iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** V **Month of publication:** May 2022

DOI: https://doi.org/10.22214/ijraset.2022.43133

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue V May 2022- Available at www.ijraset.com

Design and Fabrication of Motorized Hacksaw Machine

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***Abstract:** As we know that in large manufacturing industries, the cutting operation is very required for raw material, for this purpose they use manually operated conventional hacksaw machine for cutting operation. In that type of machine single piece can cut at a time by using an electric motor . Also,one labour utilizes for same. This project is on the design and construction of an electric supply hacksaw machine for cutting of metal to different size and length with the help of hacksaw. The objective of this project is to save man power and time in cutting metals in order to achieve high productivity. It is a cutting machine with teeth on its blade used specially for cutting metals. The power to hacksaw is provided by the motor. Here, the step down transformer is used for converting the 220-230V AC power to 12V DC power to run the machine smoothly , then the current is supplied to the motor then with the help of single slider crank mechanism. 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 cutting in various places. It can be used for operating on materials like thin metals ,woods etc.*

I. INTRODUCTION

There are 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. Motorized hacksaw cutting machine is basically a cutting device. [1].A hacksaw is a fine –toothed saw, originally and principally for cutting metal[2] . They can also cut various other materials, such as plastic, wood and steel etc. This paper proposes the prototype model of motorized hacksaw machine which is able to cut piece 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 [3] 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. It is also helpful for small scale industries due to its simple working and operating conditions along with its compatibility, efficiency and affordable price.

II. LITERATURE REVIEW

1) "Material selection and testing of hacksaw blade based on mechanical properties" stated that the appropriate saw blade must be selected for better operations and fine cutting by selecting a number of teeth per inch.
2) There are four types of blades based on the materials namely High carbon steel , Alloy steel ,Bi -metallic strip and High speed steel blades . Out of these four the best suitable for cutting hard materials like a Mild steel bar and Aluminium is a Bi-metallic blade on the basis of properties of materials ,Wear resistance and Cutting performance.
3) "Theoretical Analysis of Multi-way Power Hacksaw Machine" proposes the model of multi-way hacksaw machine which is able to cut four pieces simultaneously without any jerk and minimum vibrations.
4) "Design and Fabrication of Automated Hacksaw Machine"(April 2014) gives an idea about the various components required for fabrication of the proposed model. These components will help to get smooth working condition and future automation of different mechanical actions as well as linkages.

5) The vast review of literature will help to understand the concepts , theorems and different factors affecting the performance of the machines R.S Khurmi , J.K Gupta in their books "THEORY OF MACHINES" (velocities in mechanisms) helps to find velocity diagrams of slider crank mechanism.
6) "Design , Construction and Performance Test Pedal Operated Hacksaw Machine" (October 2019)gives an ideas about the frame work and the idea about the single slider crank mechanism based project .

A. *Problem Statement*

Manual labor takes time and is not effective as they can work for 5-6 hours at a stretch for cutting any objects. The time consuming because of replacement of blades for different sizes and also it take some time to cut if the blade is weak than that of the substance which we are going to cut.
We can modify that machine to use it on large scale but its cost will increase. This machine can be used in small scale industries without any problem as compare to that of large scale industries.

B. *Aim and Objective*

To formulate an idea to suit our required functionality that is to cut the types of materials. To develop the idea to suitable mechanical principles and to design the idea into practice. To fabricate the design and the selected material which are cost effective.

III. DESIGN OF MACHINE

An To design any machine or machine part the first thing is to The first stage of the design process is to understand the perspective of the target customer to identify and address the problem at hand.

IV. MATERIAL SELECTION

A. *Material for Fabrication*

1) Plate – Mild Steel
2) Frame square pipe-Mild steel

B. *Standard Parts Used*

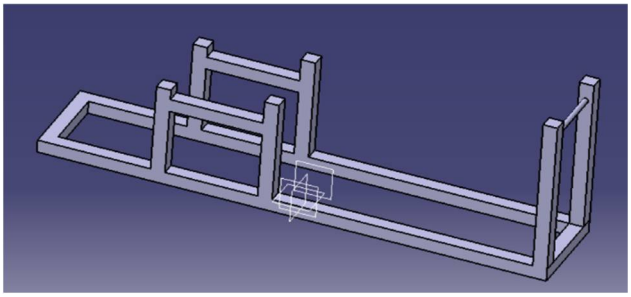
Step down transformer
1) Wiper motor
2) Connecting – rod
3) Hacksaw with suitable blades
4) Wooden bench-wise
5) Sliding

V. FABRICATION

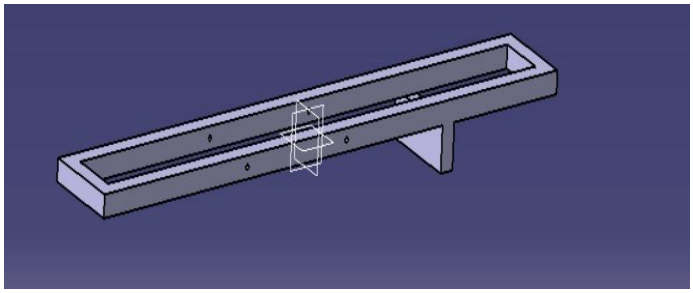
A. *Machine Components*

1) *Machine Frame*

The whole frame is made up of mild steel square pipe. The required frame must be in light weight and also it should be easy to handle. This motorized hacksaw machine having dimension 880×125 ×300 (l × b × h) mm is fabricated. For fabrication purpose the mild steel angle section is use to built the frame.



Bottom frame (Base)



Top frame (upper frame)

Motorized hacsaw Machine Frame

2) Step-down Transformer

A step-down transformer is a type of transformer that converts the high voltage (HV) and low current from the primary side of the transformer to the low voltage (LV) and high current value on the secondary side of the transformer. The reverse of this is called as a step-up transformer.

a) Useful in stepping down the voltage ,thereby making transmission power easier and cheap
b) Provides varied voltage requirements.
c) Low cost

Fig : Step down transformer

3) Standard Sliding

Here, the sliding are attached to the hacksaw and the sliding mechanism is used there to move the hacksaw to and fro for the cutting purpose.

4) Single Slider Crank Mechanism

A single slider crank chain mechanism is a modification of the basic four bar chain. It consist of one sliding pair and three turning pairs. It is usually found in reciprocating steam engine mechanism. This type of mechanism converts rotary motion into reciprocating motion and vice-versa.

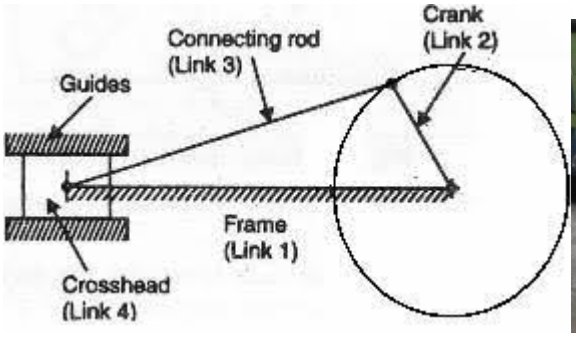


Fig: Single slider crank mechanism

5) Motor

Wiper motor (DC)
Motor is used from TATA 407.
Working voltage = 12 Volt DC [Ampere] 6A
Motor RPM = 45RPM
Torque = 15.27 NM

Fig: Motor

B. Fabricated Machine

1) Top view
2) Front view
3) Side view
4) Side view while operating

Fig : Top view

Fig : Front view

Fig : side view

Fig : side view while operating

VI. MACHINE SPECIFICATION

Component Name	**Description**
MOTOR	Wiper motor (DC) Working voltage ; V= 12 volt and Current (I) =6A , Power = 72W Revolution=45RPM Torque= 15.27 NM
Transformer	Used to reduce the voltage of conventional power circuits to operate low voltage devices. Voltage = 12V ; Current = 3A
Single slider cranck mechanism	To convert circular motion into reciprocating motion.
Cutter Blades	Hacksaw blades of various materials.

VII. RESULT

A. Manual Cutting Cost

Amount paid to the labour for one day = Rs.300 per labour
Total number of labour required in general = 5
Total amount paid to the labour=5*300=Rs.1500
Total cost in one day=Rs.1500

B. Cutting Cost using Motorized Hacksaw Machine

Electricity require for cutting the rod of 20mm diameter maximum and 10 foot long = 7 Unit
Cost of electricity per unit = Rs.10
Total cost of electricity required to cut the 10 foot long rod with 20mm diameter = 7*10
=70
Amount paid to the labour = Rs.300

Total cost = Total cost of electricity required to cut 10 foot long rod with 20mm diameter + Amount paid to the labour + Maintenance

=70+300+150

=520

Amount saved by one day =1500-520

=Rs.980

C. *Advantages*

Reduce the human effort- Motorized hacksaw machine is mostly design for reduce the human effort in which only one operator can be operate or handle the machine. While the machine will begin there not required more than one or two worker.

1) Reduce the cost- In the industrial sector for cutting the various types of materials. It can cut at cheapest prices because it saves the worker cost.
2) Reduce the time- When worker is cutting the material they have more time for cutting but when the use of Motorized hacksaw machine they increase the capacity of the working and cutting and it can possible the maximum cutting within minimum time.
3) Easy to handle- Motorized hacksaw machine is easy to handle and we can easily start the machine.
4) Unskilled worker can operate- No skilled person required for operating this machine.
5) Safety to use- during the working if any problem occurs in the machine we can easily find it.
6) Adjustable Cutting mechanism- The Cutting mechanism of this machine is adjustable. We can remove this mechanism very easily so it can be change, repair and replace with other mechanism also.

D. *Disadvantages*

1) It can't cut the heavy materials more than 20 mm of diameter .
2) Water is harmful for this because it works on electricity.
3) Extra time is required if material is strong enough than the hacksaw blade.

VIII. CONCLUSION

The purpose of the project is to fabricate a machine to carry out the operation like cutting various types of materials. which should be helpful for the workers have small scale industry by the observation of the results and discussion. We met the worker who is working with hand operated hacksaw and other working on cutter machine and take details from them. The variation between manual method and cutting method are described below: The labours required for the cutting method is less than manual method.Further, the cutting method is suitable for the small scale farmers as it is economically feasible. The time duration required for the cutting method is less than the manual method. The cost required for the cutting the types of material is also less. The motorized hacksaw machine to develop is just concept. The machine operated by single labour. This machine is helpful for the both the small as well as large scale industry. Based on literature review, We have concluded that many have worked on comparison and performance evaluation of hacksaw machine on favour of manual , semi operated and automatic operated.

1) Labour requirement is reduced.
2) Time consumed is less.
3) Cutting cost is reduce.
4) Useful for small scale industry workers.

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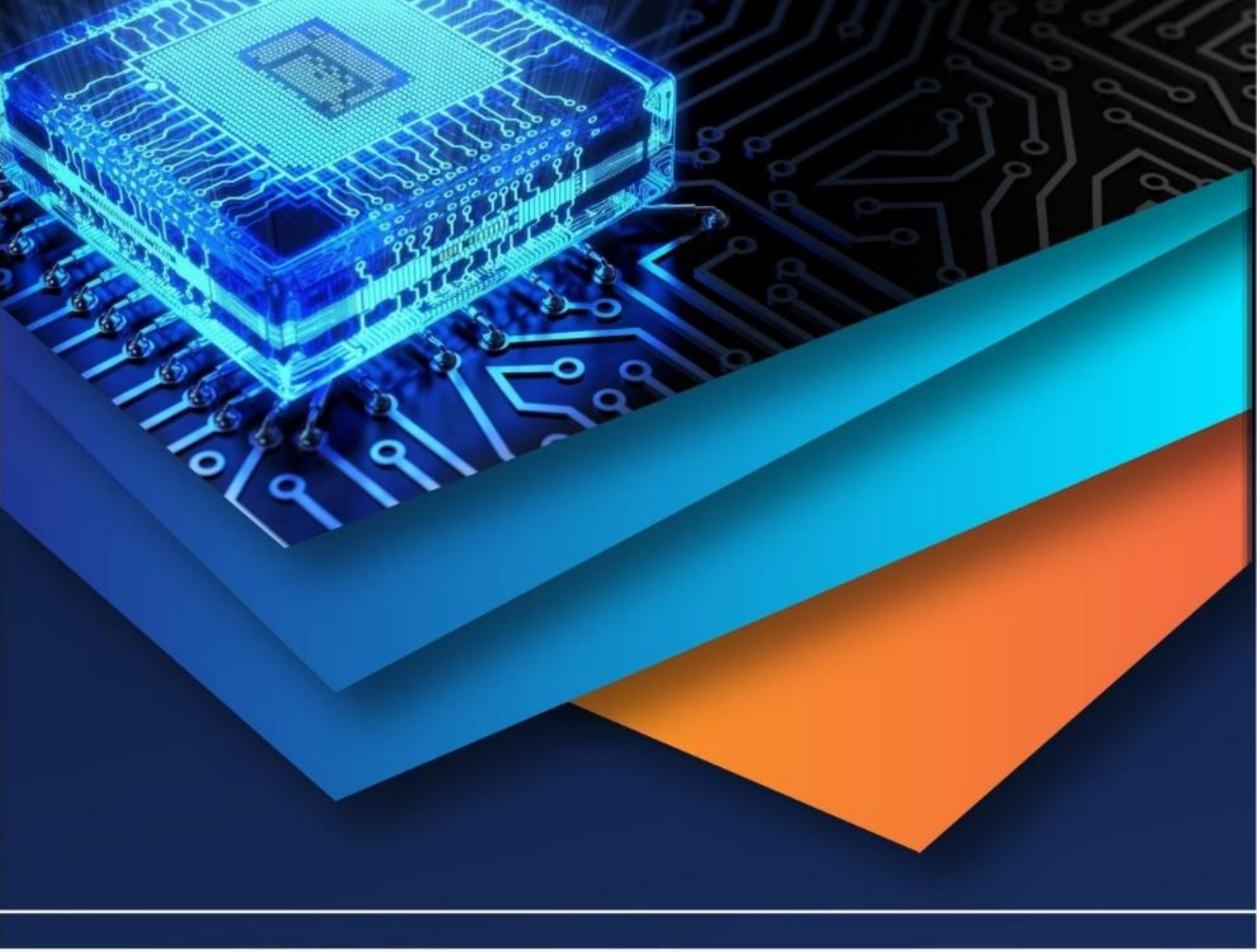
Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 04 | Apr 2021.



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