

DESIGN AND FABRICATION OF TWO WAY PADEL OPERATED HACKSAW MACHINE

¹Mukund S. Gosavi, ²Mahesh S. Gosavi, ³Suraj D. Sawant, ⁴Prashant T. Sawant

MECHANICAL ENGINEERING DEPARTMENT
SOLAPUR UNIVERSITY/FABTECH TECHNICAL CAMPUS COLLEGE OF ENGINEERING AND RESEARCH,
SANGOLA, MAHARASHTRA, INDIA

ABSTRACT

This project work deals with the design and fabrication of a pedal powered two way hacksaw cutting machine. In this Pedal operated two-way hacksaw machine which can be used for Small scale Shop applications for cutting of wooden block, PVC pipe. The machine works on the principle of Scotch yoke mechanism. In scotch yoke mechanism rotary motion is converted into a To and Fro (reciprocating) motion. In this machine peddle in connected Sprocket (ratchet) through chain which is connected to scotch yoke mechanism to the hacksaw frame from both the side and the power is supplied to the hacksaw frame by means of chain.

The main aim of this machine to reduce cutting time as well as energy. In which no external power is required for cutting operation, it also available in minimum cost. The peddle power two-way hacksaw machine, which runs on human power, works on the principle of the conversion of rotational motion to oscillatory motion. This is a project which saves electricity need and can be easily use in day today's life.

1. INTRODUCTION

Pedal power is the transfer of energy from a human source through the use of a foot pedal and crank system. This type of energy is mostly used for travelling (transportation) purpose and has been used in bicycles form hundred years ago. Minimum pedal power is used to power agricultural and hand tools and also for generate electricity. Some applications include pedal powered grinders and pedal powered water wells. This pedal power can be utilized for operating hacksaw.

The Pedal Driven Hacksaw (PDH) is working on Scotch Yoke Mechanism. The PDH is used to cut ply wood in small scales. PDH helps to obtain a less effort uniform cutting. It can be used in places where electricity is not available. It is designed as a portable one which can be used for cutting in micro and small workshop. The main parts of PDH are hack saw, reciprocating rod welded to the pedal of a bicycle through Scotch Yoke mechanism, flywheel, sprocket and chain drive. The hack saw is connected with the reciprocating rod. By operating pedal of bicycle the reciprocating rod movement is to and fro done, the hack saw will be moving with the rod. The work piece is hold in holding fixture and it is cut by To and Fro motion of blade . Thus the work piece can be cut without any external energy like electricity. Hence this shows us no electric power and fuel; this is very affordable and best.

2. OBJECTIVES

To reduce the human efforts for cutting the PVC pipes, metals and wood.
To make the cutting process precise and fast.
To save the electrical power required to operate the hacksaw.

3. COMPONENTS REQUIRED

3.1 Pedal: -

Pedal are usually made of hard plastics mainly used to propel cycle or anything with the use of feet of humans. They are initially attached to cranks connecting directly to the driven (usually front) wheel to propel.



3.2 Crank:-

The bicycle drive train reciprocating motion legs chain belt, which in turn drives the rear wheel. It have pedal, crank to the bicycle frame at the bottom bracket, and also at the rear sprocket, cassette freewheel crank set is the component that converts the human pedal effort into rotational motion used to drive chain wheels attached to the arms. It is connected to the rider by the or via the chain. But in this crank set the two cranks, one on each side is mounted in same direction as compared to the conventional crank of mounting 1800 apart, connect the bottom bracket axle to the pedals.



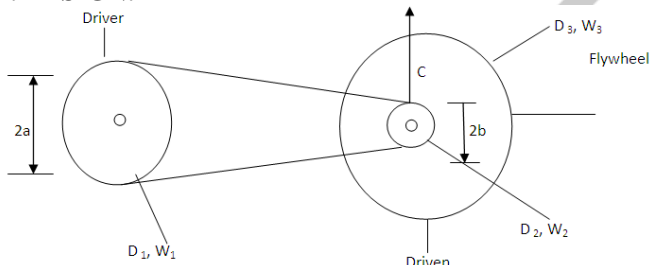
3.3 Supporting frame:-

The frame is made of cast iron totally consisting of L-shape brackets, rectangular hollow bars, circular rods, hollow pipe, flat bars, etc

3.4 Hack saw assembly:-

Hacksaw blades are metal strips having some teeth like cutting edges on one or both side of the metal strip. This blade is fitted to the frame to do the cutting operation. Various types of blades are available in market in standardized sizes, 10 or 12 inches (254 or 305 mm) for a standard hand hacksaw. "Junior" hacksaws are 6 inches (152 mm) long. For Power hacksaw may use large blades in a different sizes, or small machines may use the same size hand blades. The pitch of the teeth can be anywhere from 14 to 32 teeth per inch (tpi) for a hand blade, with as few as 3 tpi for a large power hacksaw blade.

4. DESIGN:-



The block diagram representation of speed ratio of the system. $W_2 = W_3$

The ideal Mechanical Advantage (IMA) = D_{Driven} / D_{Driver}

$D_{Driven} \Rightarrow IMA = D_{Driven} / D_{Driver} = W_{in} / W_{out}$

Where: D_{Driven} = Diameter of driven sprocket = D_2

D_{Driver} = Diameter of driver sprocket = D_1

W_{in} = Input rotational velocity of wheel = W_1

W_{out} = Output rotational velocity of wheel = W_2

And,

$IMA_{total} = IMA_1$ Also $IMA_{total} = W_{in} / W_{out}$

So, using the datas below:

Sprocket 1, Driver (D_1) = 195mm

Sprocket 2, Driven (D_2) = 80mm

Flywheel Diameter (D_3) = 450mm

No. of Teeth of D_1 = $TN_1 = 44$

No. of Teeth of D_2 = $TN_2 = 18$

$IMA_1 = D_2 / D_1 = 80 / 195 = 0.41$

$IMA_{TOAL} = 0.41$

Which is less than 1.

So, using $N_{in} = 120$ RPM

$\Rightarrow W_{in} = 2\pi N_{in} / 60 = 2 \times 3.142 \times 120 / 60 = 12.568$ rad/s

$IMA_{total} = W_{in} / W_{out}$

$W_{out} = W_{in} / IMA_{total} = 12.568 / 0.41 = 30.63$ rad/s

$\therefore W_{out} = 30.63$ rad/s

\therefore The output rotational speed of the flywheel = 30.63 rad/s

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

Where FC = centrifugal force on the flywheel and V = Linear Velocity

but ,

$V = W_{out} \times r$ where r = radius of flywheel.

So, using the weight of an average man say 60-75kg and 7kg mass of flywheel

But flywheel radius = $D_3 / 2 \times 1000$ metres = $450 / 2 \times 1000$ m = 0.225 m = 225m

$\Rightarrow V = 30.63 \times 0.225 = 6.89$ M/S

And,

$FC = mrw^2 = 7 \times 0.225 \times (30.63)^2 = 1641.84$ N = 1.641 KN

The power, $P = FC \times V = 1641.84 \times 6.89 = 11315.15$ W

= 11.315 KW

The Torque, $T = FC \times V = 1641.84 \times 0.225 = 369.414$ N/m

= **0.369 KN/m [2]**

5. Equipment used: -

5.1 Lathe machine:-

A lathe is tool that works on principle that workpiece rotates on its axis and various operations are done by the tool being applied to the workpiece. Various operations done by lathe are cutting, sanding, knurling, grooving, drilling, facing, turning, etc.



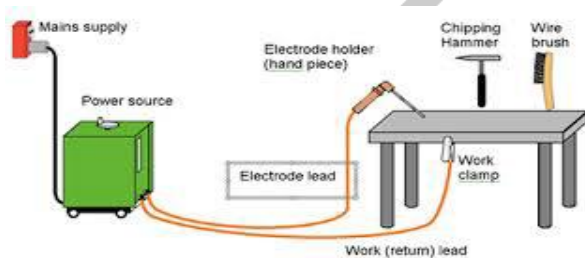
5.2 Drilling machine:-

- Drilling is the operation of producing circular hole in the work-piece by using a rotating cutter called DRILL.
- It is the simplest and accurate machine used in production shop.
- The work piece is held stationary i.e. clamped in position and the drill rotates to make a hole.
- The machine used for drilling is called drilling machine.
- The drilling operation can also be accomplished in lathe, in which the drill is held in tailstock and the work is held by the chuck.
- The most common drill used is the twist drill.



5.3 ARC welding:-

Arc welding power supply electric arc direct alternating is a type of that uses a to create an between an electrode and the base material to melt the metals at the welding point. They can use either (DC) or (AC) current, and consumable electrode.



5.4 Circular saw cutting machine :-

It is metal cutting machine having a circular saw teeth.

5.5 Other: -

Other equipments used are Try-square, hammer, nuts and bolts hand drilling machine. [4]

6. APPLICATIONS

1. Cutting of two metal piece at the same time.
2. Cutting of wooden workpieces.
3. Cutting of plastic materials and PVC pipes.

7 CONCLUSIONS

By successfully completion of the project we can be able to eliminate the shortcomings of the two way acting hacksaw machine. The two way pedal powered hacksaw machine required 50% less time for cut two workpieces as compare to single way hacksaw machine.

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