Four Way Hacksaw Machine

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Abstract: This paper presents the creation and idea of four ways hacksaw sharp edge machine fundamentally did for creation based ventures. Ventures are fundamentally implied for creation of valuable labor and products at low creation cost, Machinery cost and low stock expense. This task comprises of a wrench and slider system, direct bushing. Today in this world each undertaking have been made faster and quick because of innovation progression however this progression additionally requests colossal speculation and use, each industry wants to make high usefulness rate keeping up with the quality and standard of the item at low average cost. We have fostered a model; we have chosen to utilize very nearly 1/10th of the scale for the framework. These machines can be utilized in remote spots where power is ordinary. It is planned as a compact one which can be utilized for cutting in different spots. It can be utilized for working on materials like slim metals, wood.

Keywords: Four way hacksaw, Crank, Connecting rod, Voltage controller

1. INTRODUCTION
So, many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, Screws etc. This needs more and more number of pieces to be cut for mass production of those components. Four way hacksaw blade machine is basically a cutting device, which cut in four directions at a same time. A hacksaw is a fine toothed saw, originally and principally for cutting metal. They can also cut various other materials, such as plastic, wood and steel etc. This paper proposes the prototype model of four-way hacksaw machine which is able to cut four pieces simultaneously without any jerk and minimum vibrations. The prototype model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw. This prototype model overcomes the limitations of conventional hacksaw machines which can cut single piece at a time. It is able to cut metal bars of different materials at same time and will be helpful in many industries due its compatibility, reliability and efficiency. In present condition many electrically operated power hacksaw machines of different companies with different specifications are available for the use in shop floor. These machines are so precious that they can cut metal bars with minimum time made up of different materials but they have one and major disadvantage that those are able to cut single piece of bar at a time. For industries to achieve the mass production, it is necessary to cut metal bars with high rate. So, it is impossible to depend upon conventional single frame power hacksaw machines and need the improvement in technology and design of such machines.

1.1 OBJECTIVE OF MODEL
The main objective of this project is to reduce the human effort for machining various materials.
The objective of principles of this project is to save man power and time in cutting materials in order to achieve high productivity.
Implementation in the existing technology.
To show the innovative idea on existing system.
To make use of electronic component that are readily available and chipset.
To prepare and efficient and cost effective system.

1.2 LIST OF COMPONENT WITH MATERIALS DETAILS

<table>
<thead>
<tr>
<th>S.No</th>
<th>Component</th>
<th>Materials Details</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Frame</td>
<td>Mild steel</td>
<td>2 feet in square shape</td>
</tr>
<tr>
<td>2</td>
<td>Motor</td>
<td>Crompton</td>
<td>0.5 horse power(1440rpm)</td>
</tr>
<tr>
<td>3</td>
<td>hacksaw</td>
<td>Mild steel</td>
<td>365.7 mm</td>
</tr>
<tr>
<td>4</td>
<td>Baby vise</td>
<td>Mild steel</td>
<td>2 Inches</td>
</tr>
<tr>
<td>6</td>
<td>Bolts</td>
<td>Mild Steel</td>
<td>3 Inches</td>
</tr>
<tr>
<td>7</td>
<td>Connecting rod</td>
<td>Mild Steel</td>
<td>14.39 Inches</td>
</tr>
<tr>
<td>8</td>
<td>Disc</td>
<td>Mild Steel</td>
<td>228.6 mm</td>
</tr>
</tbody>
</table>
2.1 FRAME
We take 2 feet square mild steel casing base. We take 61 cm in base length since; we need to give dependability our model of four way hacksaw machine not get parcel of vibration when the machine in running condition.

![Fig -1](image1.png)

2.2 ELECTRIC MOTOR
The motor we have used in this project is manufactured by Crompton DC motor of 1440 rpm.

![Fig -2](image2.png)

2.3 HACKSAW
Hacksaw edge is made Hacksaw edge is made of Bi-metallic. In hacksaw like most casing saws, the edge can be mounted with the teeth confronting toward or away from the handle, bringing about cutting. Activity on either the push or pull stroke. In typical use, cutting in an upward direction downwards with work held in a seat bad habit, hacksaw edge should be set to confront advances. Some edge saws, including fret saws and penetrating saws have their edges set to confront the handle since they are utilized to cut by being pulled down against a level surface, by the assistance of driving rod system [4]. The hacksaw cutting edge is associated to the connection bar by the assistance of direct bushing.

![Fig -3](image3.png)

2.4 BABY VISE
This is a job holding device that is often used to hold the tasks while performing operations such as sawing, filing, chipping, tapping, external threading, etc. It is fitted above the bench.

![Fig -4](image4.png)
2.5 VOLTAGE CONTROLLER

Voltage controller is used in four way hacksaw machine for control the alter speed of a motor by altering the incoming voltage, but the motor must have an increasing torque load (e.g. Industrial fans, winding machines). The motor attached to the voltage controller is usually never started with high starting torque (or a loaded start); supplying a low voltage to a motor with a high load can heat up the motor and burn its windings (e.g. trying to start a motor).

2.6 DISK

We use the acrylics transparent disc in circular shape (radius of 7.5 cm). On this disc all the bearing is happen. It helps to convert the rotary motion to linear movement.

2.7 BOLTS

The bolts we have used in this project for climbing the hacksaw to machine frame.

LIMITATIONS

Four way hacksaw machines over comes all the limitations and drawback of conventional hacksaw machines. It is also helpful for small scale industries due to its simple working and operating conditions along with its compatibility, efficiency and affordable price. Present situation of industry centers around the high creation rate with less utilization of assets. To accomplish this we really want to limit inactive time and machine time per unit. The four way hacksaw edge machine works on those factors by diminishing time per unit to expand the creation. In current circumstance electrical as well as pressure driven worked machines are utilized however the result from them isn't palatable as it has low cutting rate.

REVIEW OF LITERATURE

The vast review of literature will help to understand the concepts, theorems and different factors affecting the performance of machine.

- Theoretical Analysis Of Four Way Hacksaw Blade Machine Rishi Anand, Khomesh, Shrawan Kumar, Alok Verma, April 2016: In this paper presents the concept of four way hacksaw blade machine mainly carried out for production based industries. Industries are basically meant for production of useful goods and services at low production cost, Machinery cost and low
inventory cost. Knowledge about developed a model of a machine reach would be capable of performing different operation simultaneously, and it should be economically efficient. These machines can be used in remote places where electricity is regular. It is designed as a portable one which can be used for cutting in various places. It can be used for operating on materials like thin metals, wood.

- **Theoretical Analysis of Multi-way Power Hacksaw Machine** Kshirsagar Prashant R, Rathod Nayan, Rahate Prashant P, Halaye Prashant P, April 2015 :

  In his research paper stated that it consists of single phase vertical electric motor rigidly placed at the center of metallic foundation provided. The shaft of motor rotates at 90-100 rpm with the power 2HP. The circular disc is mounted on the shaft of motor with the help of key and key slot arrangement.

- **Design & Fabrication of Human Powered Multipurpose Machine** Rakesh Ambade, Amit Sartabe, Meghraj Arekar, Vaibhav Khachane, Prajakta Gawali, April 2015:

  In their paper states that it consist the pedal powered machine setup, has a simple mechanism operate with chain and sprocket arrangement. The chain is placed on the teeth of the wheel and pinion. The shaft is mounted on pedestal bearings. First mechanical linkage is removed by removing nut and bolts and v belt drive drilling attachment.

- **Design and Fabrication of Automated Hacksaw Machine**, D. V. Sabariananda, V. Siddhartha, B. Sushil Krishnana, T. Mohanraj, and April 2014:

  It is known that conventional power hacksaw machine can be replaced with automated power Hacksaw machine. 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 intervention of labor is reduced to maximum level. In this rapid emerging industrial section the use of power Hacksaw machine is wide, time and labour plays a major role in production process.

**METHODOLOGY**

The single phase vertical electric motor rigidly placed at the center of wooden foundation provided. The shaft Crompton DC motor of 1440 rpm with the power 12 V. The circular disc is mounted on the shaft of motor with the help of key and key slot arrangement. The eccentric point on the plane of disc is provided such that the desired cutting stroke is achieved (around 4-5 inches). One end of each connecting rod is pivoted at this eccentric point by the use of suitable bearing. Another end of each rod is connected to the hacksaw blade fame with the help of linear bushing to get vertical and horizontal Degree of Freedom of rotation for the proper cutting operation. The layout of the system is given in the diagram below. The hacksaw frame slides on the guide ways provided. When motor is ON and disc starts rotating, due to the reciprocating motion of hacksaw frame the metal rod is cut which is firmly fixed in vice. The automatic feeding of coolant is provided to reduce heat generated due to friction which also avoids the jerk.

![Diagram of Four Way Hacksaw Machine](image)

**Fig.8 Four way hacksaw machine**

**DESIGN & CALCULATIONS**

- **Input Shaft**
  - Input Power = 50 Watts
  - Motor speed = 0-9000 rpm
  - Input shaft speed = 1400 rpm

  In designing four way hacksaw machine we have considered a higher end motor of power 0.5 Hp (373 Watt) in order to incorporate the factor of safety.

<table>
<thead>
<tr>
<th>Material Designation</th>
<th>Tensile Strength(N/mm²)</th>
<th>Yield Strength(N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 36(13Ni3Cr80)</td>
<td>800</td>
<td>680</td>
</tr>
</tbody>
</table>

\[ P = \frac{2\pi NT}{60} \]

\[ 373 = \frac{2\pi 1400T}{60} \]
Table 1: Selection of material for Input shaft Maximum allowable shear stress is given by
\[ f_{s\text{max}} = 0.18 \sigma_{ut} \]
\[ = 0.18 \times 800 \]
\[ = 144 \text{ N/mm}^2 \]

OR
\[ F_{s\text{max}} = 0.3 \sigma_{yt} \]
\[ = 0.3 \times 680 = 204 \text{ N/mm}^2 \]

By taking into consideration minimum of above values
\[ F_{s\text{max}} = 144 \text{ N/mm}^2 \]
\[ T = 2545.4959 = \pi \frac{144 d^3}{16} \]
\[ d = 4.48 \text{ mm} \]

Assuming appropriate diameter \( D = 12 \text{ mm} \)
Therefore minimum section diameter of input shaft = 12 mm

**DESIGN OF CRANK PIN**

We know that
\[ T = \text{Force} \times \text{Radius} \]
\[ 2545.4959 = \text{Force} \times 36.57 \text{ mm} \]
\[ \text{Force} = 69.60 \text{ N} \]

**COST ESTIMATION**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>NAME OF COMPONENT USED</th>
<th>QUANTITY</th>
<th>COST OF THE COMPONENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor</td>
<td>1</td>
<td>1500 Rs</td>
</tr>
<tr>
<td>2</td>
<td>Mini Bench Vise</td>
<td>4 Pcs</td>
<td>900 Rs</td>
</tr>
<tr>
<td>3</td>
<td>Hacksaw Frame</td>
<td>4 Pcs</td>
<td>330 Rs</td>
</tr>
<tr>
<td>4</td>
<td>Iron Rods</td>
<td>15 Kg</td>
<td>1550 Rs</td>
</tr>
<tr>
<td>5</td>
<td>Door Hinges</td>
<td>4 Pcs</td>
<td>60 Rs</td>
</tr>
<tr>
<td>6</td>
<td>Iron Circle Plate</td>
<td>1</td>
<td>100 Rs</td>
</tr>
<tr>
<td>7</td>
<td>Speed Controller</td>
<td>1</td>
<td>280 Rs</td>
</tr>
<tr>
<td>8</td>
<td>Nut Bolt</td>
<td>4 Pcs</td>
<td>20 Rs</td>
</tr>
<tr>
<td>9</td>
<td>Welding</td>
<td>-</td>
<td>150 Rs</td>
</tr>
</tbody>
</table>

Total cost - 4980 Rs

**ADVANTAGES AND APPLICATIONS**

**ADVANTAGES**

- Four Blades can operate at the same time.
- Hence saves time.
- Saves labor required.
- Increases productivity

**APPLICATIONS**

- In small scale industries of manufacturing and fabrication.
- In colleges and professional workshops etc.

**CONCLUSION AND FUTURE SCOPE**

As per the above discussion we concluded that to overcome problems in conventional hacksaw machines, due to high efficiency, easy to operate and affordable price the proposed model of multi-way power hacksaw machine is helpful and completes all the expectations needed in the mini industries.
REFERENCES

BIOGRAPHIES

Prakhar Srivastava- He is currently Student of B. Tech second year, Dept. of Mechanical Engineering, Rameshwaram Institute of Technology and Management, Lucknow.

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Karunakar Singh- He is currently working as an assistant professor and head of department at Rameshwaram Institute of Technology and Management, Lucknow. He is M.Tech qualified. He was awarded with education excellence award and currently he is working as NPTEL translator also. He has a teaching experience of 9 years and 2 years industrial experience.

Manisha Singh Chauhan: - Currently Working as Assistant Professor at Rameshwaram Institute of Technology and Management, Lucknow. She is done M.tech Degree in Manufacturing Technology & Automation from Centre for Advanced Studies, AKTU, Lucknow. Her field of interest is Materials Degradation, Manufacturing process, Materials Engineering. Currently published three different research papers in Different research publication using different extract. She is also work as a research volunteer in International Computing system in AKTU, Lucknow.