Pedal Powered Hacksaw

Lokendra Bhati[1], Pankaj Sharma[2], Rajesh Parmar[3], Satish Lodhi[4], Shadab Mevati[5]
[1, 2, 3, 4, 5] Department of Mechanical Engineering
[1, 2, 3, 4, 5] Swami Vivkananda College Of Engineering Indore, Madhya Pradesh

Abstract- *This project work deals with the design and fabrication of a pedal powered hacksaw cutting machine. The aim of this work is to develop a modernized and less stressful operation for cutting wood, metals and plastic materials. It is very useful for cutting PVC materials (pipes) and can be used widely in lather and in furniture making industries. This work can also serve as an exercising machine for fitness while cutting, it uses the principle of a slider crank mechanism which converts the rotary motion of the flywheel to the reciprocating motion of the hacksaw during pedaling.*

Keywords- pedal power, Hacksaw, reciprocating motion, slider-crank mechanism, rotary motion.

I. 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 pedaling than by hand-cranking. At the rate of ¼ HP, continuous pedaling can be served for only short periods, approximately 10 minutes. However, pedaling at half this power (1/8 HP) can be sustained for close to 60 minutes but power capability can depend upon age . 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. 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.

II. PROBLEM STATEMENT

Cutting by a hacksaw with hand has following problems.

a. More effort is required.
b. Less accuracy.
c. Takes more time for operation.

III. PROBLEM DEFINITION

To meet out such problems like – More effort requirement, getting less accuracy and taking more time for operation, we design and construct a pedal driven hacksaw machine that will use a less effort pedaling power to produce uniform cutting of PVC pipes, metals, wood and at the same time serve as an exercising machine for fitness.

IV. PROPOSED METHODOLOGY

The cycle frame is fixed with the base mild steel by the process of welding The chain sprocket is connected to the cycle frame and it is connected to the pedals.The one end of the chain is connected to the big sprocket and the other end is connected to the small sprocket which is held in a chain hub.The other end of the hub is fixed with the small chain sprocket .From the other end of the hub another chain is connected to the sprocket and other end is connected to another small sprocket which is held with the circular rod and bearing setup.The circular rod is inserted into the bearing and is welded with the sprocket at one end and with rotating disc at the other end.The connecting rod is connected to the rotating disc at one end and to the hacksaw at the other end. The hacksaw moves in fro motion when the pedal is powered, so as the rotating disc rotates.The pipe vice is fixed at the end to hold the work piece tightly in a straight position.As the pedal is powered by the human energy, the chain and sprocket rotates which makes the hacksaw blade to move in to and fro motion.When the hacksaw moves, the workpiece metal will be cut into a desired shape and the weight holder is fixed above the hacksaw to make the hacksaw blade to move.

V. WORKING PRINCIPLE

Conversion of rotating motion of the sprocket into reciprocating motion of the hacksaw with the help of chain-sprocket arrangement and a flywheel

VI. WORKING OF THE MODEL

It 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.

Specification and calculation: The block diagram representation of speed ratio of the system. W2= W3 The ideal Mechanical Advantage (IMA) =D_{drivn} = DDriven= W_{IN} DDriver W_{OUT} Where:

D_{Driven} = Diameter of driven sprocket =D_2

D_{Driver} = Diameter of driver sprocket = D_1

W_{IN} = Input rotational velocity of wheel = W1 W_{out} = Output rotational velocity of wheel = W2 And Also IMA_{Total} = W_{IN}/ W_{out}

And Also IMATotal = WIN/ Wout

So, using the datas below:

Sprocket 1, Driver(D1) = 160mm

Sprocket 2, Driven(D2) = 60mm

Flywheel Diameter (D3) = 110mm

No. of Teeth of D1 = TN1=44

No. of Teeth of D2 = TN2 = 18

$IMA_1 = D_2/D_1$ = 60/160 = 0.40= IMA TOAL

Which is less than 1.

So, using N_{IN} = 90 RPM(Calculated manually)

$\Rightarrow W_{IN} = 2\pi Nin/60$ = (2x3.142x90)/60 = 9.42rad/s IMA Total = W_{IN} /W_{out}

$\Rightarrow$Wout = Win/IMA total = 9.42/0.4 = 23.55 rad/s:. Wout = 23.55rad/s

:. The output rotational speed of the flywheel = 23.55 rad/s

$\Rightarrow$The power output, P =$F_C \times V$

Where F_C = centrifugal force on the flywheel.

and V = Linear Velocity

but V = Wout×r where r = radius of flywheel.

So, using 1kg mass of flywheel

But flywheel radius = D_3/(2X1000) metres

= 110/(2X1000) m = 0.055m

$\Rightarrow$V = 23.55X 0.055 = 1.3m/s and

F_C = mrw2 =1x0.055 x (23.55)2

= 30.50N = 0.0305KN

:. The power, P = F_C x V

= 30.50 x1.3 = 40W= 0.040KW

:. The Torque, T = F_C x V = 30.50x 55= 1677.5Nmm.

Velocity ratio

V.R. = (length of crank pedal/hacksaw cutting stoke)

= 8cm/10cm = 0.8

:. V.R = 0.8

Efficiency Of The Machine

Efficiency = (IMA/V.R.) x 100%

Where I.M.A = Ideal Mechanical Advantage = 0.4(as calculate earlier)

:. Efficiency = (0.4/0.8) x 100% = 50%

VII. RESULTS AND DISCUSSION

The machine was tested for three different materials (mild steel pipes, wood and plastic pipes). The ideal mechanical advantage of 0.4, power output of 40W and efficiency of 50% makes it very adequate and efficient as a useful machine for exercise and as a cutting machined compared to the existing ones.

VIII. CONCLUSION

Thus the pedal powered hacksaw machine is designed tested successfully. The output is verified by cutting the metal pipes, plastics in the hacksaw by pedaling action. The following advantages were seen such as it is more convenient and easier. It is more eco-friendly.

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