kind of manipulator we can generate the de-scaled replica of the object or we can say it to be a copying machine which can be employed in mass production with economical production/machining cost. The 3-DOF in this manipulator adds a feature to increase or decrease the depth of engrave and thus can be used in metal engraving industries or wood carving industries to copy the engraved wooden design. At the end-effecter we can replace the cutter by a welding torch or a paint brush to perform the desired typical operation with very ease and accuracy. The only constraints are its poor dynamic performance but our kinematic analysis shows it to be perfect for light and slow speed operation.

The three degree of freedom in this manipulator adds a feature to increase or decrease the depth of engrave and thus can be used in metal engraving industries or wood carving industries to copy the engraved design.

3. LITERATURE REVIEW

The Mechanism and Kinematics of a Pantograph Milling Machine Mahendra Verma, Abrar mad, Niyazul S Haque, SahilL Mallick, Ishank Mehta, R. K. Tyagi.

Design and fabrication of pantograph mechanism j. thamilarasan 1 a. prabhu 2, r. pushapkumar 3 & k. karthiK.

Effective Recycling and Use of Wood Carving Waste in Wood Industry Jijin I1 Rinitha

Design, manufacturing, evaluation, and analysis of cnc carving machine m.a. khan1, a. shafi2, s.a. ahmad3, s.f.h. shah4, m.m a. bhutt.5

Wood Engraving Using 3 axis CNC machine Ms. Disha D.Devardekar1, Ms. Aishwarya J.Gudale2, Ms. Rutuja R.Karande3.

4. METHODOLOGY

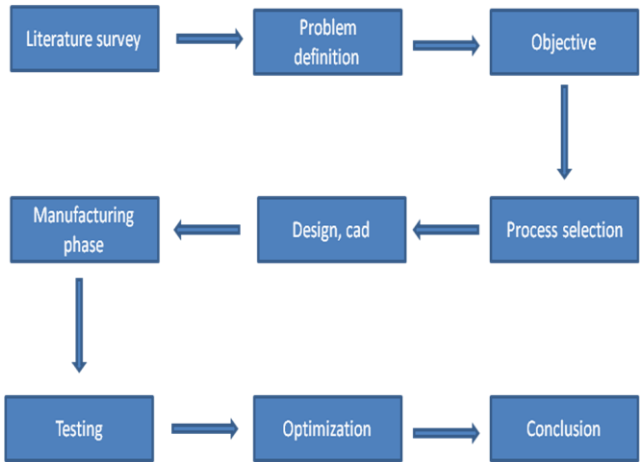

Fig 1: methodology

5. DESIGN AND CALCULATION

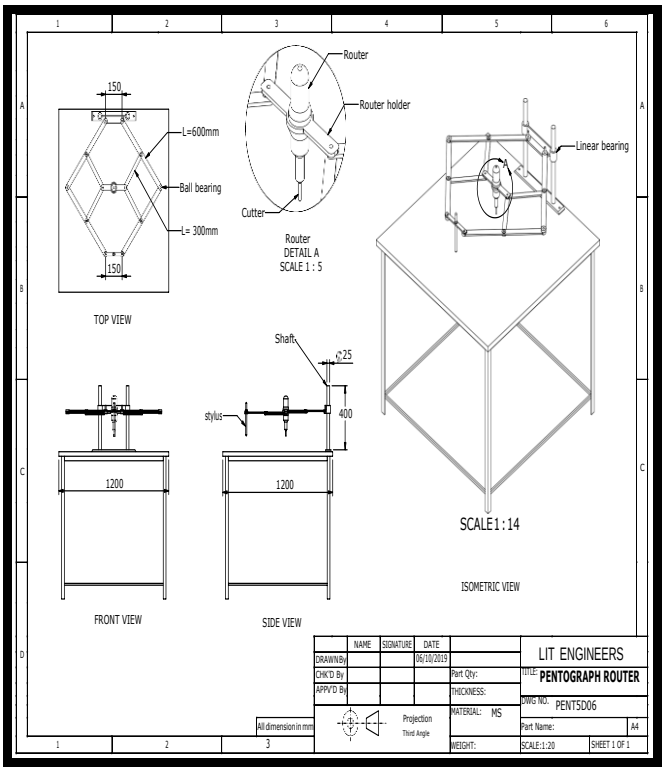

Fig 2: Assembly detail drawing

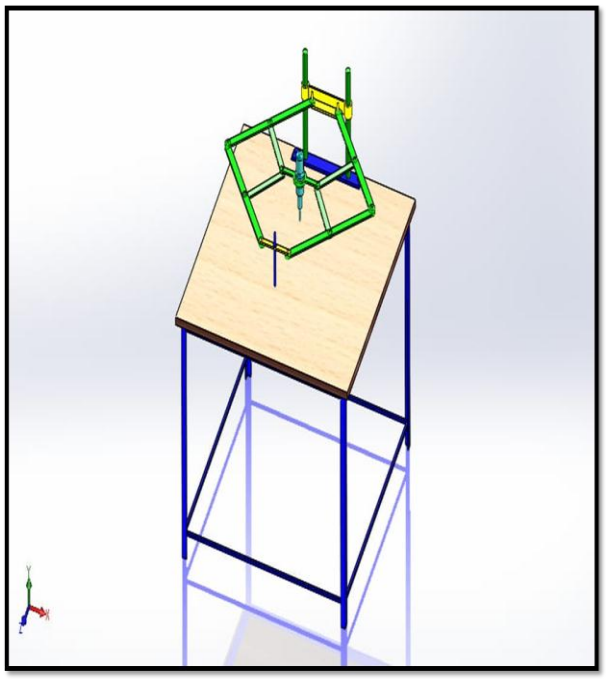

Fig 3: solid works design

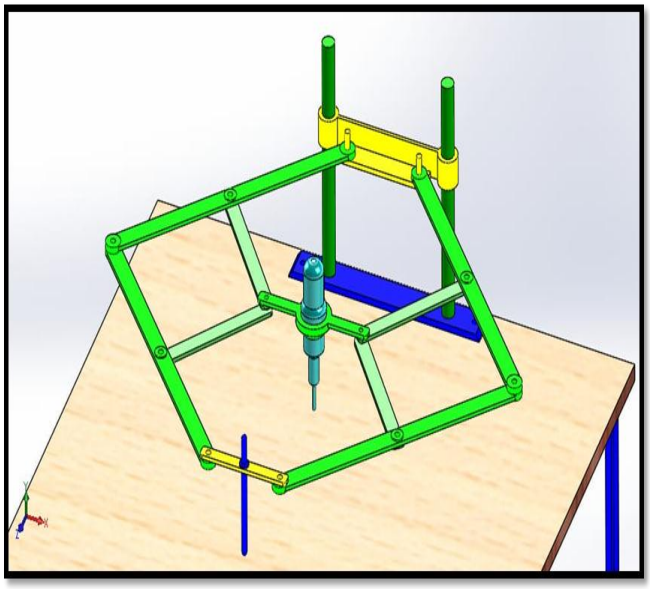

Fig 4: linkage assembly

This drawing shown in above fig vertical shaft and linkage assembly of out model. In fig above vertical shaft is shown. The diameter of the shaft is depend on the arrangement of creates 3D surface or design on the wooden block etc.

Here is two links are fixed with the construction of vertical shaft base.

Link (1 & 2): (described by green)

Link: 1 = a = 600mm

Link: 2 = b = 600mm

Link: 2 = b = 600mm

(a + b) = 1200mm

Here, a = b

Link (3,4): (described by light green):

Link: 3 = c = $\frac{a}{2} = \frac{600}{2}$ = 300mm

Link: 4 = d = $\frac{b}{2} = \frac{600}{2}$ = 300mm

Now, the reducing scale ratio (R) is :

$$R = \frac{a}{(a+b)}$$

$$= \frac{600}{(600+600)}$$

= 0.5

R = 1:2

Assuming the distance between two fixed links a' and b' is denoted by (Z):

Length of yellow bar stylus: b' = 150

Length of yellow bar where two links are fixed: a' = 150
Condition to get two yellow bar translate:

$$= \frac{(d|d')}{(z|b')}$$

$$= \frac{(300|150)}{(z|150)} = 0.5$$

Z = 1:2

Hence we conclude that, Z = R.

Note: The height of the vertical shafts is depending on the height of the work piece or pattern.

6. LIST OF COMPONENT

Table -1: component detail

Sr. no.	Components	Material type	Quantity
1	Router machine	-	1
2	Rectangular shaft	Mild steel	2
3	Metal Sheet	Mild steel	1
4	Nut & Bolt	Stainless steel	16
5	Tool Bits	High speed steel	As per requirement
6	Stylus	Iron	1
7	Bearing	Stainless steel	16
8	90 Angle Metal Strip	Mild steel	2

7. RESULT AND DISCUSSION

This machine can be used in small and medium scale industries. This machine is mainly used in wood fabrication oriented industries. The material can be removed at any shape like oval, rectangular, ellipse, square, circular, pentagon, hexagon shapes etc. This machine is used to guide the cutting tools. This machine is used for reproduction of maps and plans on enlarged or reduced scale.

8. ADVANTAGES AND APPLICATION

1. The main advantage is the pantograph is portable and it can move in 180degree of rotation.
2. The scaling factor can be adjusted according to the need with slight changes in the design depending on if the scale has to be reduced or enlarge.
3. The design of the portable pantograph four bar mechanism such that, it reduce the weight up to 10times.
4. The cost is also reducing to a great extent.
5. The pantograph is cheap in price.
6. It works with accuracy.
7. It has highly effective mechanism.
8. It is economical.
9. Unskilled workers can do operation easily.

9. ACKNOWLEDGEMENT

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10. CONCLUSION

Pantograph may be old mechanism, but still in present days. It has many beneficial uses. Pantograph is parallelogram linkage which is used in our paper engraving purpose on Material like wood. Our model of pantograph engraving machine is having low weight, portable and easy to handle for unskilled persons also than other complicated engraving machines. We designed such mechanism for engraving machine which is safe; hence there are no problems in manufacturing too.

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