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Quad Blade Hacksaw Machine Operated By Sliding Crank Mechanism

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Abstract - *Work done in this project is to develop a modernized quad blade hacksaw machine with less stress full operation for cutting wood, metal and plastic materials. Effort has been made to develop a hack saw to improve the performance by making it a motor driven two way hack saw machine. We have used an A.C. motor for rotating the Crank shaft using slider crank mechanism which is linked with the connecting rods. This motion is used for hack saw machine and we can operate four hacksaws at same time. This machine also will do cutting of various materials, hence this sort of mechanism of hack saw machines are going to be welcomed by many industries thanks to compactness and efficiency. This machine consists of four hack-saw blades mounted in two directions. To achieve this goal the quad blade hack saw machine is developed*

***Key Words*: Quad blade hacksaw machine, motor driven, A.C motor, slider crank mechanism, connecting rods, compactness and efficiency, etc.**

1. INTRODUCTION

A hacksaw is a tool which is used by hand in maximum cases and used to cut through materials like plastic tubing and metal pipes. Its cutting mechanism is provided by removable blades which feature sharp teeth along their fringes. Generally a hacksaw consists of a frame which is faced in downward direction. Most blades range in length from ten to 12inches (25.4 to 30.48 cm), although six-inch (15.24 cm) blades can be purchased to fit smaller hacksaw models. Due to increase in demand of products, need for mass and quick production has increased. Machines are often designed to yield a high mechanical advantage to reduce the effort needed to do that work; even our motto behind this project is of same thing.

2. LITERATURE SURVEY

- "Design and fabrication of Automated hacksaw machine", **Sabarianandа, V. Siddhartha, B. Sushil Krishnana,T.Mohanraj**, April 2014: Automated power hacksaw machine gives high productivity in short time period in comparison with the conventional power hacksaw machines. The major advantage of this machine is the involvement and the usage of labor is reduced.
- **Akshay N. Shirbhate**: Pedal operated multi-operational machine which works on various operations without use of electricity. By using this machine we can perform operation like cutting, electricity generation, grinding & water lifting for agriculture.
- **S.G.Bahaleyetal**: He designed and fabricated a pedal powered multipurpose machine. It is a human powered machine he developed because for lifting the water to a height 10 meter and generates 14 Volt, 4 ampere of electricity in most effective way.
- **Sreejith K.**: He investigated on design, fabricate and experimentally investigate the working of Pedal Driven Hacksaw (PDH). PDH is working on Slider Crank Mechanism.

3. CONCEPTUAL OVERVIEW OF COMPONENTS

3.1 Hacksaw frames

Hacksaws consist of a metal frame that too with a handle, and pins for attaching a narrow blade. To hold the blades and keep them in tension a screw is given.

3.2 Blades

A saw blade is a tool consisting of a tough and a hard toothed edge. It is used to cut materials like Iron, wood and also some plastic materials

3.3 Bearings

The term "bearing" springs from the verb "to bear" an impact being a machine element that permits one part in touch (i.e., to support) another.

The other sort of bearing we've utilized in this project to support crank shaft is "solid bearing" which is additionally referred to as Plummer block/pillow block.

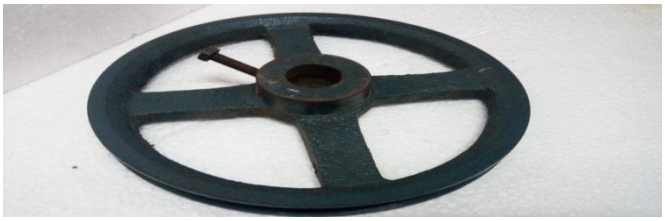
A support block is said to be any mounted bearing where in the mounted shaft is during a parallel plane to the mounting surface, and perpendicular to the centre line of the mounting holes.

3.4 Crankshaft

A crankshaft is the one which converts the reciprocating motion into rotational motion
If it's connected to a motor it's a motor driven (as in our project) it also converts the reciprocating motion given by motor to linear motion

3.5 Pulley

A pulley may be a wheel on an axle or shaft that's designed to support movement and alter of direction of a cable along its circumference. The drive element of a pulley system are often a rope, cable, belt, or chain that runs over the pulley inside the grooves to lift loads, apply forces, and to transmit power. We've used a 3cm pulley which is driven by belt.



3.6 Bench Vice

Bench vice may be a mechanical apparatus utilized to secure an object to permit work to be performed there on. They do have two parallel jaws, one fixed and therefore the other movable, threaded in and out by a screw and lever.

3.7 V Belts

The belts or ropes are made use to transmit power from one shaft to a different by means of pulleys which rotate at an equivalent speed or at different speeds. A belt may be a loop of flexible material wont to link two or more rotating shafts mechanically, most frequently parallel. Belts could also be used as a source of motion, to transmit power efficiently. V belts (also style V-belts) solved the slippage and alignment problem. It's now the essential belt for power transmission.

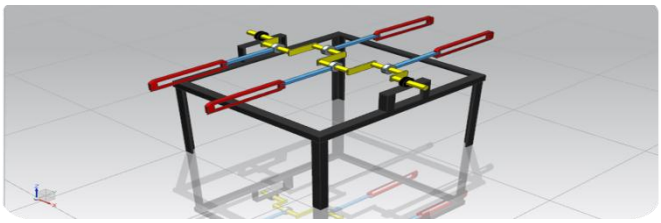
3.8 Single Phase AC Motor

An electric motor is an electrical machine that converts electricity into energy.

It consists of a one phase winding which is mounted on the stator of the motor and a cage winding placed on the rotor. A pulsating magnetic flux is produced, when the stator winding of the single-phase induction motor shown below is energized by a one phase supply. It has two basic parts, an outdoor stator having coils and an indoor rotor attached to the output shaft producing a second rotating magnetic flux.

4. SOFTWARE USED

Software we have used to design the components and assembly is NX-11.
Siemens software, NX is a powerful integrated solution that helps you deliver better products faster and more efficiently. It is very flexible and user friendly software.

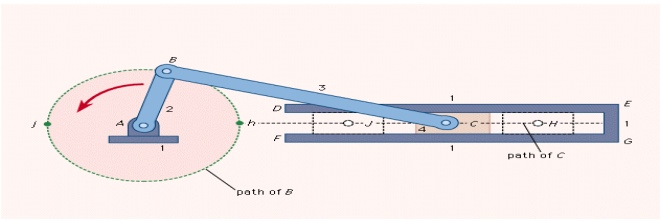


5. MECHANISM INVOLVED

The type of mechanism involved during this project is "Sliding Crank Mechanism".

It is a mechanism designed to convert straight-line motion to rotation, during a reciprocating piston engine, or to convert rotation to straight-line motion.

A slider and crank linkage is a four-link mechanism which consists of three revolute joints and a prismatic, or sliding, joint. The rotation of the crank in the mechanism drives the linear movement the slider.



6. FABRICATION

Metal fabrication is nothing but the building of metal structures by using different sorts of operations like cutting, welding, drilling etc and eventually assembling it. Cutting is completed by sawing, shearing; Bending is completed by hammering (manual or powered) or via press brakes and similar tools. Assembly is finished by welding and clamping.

The different fabrication methods/machining operations involved in our project are mentioned below.

- Cutting
- Drilling
- Grinding
- Cleaning
- Welding
- Assembly etc.

7. PROCEDURE DEPLOYED

We initially designed the parts using NX-11 software which is SIEMENS software for designing, CAD and even used for analysis. Each and each part is designed individually with the accurate and same dimensions which we would like to use in our project. Then we assembled all the parts to bring out the entire assembly and it's even now ready to perform structural analysis and motion analysis.

We ordered the raw materials like flats, shaft and L-angular and purchased them. We marked consistent with the size we'd like. Using cutting machine we've cut them into pieces up to the marked point. Then the shafts were machined and facing, turning operations were administered and knurling was done on the shafts pieces to make ball bearing set on the shaft as designed.

By marking the L-angular up to the required dimensions we cut them into pieces. Then the primary welding was done. After finalizing that it was the correct frame we need to make, we have full welded the frame. Care was taken to avoid blow holes and over weld.

Vice(s) are set to the frame and the next step is of complete assembly. By marking the point at which the bed bearings are to be set, grooves were made to fix those using bolts and nuts. Two bed bearings were mounted on the frame.

The four ball bearings are mounted on the crankshaft, as it was knurled those get fit easily and firmly. Then the clamps are used to join the hacksaw frames which were already assembled with hacksaw blades to the ball bearings. Those clamps are fitted to the bearings using nuts and bolts.

On the crankshaft a large pulley i.e., driven pulley is mounted. The motor is placed in the bottom of the equipment. Then the v-belt is mounted on the driving shaft onto the driven shaft. Connect the motor to power supply.

Now the machine is ready to make use of purpose for which it is designed. Fix the work pieces to the four vise(s) and place the hacksaw blade at the point from which cutting is to be started. Now the power is turned on and

the motor comes to work. The driving pulley of motor drives the driven pulley on the crankshaft, then the equipment comes to action. The forward stroke of the crankshaft is a cutting stroke where the work pieces are cut, as they are mounted two at one direction and the other two in opposite direction. Hence two blades will experience cutting strokes and the other two will experience return stroke. These repeated motions will result in productivity.

8. CALCULATIONS

Torque:

$$\text{Power (P)} = \frac{2 * \pi * N * T}{60}$$

Here,

N = Speed in RPM

T = Torque in N-m

From motor specifications,

P = 750 W

N = 1440 rpm

$$\text{Power (P)} = \frac{2 * \pi * 1440 * T}{60}$$

$$\text{Torque (T)} = \frac{750 * 60}{2 * \pi * 1440}$$

= 4.97 N-m

9. RESULTS

After the equipment is brought to functioning, the results we have obtained is given in the below Table-1.

The revolutions per minute is the number of revolutions taken by crankshaft in one minute and time required for cutting the material is given in minutes.

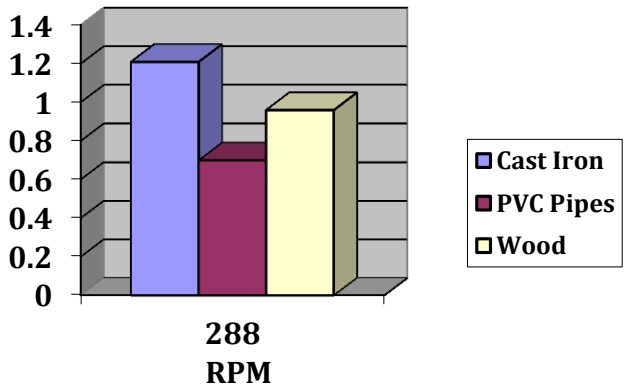
Table-1: Results obtained

Material	Revolutions per minute	Time taken (min)
Cast Iron	288	1.21
PVC Pipes	288	0.7
Wood	288	0.96

We have compared our values to that of the values mentioned in IJSDR Aug, 2016 journal named 'Fabrication of pedal powered hacksaw machine'. Thus we can say that power hacksaw machine is more efficient then pedal operated one.

Chart Representation:

Our obtained values are expressed in the bar graph as below, by placing **Revolutions per minute on abscissa** (x-axis) and the time **taken on Ordinate** (y-axis).



10. CONCLUSION

It is known that conventional hacksaw machine can be replaced with crank shaft operate hacksaw machine. Crank shaft operate hacksaw machine gives high productivity in short time period in comparison with the conventional hacksaw machines. The major advantage of this machine is that intervention of labor is reduced to maximum level. In this rapid emerging industrial era, the utilization of power Hacksaw machine is wide. Time and labor plays a serious role in production process this will be overcome by using this sort of automatic machines. The semiautomatic hacksaw machine can be made use of at any of the industries like pump manufacturing industries that involve bulk amount of shafts that have to be cut frequently. The range of size of work-pieces which will be cut using the automated hacksaw machine are often varied by changing the blade size.

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