

Fabrication of two-way pedal powered hacksaw machine

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Abstract

In this Pedal operated two-way hacksaw machine which can be used for industrial applications for cutting of wooden block, metal bar and pipe too. The machine works on the principle of slider crank mechanism. In this machine peddle in connected to the crank which is connected directly to the hacksaw frame from both the side and the power is supplied to the hacksaw frame by means of chain. The main objective behind this machine to reduce both cutting time and energy in which no external power is required for cutting operation, it also available in affordable 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 green project which saves our electricity need and can be easily applicable in day today's life.

Keywords: *Two-way hacksaw machine, peddle power, time and cost saving, green project.*

1. Introduction

1.1. Hacksaw :

A hacksaw is a fine-toothed saw, mainly used in purpose of cutting metal. Hacksaw can also be used to cut various other materials for example- plastic material (PVC pipes and pipe fixtures) and wooden materials with them. There are two type namely, hand saw versions and powered versions (power hacksaws). Almost all the hacksaws are hand saws with a C-shaped frame that holds a blade under tension with the retention screw. Such hacksaws have a handle, usually made of a wooden grip, with pins for attaching a narrow disposable hacksaw blade. The cutting edge of a saw is either a serrated blade like teethes. The frames have also provision for adjusting to accommodate blades having different lengths. A screw or other mechanism is used to put the thin blade under tension.

1.2. Pedal Powered hacksaw :

Pedal power is the transfer of energy from a human by the use of a foot pedal and crank system mechanism. Such technology is most commonly used for transportation and has been used to propel bicycles in many decades. Almost one third world development projects currently transform used bicycles into pedal powered tools for sustainable development. This project concentrates on pedal powered hacksaw machining. [1]

An individual is able to generate power four times more (1/4 HP) by pedaling as compared to hand-cranking process. At the rate of 1/3 HP, continuous pedaling can be served for only short periods, approximately 10 to 15 minutes. However, pedaling at half this power (1/8 HP) can be sustained for close to 50 minutes but the power capability can depend upon individual person. [2]



Fig 1.1

2-way pedal power hacksaw machine:

In this project instead of conventional power hacksaw machine we aimed at constructing a two-way cutting hacksaw machine powered by pedal. The two hacksaw frames are placed on the same side of the machine. The two hacksaw frames are guided through a circular rod above it and frames are pin jointed to the links or

connecting rods connecting the crank. The crank is mounted on vertical L-shaped brackets supported by two ball bearings to reduce the friction created by the rotating rod of crank.

The crank in return is connected to another crank carrying pedals through a chain. Hence when pedaling is done through pedals it turns the crank via chains and the hacksaw frames connected to the crank makes an oscillatory forward and backward movement over the guides provided above the hacksaw frame. Due to the oscillatory forward and backward movement it cuts the workpiece which is attached to bench vice below the hacksaw blade.[3]

Hence in this way it enables to cut the workpiece on both the sides reducing the time taken for cutting multiple workpiece quickly. [4]



Fig1.2

1.3. Components used in 2-way cutting pedal powered hacksaw machine:

1.3.1. Hacksaw blade:

Hacksaw blades are metal strips having some teeth like cutting edges on one or both side of the metal strip. Such a blade is attached to the hacksaw frame to enable the cutting action.

Blades are available in standardized lengths, 10 or 12 inches (254 or 305 mm) for a standard hand hacksaw. "Junior" hacksaws are 6 inches (152 mm) long. Powered hacksaws may use large blades in a range of sizes, or small machines may use the same hand blades. The pitch of the teeth can be anywhere from fourteen to thirty-two teeth per inch (tpi) for a hand blade, with as few as three tpi for a large power hacksaw blade.

1.3.2 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.



Fig1.3

1.3.3. Crank:

The crankset is the component of a bicycle drivetrain that converts the reciprocating motion of the rider's legs into rotational motion used to drive the chain or belt, which in turn drives the rear wheel. It has chainrings or chainwheels attached to the cranks, arms, or crankarms to which the pedals attach. It is connected to the rider by the pedals, to the bicycle frame by the bottom bracket, and to the rear sprocket, cassette or freewheel via the chain.

But in this crankset the two cranks, one on each side is mounted in same direction as compared to the conventional crank of mounting 180° apart, connect the bottom bracket axle to the pedals.



Fig1.4

1.3.4 Cast iron frame:

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

1.3.5 Bench vice :

A vice is a job or workpiece holding device. It is a mechanical apparatus used to secure an object to allow work to be performed on it. Vises consists two parallel jaws, one fixed and the other movable, threaded in and out by a screw and lever. Vice are generally fixed to the table

or bench so as to provide necessary force for holding workpiece during machining and also for reducing the vibrations generated due to machining.



Fig 1.5

1.3.6. Circular Ball Bearings: A ball bearing is a type of rolling-element bearing that uses balls made up of steels or alloys to maintain the separation between the bearing races. The sole purpose of a ball bearing is to reduce rotational friction and support radial and axial loads of the rotating shafts. This is done by using by using at least two races to contain the balls and transmit the loads through the balls.

1.4. Equipment used:

1. **Lathe machine:** A lathe is tool that's 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.



Fig 1.6

2. **Drilling machine:** Drill is the process of making holes in workpiece with the help of rotating drill bits that work as tool for drilling purpose. This forces the cutting edge against the workpiece, cutting off chips (swarf) from the hole as it is drilled.



Fig 1.7

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

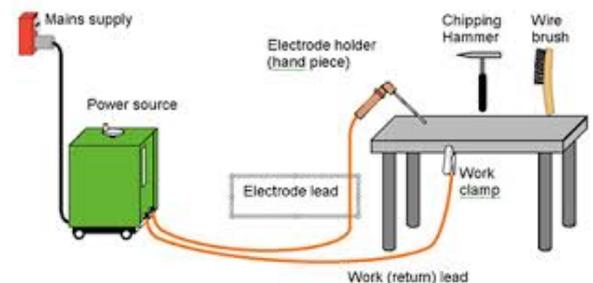


Fig 1.8

4. **Circular saw cutting machine :** It is metal cutting machine having a circular saw teeth.

5. **Other:** Other equipments used are Try-square, hammer, nuts and bolts,hand drilling machine,

1.5.Mechanism:

Crank and slider mechanism

This mechanism is used to convert the rotary motion of the crank into the reciprocating motion of hacksaw. The rotary motion through pedal is transmitted to the crank connecting hacksaw frame which is guided over a circular rod. A slider crank mechanism converts circular motion of the crank into linear motion of the slider. In order for the crank to rotate fully the condition $L > R + E$ must be satisfied where R is the crank length, L is the length of the link connecting crank and slider and E is the offset of slider. A slider crank is a RRRP type of mechanism i.e. It has three revolute joints and 1 prismatic joint. The total distance covered by the slider between its two extreme positions is called the path length. Kinematic inversion of slider crank mechanisms produce ordinary an whitework quick return mechanism

The lengths of the crank and connecting rods are made using trial and error method.

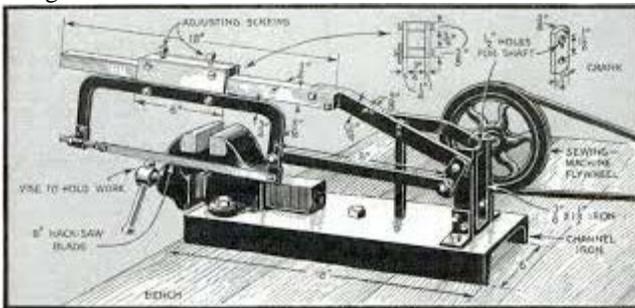


Fig 1.9

2. Literature Review:

S.G.Bahaley, Dr. A.U. Awate, S.V. Saharkar [5] designed and fabricated a pedal powered multipurpose machine. It is a human powered machine which is developed for lifting the water to a height 10 meter and generates 14 Volt, 4 ampere of electricity in most effective way. Power required for pedaling is well below the capacity of an average healthy human being. The system is also useful for the work out purpose because pedaling will act as a health exercise and also doing a useful work

Prof. Kshirsagar Prashant R [6] et al researched on Theoretical Analysis of MultiWay Power Hacksaw Machine and concluded that to overcome problems in conventional hacksaw machines, due to high efficiency, easy to operate and affordable price the proposed model of multi-way power hacksaw machine is helpful and completes all the expectations needed in the mini

industries. Future scope of proposed research work to increase the production rate, cuts the metal bars easily. It can withstand the vibrations, no hazards from jerk, no Special training required to operate it.

Sreejith K. [7] et al investigated on design ,fabricate and experimentally investigate the working of Pedal Driven Hacksaw(PDH). PDH is working on Slider Crank Mechanism

Dharwa Chaitanya Kirtikumar [8] designed and developed a multipurpose machine which does not require electricity for several operations like cutting, grinding etc. This is a human powered machine runs on chain drives mainly with human efforts. But if you wanted to operate this machine by electric power this machine can also does that. It has some special attachment so use both human power as well as electric power. The design is and can be built using metal base,chain, pulley ,rubber belt, grinding wheel, saw, bearing, foot pedal (for operated by human),electric motor, chain socket.

3. Applications:

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

4. Advantages:

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:

By successfully completion of the project we can be able to eliminate the shortcomings of the one way acting hacksaw machine. The two way acting pedal powered hacksaw machine will cut two workpiece at the same time reducing the amount of time taken by the earlier one.

The two way acting pedal power hacksaw machine will efficiently cut 2 workpiece at the same time.

7. Future Scope:

For more faster operations in particular areas such as in workshops , the pedal mechanism can be replaced by a electric motor which will increase the speed of cutting further more thereby reducing more time. But the electricity consumption by the electric motor should also be taken into account and the machine also needs to be bolted to the base to cancel out the vibrations created by the motor.

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