Pedal Powered Hacksaw Machine

Abhishek Baravkar, Rohan Jagtap, Yogesh Bhujade , Praful Kurhade, Prof.M.P.Palaskar,

Student Department of Mechanical Engineering , Sanjivani K.B.P. Polytechnic Kopargaon,

Abhishekbaravkar431@gmail.com, jagtaprohan5127@gmail.com, prafulkurhade4062@gmail.com, bhujadeyogesh5@gmail.com, mppalaskarme@sanjivani.org.in,

Abstract

In this project work an effort has been made to design and developed model of Pedal Powered Hacksaw. The pedal powered hacksaw is a device which is used for cutting wood, plastic and metals. The basic principles of power driven hacksaw is Slider Crank Mechanism which is an inversion of four bar chain mechanism. In this mechanism, the connecting rod is directly connected to the hacksaw for the processing of cutting the wooden blocks. The hacksaw move to and fro motion when the pedal is powered, so as the rotating disc rotates. The main aim of this project is to reduce the human effort for machining various materials.

Keywords: Pedal Powered Hacksaw, Sprocket Arrangement, Slider and Crank Mechanism.

1. Introduction

Pedal power represents a paradigm of sustainable energy utilization, harnessing the remarkable potential of human effort through ingenious foot pedal and crank systems. While its most iconic application remains in propelling bicycles, its versatility extends far beyond mere transportation, finding utility in diverse realms such as agriculture, tool operation, and even electricity generation. This essay delves into the multifaceted domain of pedal power, with a particular focus on its application in the realm of machining, notably the innovative concept of pedal-powered hacksaw machining.

The genesis of this project lies in the recognition of the extraordinary capabilities of humans to generate energy through pedaling. With a well-designed pedal-powered mechanism, individuals can channel their physical exertion into productive endeavors, such as operating machinery for cutting, shaping, or other fabrication tasks. In the specific case of hacksaw machining, the integration of pedal power presents a compelling solution for efficient material cutting across various substrates, be it metal, wood, or other materials.

The mechanical setup of a pedal-powered hacksaw machining system entails a sophisticated interplay of components aimed at converting the rotational motion generated by pedaling into the precise linear motion required for the operation of the hacksaw blade. This mechanism embodies the fusion of human biomechanics and engineering ingenuity, culminating in a sustainable and eco-friendly solution for machining operations.

Central to the efficacy of pedal-powered hacksaw machining is the considerable power output achievable through human pedaling. With individuals capable of generating up to 1/4 HP (horsepower) through sustained pedaling efforts, the system possesses ample energy to drive the hacksaw blade with requisite force and velocity, ensuring swift and precise cutting actions. Moreover, the sustainability of this endeavor is underscored by the realization

that while continuous pedaling at maximum power may be feasible for shorter durations, a reduced power output, such as 1/8 HP, can be sustained for more extended periods, nearing 60 minutes.

2. Literature review

Chaudhary et al. [1], Pedal operated hacksaw machine which can be used for industrial applications and Household needs in which no specific input energy or power is needed. This project consists of a crank and slider mechanism. In the mechanism pedal is directly connected to the hacksaw through crank and slider mechanism for the processing of cutting the wooden blocks, metal bars and materials. The objective of the modal is using the conventional mechanical process which plays a vital role. The main aim is to reduce the human effort for machining various materials such as wooden blocks, steel, etc. The power hacksaw machine, which runs on human power works on the principle of the conversion of rotational motion to oscillatory motion. Importance of the project lies in the very fact that it is green project and helps us to reduce our electricity need. Secondly, this cutter can be used and transferred to our working place easily. Moreover, if we want we can generate electricity with our project by connecting it to dynamo, diode and battery.

3. Objective of project work

This project is focused on the development of a pedal-powered hacksaw machining system, leveraging the considerable advantage of pedalling over hand-cranking, with individuals capable of generating four times more power (equivalent to 1/4 HP) through pedalling. Pedal power involves transferring energy from a human source through a foot pedal and crank system. Thus, the project aims to design and develop a pedal-operated hacksaw. The main objectives include:

- Analyzing the press force required for the cutting operation.
- Analyzing the speed and length of the cutting stroke.
- Determining the mathematical design of the chain and sprocket mechanism.
- Determining the mathematical design of the crank and slider mechanism.
- Designing the blade for low-force cutting applications to validate the problem statement.

Through addressing these objectives, the project seeks to create an efficient and sustainable cutting tool that effectively harnesses human energy. By conducting mechanical analysis, refining designs, and practical experimentation, the pedal-powered hacksaw machining system aims to demonstrate its capability and contribute to innovative solutions in machining technology.

COMPONENTS USED

Chain Sprocket Mechanism: The Function of chain drive is to convert the pedal operated manual force to rotary motion of sprocket, thereby rotating the crank wheel. The other function is to speed up the human force with respect to the driven sprocket so as to maintain the speed stroke of hacksaw.

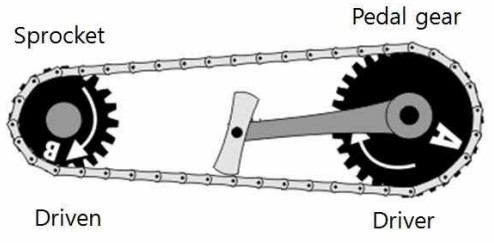

Fig. Chain Sprocket Mechanism

A bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclists‟ foot or shoe and the crank allowing the leg to turn the bottom bracket spindle and propel the bicycle's wheels. The Size of the pedal is 60mm by 70mm and thickness is 10mm. The size of pedal crank is 250mm in length with the bearing housing provided of 30mm in diameter and internal hole for the driving shaft as 15. The parts will be selected standard.

Fig. A bicycle pedal

The Crank is connected to the driven shaft of the small sprocket. The speed of small sprocket and crank are same. The Crank will be made of Mild Steel with the diameter as 200mm and the thickness is 3mm. The hole is provided to pivot the rivet with connecting rod.

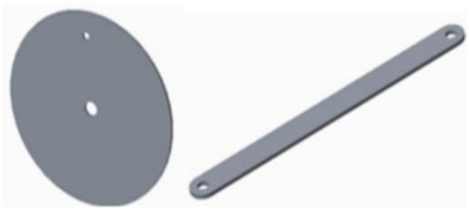

Fig 5. Crank Connecting Rod.

Frame: The width of length as 240mm and the provided of 8mm diameter to and other for hacksaw. The Mild Stee

connecting rod is 20mm with the thickness is 3mm. Two holes are the pivot the rivet one for crank material of connecting rod will be

Table 1. Components of Frame.

No.	Part Name	Quantity
1	Base Square Pipe - 1	02
2	Base Square Pipe – 2	02
3	Middle Square Pipe	04
4	Support Stand	03
5	Bearing Plates	02
6	Fixture Plate	01
7	Guide Plate	02
8	Guide Rod-1	01
9	Guide Rod-2	02

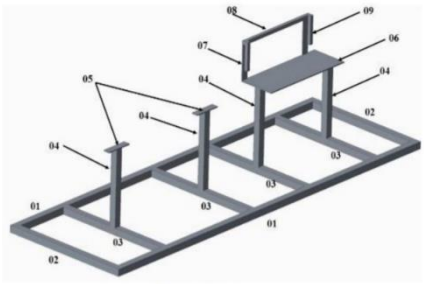

Fig 6. Frame.

Fig 7. Assembled View of Hacksaw Mechanism.

Working process:

The Pedal Operated Hacksaw Machine consists of the pedal arrangement which rotates the crank and through it slider consists of oscillating mechanism. The power is transmitted to the crank and slider mechanism. This mechanism is used to rotate the crank disc; the disc which is having an extended rod is connected to the sliding portion of the hacksaw directly by means of a linkage. The hacksaw is passed through the guide ways by means of maintaining the cutting axis. As the user operated the pedal, the hack saw cuts the various materials automatically with less power. The dead weight is for compressive force while the user operated

the foot pedal as shown in Fig. 4.1

Fig. 4.1 Working

4. Advantage

1. Time saving as compared to manual and single way hacksaw machine.
2. No input power is required.
3. At a single point of time it can able to cut more than one job of any required size.
4. It is easily portable.

5. Disadvantages

1. Totally manually operated.
2. It needs human effort.

6. Conclusion

The machine is cost effective compared to power hacksaw machine. Also, the machine consumes no electricity at all, which is a major plus point. Machine is simple in design, reliable, and can be used where electric supply is not available, particularly in rural areas. The machine operates with the mechanical efficiency of 78.94% and mechanical advantage of 0.45. The only maintenance required is lubrication. Teeth blunt rate and wear rate is very slow. If maintained properly, the life of the machine is more than 10 years

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