Design and Fabrication of Pedal Operated Hack Saw

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***Abstract*:- In this 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, pvc 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, PVC 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 this 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.**

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 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.

2. COMPONENTS REQUIRED

I. Hack saw blade
II. Pedal arrangement
III. Stand setup parts
IV. Crank and slider mechanism
V. Hack saw assembly
VI. Metal slab

2.1. PEDAL POWER HACKSAW

The principle of pedal power hacksaw is to change circulatory motion or cycling motion into translatory motion with the help of metal cutting rod. This is mainly used for cutting metals and plastics. it is manually pedal operated system. If we use dynamo then we can produce electricity which will be help to lighting the work piece area when electricity is not available in mechanical workshop. A hacksaw is a fine- tooth saw with a blade under tension in a frame, used for cutting materials such as metal or plastics. Hand-held hacksaw consist of a metal arch with a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. A screw or other mechanism is used to used to put the thin blade under tension. It is a fine tooth hand saw with a blade under tension. It is used to cut metals and PVC pipes. It would be useful in many projects discussed on this site which used plastic pipes as materials. Blades of hacksaw are measured in TPI (Tooth per Inch). Different TPI is needed for different jobs of cutting.

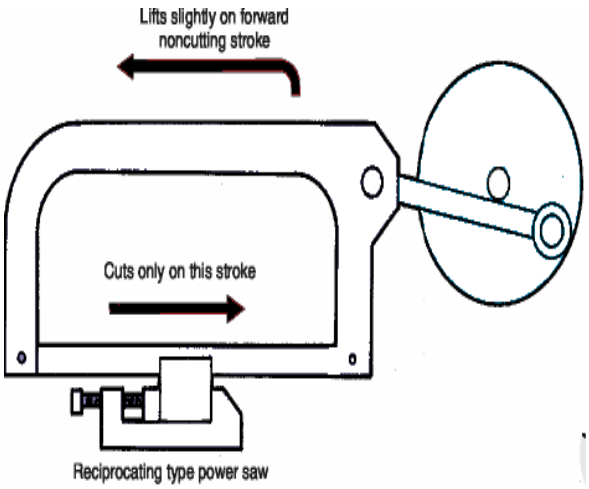

Fig 2.1

There are three types of cutters available in the market:

1. Simple hacksaw which can be used for hand cutting things.
2. Small Electrically Hacksaw for personal uses.
3. Large Cutter Machines used for Industrial Purposes.

From the above three, first one will be used for our project

2.2 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 . The stand described here is designed to support most bicycle

1. The stand assembly is divided into two parts: the rectangular base frame and two triangular upright supports.

Measure and cut the five pieces of 3/4" (20mm) angle specified for the base frame. Miter the corners at 45 degrees so they fit together tightly and form square corners.

2. Weld the rectangle together. Do not weld the center frame member to the rectangle yet.
3. Measure an cut as specified the 5 pieces for each upright support.
4. Carefully assemble the upright support pieces for welding, being sure to leave1/8" (3.2mm) gap in the base of each support. This gap will mate with the center frame member of the base frame, allowing the upright supports to slide to accommodate different rear axle widths. Note that the two upright supports are not identical. They are mirror reflections of one another. Weld each upright support assembly together into a secure structure.
5. Place the upright supports onto the base frame, and position the center frame member so that it mates with the gap in the

2.3 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.

2.4 METAL SLAB

He used a guide to control the hacksaw blade which is used to cut the metal. Metal slabs were fitted on the hacksaw blade to ensure pressure on the object to be cut and linear movement of the blade. A clamp, with 360 degree rotation, was fixed to hold the metal pieces while cutting, and to allow them to be cut in any shape and angle.

2.4.1 A RECIPROCATING POWER HACKSAW

It uses a blade that moves back and forth across the work. The blade cuts on the backstroke. There are several types of feeds available. Positive feed- produces an exact depth of cut on each stroke. The pressure on the blade varies with the number of teeth in contact with the work. Definite pressure feed-yields a pressure on the blade that is uniform regardless of the number of teeth in contact with the work. The depth of the cut varies with the number of teeth contacting the work. This condition prevails with gravity feed. Feed can be adjusted to meet varying conditions. For best performance, the blade and feed must be selected to permit high- speed cutting and heavy feed pressure with minimum blade bending and breakage. Standard reciprocating metal cutting saws are available in sizes from 6~ ~ 6~ (150 mm ~ 150 mm) to 24~ ~ 24~ (900 mm ~ 900 mm). The saws can be fitted with many accessories, including quick-acting vises, power stock feed, power clamping of work, and automatic cycling of the cutting operation. The latter moves the work out the required distance, clamps it, and makes the cut automatically. The cycle is repeated upon completion of the cut. High-speed cutting requires use of a coolant. Coolant reduces friction, increases blade life, and prevents chip-clogged teeth. Cast iron and some brass alloys, unlike most materials, do not require coolant.

2.4.2 Selecting A Power Hacksaw blade

Proper blade selection is important. Use the three-tooth ruleatleast three teeth must be in con-tact with the work. Large sections and soft materials require a coarse-tooth blade. Small or thin work and hard materials require a fine-tooth blade. For best cutting action, apply heavy feed pressure on hard materials and large work. Use light feed pressure on soft materials and work with small cross sections. Blades are made in two principal types: flexible-back and all-hard. The choice depends upon use.

i. **Flexible-back blades** -should be used where safety requirements demand a shatterproof blade. These blades should also be used for cutting odd-shaped work if there is a possibility of the work coming loose in the vise.

ii. **All-hard blade** -For a majority of cutting jobs, theall-hard blades best for straight, accurate cutting under a variety of conditions. When starting a cut with an all-hard blade, be sure the blade does not drop on the work when cutting starts. If it falls, the blade could shatter and flying pieces cause injuries.

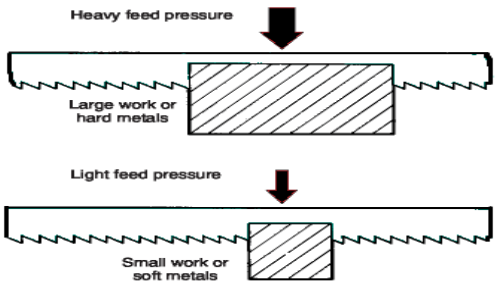

Fig 2.2- Power Hacksaw blade

Blades are also made from tungsten and molybdenum steels, and with tungsten carbide teeth on steel alloy backs.
“ ”
The following rule-of-thumb can be followed for selecting the correct blade: Use a 4-tooth blade for cutting large sections or readily machined metals. Use a 6-tooth blade for cutting harder alloys and miscellaneous cutting. Use 10- and 14-tooth blades primarily on light duty machines where work is limited to small sections requiring moderate or light feed pressure.

2.4.3. Mounting a Power Hacksaw blade
The blade must be mounted to cut on the power (back) stroke. The blade must also lie perfectly flat against the mounting plates. If long lifeand accurate cuts are to be achieved, the blade must be properly tensioned Many techniques have been developed for properly mounting and tensioning blades. Use a torque wrench and’consult the manufacturer s literature. If the information (proper torque for a given blade on a given machine) is not available, the following methods can be used: Tighten the blade until a low musical ring is heard when the blade is tapped lightly. A high-pitched tone indicates that the blade is too tight. A dull thud means the blade is too loose. The shape of the blade pin hole can serve as an indicator of whether the blade is tensioned properly. When proper tension is achieved, the pin holes will become slightly elongated, The blade will become more firmly seated after the first few cuts and will stretch slightly. The blade will require retensioning (retightening) before further cutting can be done.

2.4.4 Selecting a Band Saw Blade
Band saw blades are made with raked teeth or wavy teeth. Most manufacturers also make variations of these sets. The rakersetis preferred for general use. Tooth pattern determines the efficiency of a blade in various materials. The standard tooth blade pattern is best suited for cutting most ferrous metals. A skip tooth blade pattern is preferred for cutting aluminum, magnesium, copper, and soft brasses. The hook tooth blade pattern also is recommended for most nonferrous metallic materials. For best results, consult the blade manufacturer s chart or manual for the
proper blade characteristics (set, pattern, and number of teeth per inch) for the particular material being cut.

2.4.5. Installing a Band Saw Blade
If the saw is to work at top efficiency, the blade must be installed carefully. Wear heavy leather gloves to protect your hands when installing a band saw blade. Blade guides should be adjusted to provide adequate support, Proper blade support is required to cut true and square with the holding device. Follow the’ manufacturer s instructions for adjusting
blade tension. Improper blade tension ruins blades and can cause premature failure of bearings in the drive and idler wheels. Cutting problems encountered with the band saw are similar to those of the reciprocating hack saw. Most problems are caused by poor machine condition. They can be kept to a minimum if a maintenance program is followed on a regular basis. This typically includes checking wheel alignment, guide alignment, feed pressure, and hydraulic systems.

2.5. 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.

2.5.1. PEDAL
A bicycle shoe crank bottom bracket bicycle pedal is the part of a that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclist’s foot or and the allowing the leg to turn the spindle and propel the bicycle's wheels. Pedals were initially attached to cranks connecting directly to the driven (usually front) wheel. The safety bicycle, as it is known today, came into being when the pedals were attached to a crank driving a sprocket roller chain. that transmitted power to the driven wheel by means of a Pedals usually consist of a spindle bearings that threads into the end of the crank and a body, on which the foot rests or is attached, that is free to rotate on with respect to the spindle.

3. DESIGN

3.1 BASE FRAME:
Plan view of frame in support position. All pieces 3/4" (19mm) steel angle.

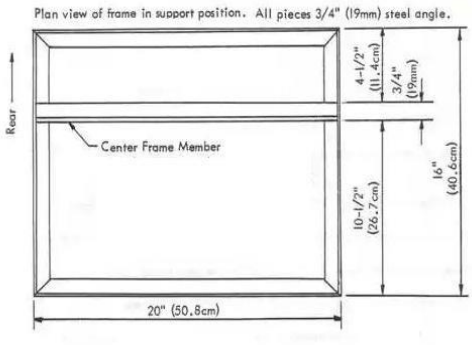

FIG 3.1

3.2. *UPRIGHT SUPPORT:*
Make two pieces of upright supports: one as shown and another one a reflection of the one shown below. All pieces are made of 3/4" 7(19mm) steel angle, unless specified otherwise. Weld all joints.

3.3. HACKSAW BLADE LENGTH=15 inch=36 cm
WIDTH=1 inch

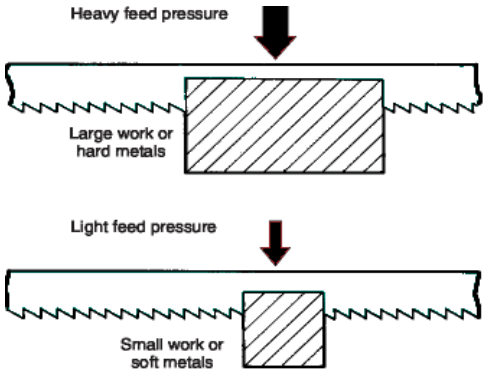

Fig 3.2- hacks blade

3.4. BEARINGS

There are two types of bearings used in this attachment,

- Ball Bearings
- Thrust Bearings

4. BLOCK DIAGRAM

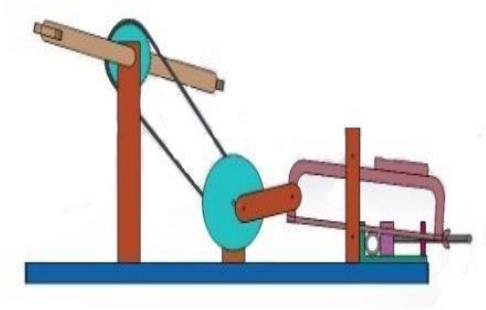

FIG 4.1

5. WORKING PRINCIPLE

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.

5.1. ADVANTAGES:

I. Time saving as compared to simple hacksaw
II. Power saving as it is manually operated
III. Easy machinery used
IV. As it is pedal operated so good for health
V. Comfortable then ordinary hacksaw
VI. It is portable
VII. It could be used wherever metal cutting is done in small scales, including at construction sites and furniture units, or to cut metal for window panes.

5.2. DISADVANTAGES

I. Its totally manually operated
II. Time consuming as compared to electrical power hacksaw
III. Without human effort its not operated
IV. Not fit for heavy production

5.3. APPLICATIONS

1. In a furniture making industry at production it is widely used
2. It can perform cutting operation in various kinds of industries.
3. This machine can be applied in carpentry and plumbing works also.

6. CONCLUSION:

Thus a low cost can enhance day today household needs and daily day to day purposes and it can be also 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 used in for industrial applications during power shut down scenarios. By using this method we can do any operation as per our requirement without the use of electricity. so we can save the electrical power.