International Journal of Engineering & Technology, 3 (2) (2014) 220-223
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www.sciencepubco.com/index.php/IJET
doi: 10.14419/ijet.v3i2.1813
Technical Paper

Fabrication of pedal powered hacksaw using dual chain drive

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Abstract

In this Paper, 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 sprocket arrangement, the crank and slider mechanism, the chain drive. In the mechanism, chain drive is directly connected to the hacksaw for the processing of cutting the wooden blocks. The objective of the paper 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, PVC etc.

Keywords: *Sprocket Arrangement, Crank and Slider Mechanism.*

1. Introduction

Pedal power is the transfer of energy from a human source through the use of a foot pedal and crank system. This technology is most commonly used for transportation and has been used to propel bicycles for over a hundred years. Less commonly pedal power is used to power agricultural and hand tools and even to generate electricity. Some applications include pedal powered laptops, pedal powered grinders and pedal powered water wells. Some third world development projects currently transform used bicycles into pedal powered tools for sustainable development. This project concentrates on pedal powered hacksaw machining.

An individual can generate four times more power (1/4 HP) by pedalling than by hand-cranking. At the rate of ¼ HP, continuous pedalling can be served for only short periods, approximately 10 minutes. However, pedalling at half this power (1/8 HP) can be sustained for close to 60 minutes but power capability can depend upon age [1-2]. As a consequence of the brainstorming exercise, it was apparent that the primary function of pedal power one specific product was particularly useful: the bicycle. Many devices can be run right away with mechanical energy [3].

A saw is a tool that uses a hard blade or wire with an abrasive edge to cut through softer materials. The cutting edge of a saw is either a serrated blade or an abrasive. A saw may be worked by hand, or powered by steam, water, electric or other power. An abrasive saw uses an abrasive disc or band for cutting, rather than a serrated blade.

2. Components required

- Pedal arrangement
- Stand setup parts
- Supporting frame
- Crank and slider mechanism
- Hack saw assembly
- Dual chain drive assembly
- Sprockets

3. Working principle

It consists of the pedal arrangement which rotates the larger sprocket as well as the smaller sprocket. The smaller sprocket rotates and 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.

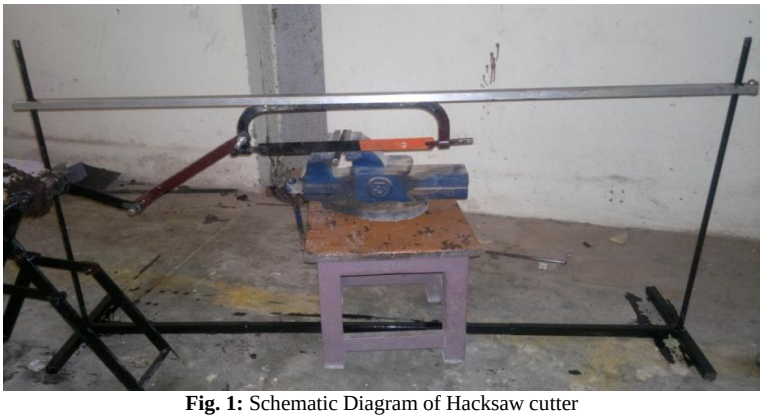

Fig. 1: Schematic Diagram of Hacksaw cutter

Fig. 2: Dual Chain drive

4. Fabrication

4.1. Pedal arrangement

A pair of pedals is attached to the stand setup in which the power will be generated manually. A typical Bicycle arrangement is used.

4.2. Stand setup parts

Stands are introduced to immobilize the apparatus. Various components used are fixed to this arrangement. The chassis of the bicycle is used as the stand setup parts

4.3. Crank and slider mechanism

This mechanism is used to convert the rotary motion of the crank into the reciprocating motion of hacksaw. The lengths of the crank and connecting rods are made using trial and error method.
The hack saw is guided by an aluminum plate. The vertical movement of the hacksaw will be guided by to iron rods. The vertical movement will act as a feeding unit.
Two sets of chain drives are made. The primary chain drive will transmit the power from the pedal to the secondary chain drive. The secondary chain drive will increase the speed of the rotation.

5. Working diagram

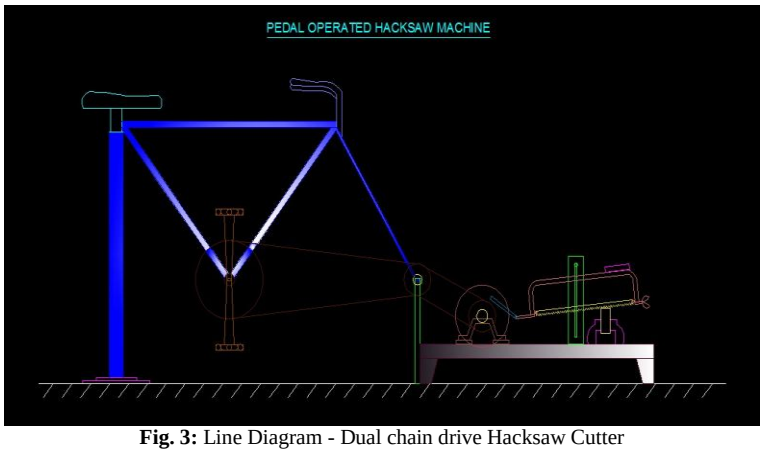

Fig. 3: Line Diagram - Dual chain drive Hacksaw Cutter

Fig. 4: Working Model - Dual chain drive Hacksaw Cutter

6. Calculation

6.1. Number of teeth of sprocket

Primary chain drive
Larger sprocket = 44
Smaller sprocket = 18
Secondary chain dive
Larger sprocket = 24
Smaller sprocket = 18

$$\frac{\text{Number of teeth in sprocket 1}}{\text{Number of teeth in sprocket 2}} = \frac{\text{speed of sprocket 2 (rpm)}}{\text{speed of sprocket 1 (rpm)}}$$

44/18 = x/20 say, pedaling speed is 20 rpm
Speed of sprocket 2 (x) = 48.8 rpm

$$\frac{\text{Number of teeth in sprocket 3}}{\text{Number of teeth in sprocket 4}} = \frac{\text{speed of sprocket 4 (rpm)}}{\text{speed of sprocket 3 (rpm)}}$$

24/18 = y/48.8
Speed of sprocket 4 (y) = 65.18 rpm
Liner velocity = rw
Angular velocity (w) = 2N/60 = 6.8 m/s
Linear velocity = 0.1 * 6.8 (r = 10 cm)
Reciprocating velocity = 0.68 m/s

7. Conclusion

Thus a low cost and simple design pedal operated hacksaw machine is fabricated. This machine reduces the human effort and hence we don't need two persons to cut the wooden logs. This simple design of conventional design which can enhance day today household needs and daily day to day purposes and it can be also used in for industrial applications during power shut down scenarios.

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