DESIGN AND DEVELOPMENT OF JIGSAW MACHINE FOR WOODEN PROFILE CUTTING

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ABSTRACT

This paper deals with the profile cutting operation and development of the jigsaw machine used for cutting operation of wooden piece. Profile-cutting operation is very important in present days because of demand of compact and good look design of product. We are taking Market Survey and observe profile cutting machine and its operation. The conventional machine used in industry is very heavy in design and high maintenance. The Blade Breaks at any time & thus workers safety is reduced. Its operation is time consuming and accuracy of operation depends upon skill of operator. To eliminate this problem we think to modify this machine with eliminating old design with new design with help of Jigsaw cutter. The Sliding is the type of frictional motion between two surfaces in contact. This can be contrasted to rolling motion. So we will use sliding mechanism to slide the workpiece. So we can easily perform cutting operation.

KEYWORDS: Profile-cutting, Jigsaw cutter, Sliding, rolling.

1. INTRODUCTION

Cutting is the separation or opening of a physical object, into two or more portions, through the application of an acutely directed force. Cutting is a compressive and shearing phenomenon, and occurs only when the total stress generated by the cutting implement exceeds the ultimate strength of the material of the object being cut. The simplest applicable equation is *stress = force/area*: The stress generated by a cutting implement is directly proportional to the force with which it is applied, and inversely proportional to the area of contact. Hence, the smaller the area (i.e., the sharper the cutting implement), the less force is needed to cut something. It is generally seen that cutting edges are thinner for cutting soft materials and thicker for harder materials. This progression is seen from kitchen knife, to cleaver, to axe, and is a balance between the easy cutting action of a thin blade is strength and edge durability of a thicker blade. A Woodworking machine is a wood machine that is intended to process wood. These machines are usually powered by electric motors and are used extensively in woodworking.

2. PROBLEM DEFINITION

As we observed during market survey worker's safety was not upto the mark and the accuracy during the cutting process got reduced due to which we came to the solution by introducing sliding mechanism by which the inadequacy we observed during market survey got overcome. Moreover the survey suggest us to use Stainless Steel blade instead of Cast Iron blade.

3. OBJECTIVE

The main aim of project is on the basic problems faced in wooden working workshops. That is the early breakage of blade and less workers safety . We are looking this project as a problem solving way in wooden working industries which will increase workers safety by introducing sliding mechanism, which is most uncovered area in this sector is cost and more efficient way.

4. **COMPONENTS**

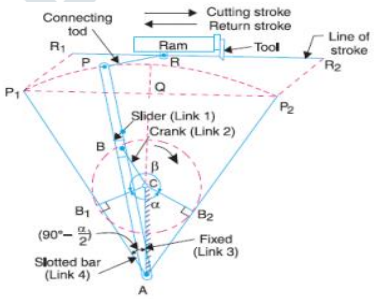
The different components used in 'Jigsaw machine' is as follows:

- DC motor
- Belt drive
- Crank and slotted mechanism
- Bearing
- Pulley Wheel
- Jigsaw blade

4.1 DC Motor : A motor an electro-mechanical device that converts electrical energy into mechanical energy. Electric motors are extremely important in modern-day life. The basic principle on which motor operate is Ampere's law. This law states that a wire carrying an electric current produces a magnetic field around itself.

4.2 Belt drive: The looped strip made up of flexible material which is used to link two or more rotating shafts mechanically is known as Belt drive. Smooth transmission of power is offered by belt drive between the shafts at a certain distance. Belt drives are used as the source of motion to transfer to efficiently transmit power or to track relative movement.

4.3 Crank and Slotted mechanism: This Mechanism is mainly used to convert rotary motion into Reciprocating Motion. This mechanism is mostly used in shaping machines, slotting machines and in rotary internal combustion engines and also in Jigsaw machine.



4.4 Bearing: A bearing is a round, wheel-like device used to reduce friction, bear stress and enable movement in the form of linear motion or rotation. To do so, the bearing usually has a smooth, metallic ball to aid the roll and carry the load. The force of the weight drives the rotation.

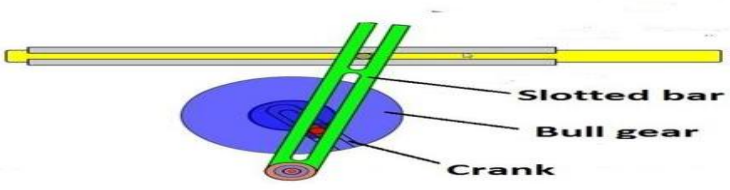
BEARING

4.5 Pulley wheel: A pulley system consists of two pulley wheels each on a shaft, connected by a belt. This transmits rotary motion and force from the input, or driver shaft, to the output, or driven shaft.

4.6 Jigsaw blade: A jigsaw blade is basically a blade used for cutting purpose. This blade is made up of Stainless steel and this blade reciprocates through which it initiates the cutting action.

5. WORKING

In this electrical operated wood cutting machine which can be used for industrial applications and factory works in which not much specific input energy or power is needed. This project consists of simple mechanism by using jigsaw. In this machine, the motor transmits power to shaft which is attached with crank and slotted mechanism that converts rotary to reciprocating motion. The crank and Slotted mechanism is attached to the jigsaw cutter that performs the Cutting Operation on wooden sheet and materials. The objective of the model is using the conventional mechanical process which plays a vital role. Importance of this project lies in the very fact that it is innovative project and helps us to reduce our effort. Moreover, the Sliding Mechanism that helps us to easily drag in forward direction. This can be used easily and work piece can be moved easily. Due to this small or big cutting can be done easily at any place and effective work is done. This process is very simple and can do cutting without any problem.



Crank & slotted mechanism

6. DESIGN

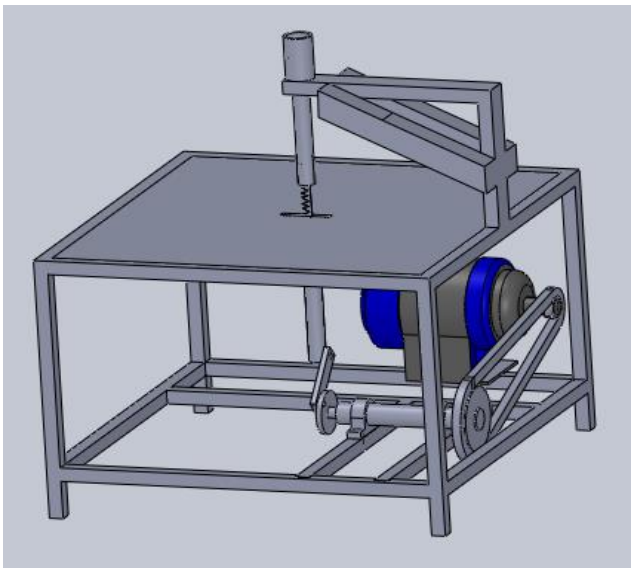
Solidworks is 3D solid modeling software which allows users to develop full solid models in a simulated environment for both design and analysis. We used this software for different purposes like Part drawing and assembly.

Step 1. **PART DRAWING**

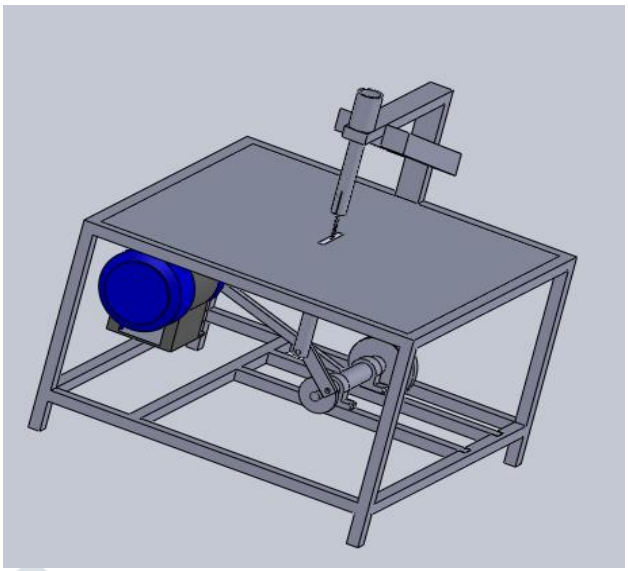
First, we made different parts of machine with proper dimensions. For making these parts we used solid modeling as well as surface modeling. Surface modeling is used to create sheet metal.

Step 2. **ASSEMBLY**

After creating all the parts they were assembled with help of different features.



VIEW I



VIEW 2

7. CALCULATION AND ANALYSIS

7.1 Calculation for the diameter of Pulley Wheel

- N1 = 1440 rpm (speed of motor at no load condition)
- N2 = 360 spm (stroke per minute)
- D1/ d2=? (d1=diameter of larger pulley, d2= diameter of smaller pulley)
- By using equation
  - N1d1=n2d2 -(1)
  - D1/d2=n2/n1 -(2)
  - D1/d2=360/1440=1/4
    Therefore choosing the diameter of smaller pulley as 5cm and the diameter of bigger pulley as 20cm.

Data assumed,
Stroke length = 85 mm
No. Of stroke per min = 360
Crank speed = 360 rpm
Crank radius R = 50 mm

7.2 Velocity calculation:

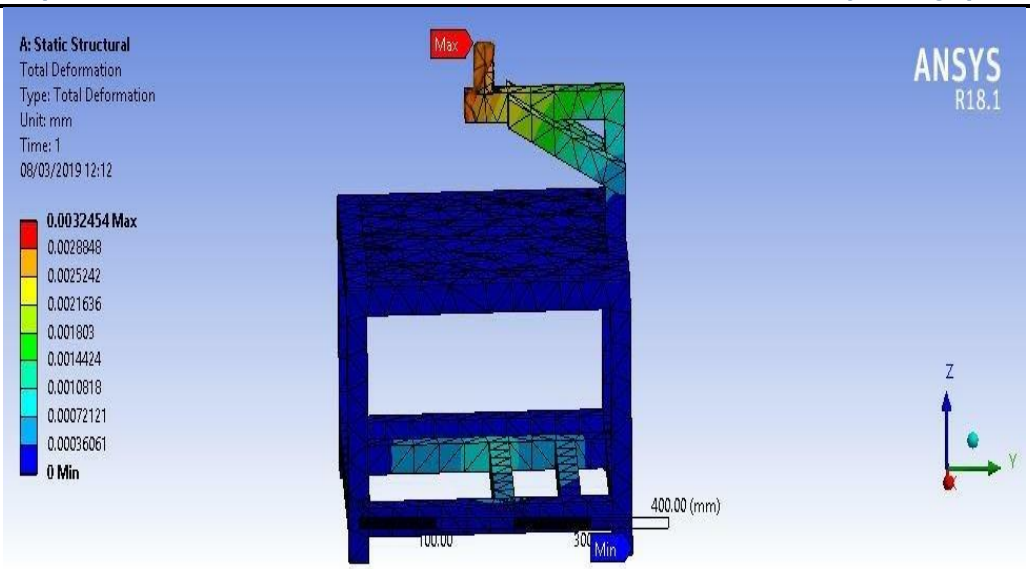
Velocity of crank can be obtained by the given equations.
Angular velocity ω = 2ΠN / 60
= 2*3.14*360 / 60
= 37.68 rad/ s
Linear velocity V = R*ω_{BC}
= 0.05*37.68
= 1.884m/s

7.3 Force analysis:

Torque produce by 1 HP gear reduction motor from 1400 rpm to 360rpm,
Power P =2ΠNT/60
Torque T=P*60/2ΠN
=746*60/2*3.14*360
=19.79 N.m

7.4 Stress Analysis:

Analysis was done in ANSYS and effect of stress was known. Frame of the machine was created as per the result of stress analysis.



8. TECHNICAL SPECIFICATION

SR NO.	COMPONENT	MATERIALS AND COMPONENTS
1	BASE TABLE	MILD STEEL(ANGLE 25.4* 25.4)
2	MOTOR	1 HP , 1440 RPM
3	BIG PULLEY SMALL PULLEY	Dia. : 200 mm Dia. : 50 mm
4	SHAFT	STEEL Length :320 mm Diameter : 25mm
5	Jig saw cutter	STAILNESS STEEL Length : 150 mm
6	Ball Bearing	Company name : NSK Bearing number : 6205
7	BELT	NYLON RUBBER
8.	Crank Slotted mechanism	CAST IRON
9.	Pedestral	PLASTIC
10.	SLIDER	STAILNESS STEEL LENGTH : 25CM

9. Experimental Setup

The view of seed jigsaw machine is as follows,

JIGSAW MACHINE

10. Conclusion:

From this project we conclude that the Machine is prepared by keeping in mind the two most crucial factors of manufacturing the accuracy and cost. The Machine Increases Safety of workers by providing mechanism to slide the work piece therefore the lack of concentration of workers doesn't affect the accuracy of the cutting process. To avoid early breakdown of the blade introducing stainless steel blade instead of cast iron blade. This machine can cut wood efficiently and with good finish upto 20mm.

11. Future scope:

- Sensors can be used to this Machine so that it can monitor some parameters.
- Machine can be improved by increasing the cutting limit more than 20mm.
- We can make automatic moving base by which system can be automated.
- We can improve cutting machine which can be important for mass production.
- We can make multipurpose machine by adding different operation in one machine
- Less power motor can be used.
- Machine can be made fully automatic.

12. Acknowledgement:

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