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Fabrication of Pedal Operated Setup for Cutting And Charging

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Abstract - Operating hacksaw manually is a very tiring and time consuming activity. It requires a lot of manual effort and delivers uneven cutting. Operating an electrical hacksaw does deliver good results but consumes a lot of energy. Hence, in this work proposed a semi-automated hacksaw using pedal power. Accordingly designed and fabricated pedal operated setup in which rotary motion of the sprocket by the effort of pedal converted into reciprocating movement of a frame connected by hacksaw. Using this mechanism a variety of components made up of different materials like Wood, Iron, Plastic have been cut and observed the time taken for this task. Finally the pedal operated setup yielding better efficiency in shearing of the components with less effort in comparison to the existing method.

Key Words: Frame, Chain Sprockets, pedal, Connecting Rod, Hacksaw, Bearings, Dynamo.

1.INTRODUCTION

According to recent researches [1][2], pedal power is the power people can transfer using a pedal and crank system. This technology is used primarily in transportation and has been used for cycling for over 100 years [5]. Moreover, less frequently, pedal power is used in agriculture and making hand tools, or even to generate electricity [4][6][9]. Some applications, including pedal-powered water wells which are most efficiently worked to draft water with less effort. Some developments in turning discarded bicycles into pedal-powered devices to increase sustainability. Many devices can start working immediately using mechanical energy [8][10]. A saw is a tool that uses hard teeth or metal with abrasive edges to cut the material. The cutting edge of the saw is a serrated or abrasive blade and the saw can be used in home appliances [7][11][12]. Therefore, this project describes about pedal driven hacksaw which can produce power more than 4 times comparing the power produced by hand lever. Moreover, the hacksaw fixed in the frame with tight tension will cut the PVC pipes and Steel pipes placed in the required position and repeated this process for cutting in any such pipes. Finally observed the accuracy and efficiency of the hacksaw operated by a pedal used in work.

2. Methodology

2.1 Existing Method

- There is no On-Boarding Self Charging System. i.e., Dynamo
- Maintenance period was very low.
- In existing system one of the main problems with Self Chargeable in Pedal Operated Hacksaw is generates less power.

2.2 Proposed Method

The modifications implemented to the existing method in order to improve the versatility of the setup, the following key changes done in the proposed method.

- The Dynamo in a wheel will generate electricity when it is in pedaling condition.
- The Dynamo, which is connected to the rear part of the hacksaw near the wheel to generate electricity.
- Electricity generated by the dynamo as above said process is stored in a lead acid battery, which is further will be used to the light bulb near the hacksaw blade.
- Here, the small pinion wheel gives movement to the Dynamo and helps to continue generate electric power. The electricity generated by the Dynamo, the consumption of electricity by the bulb occurred simultaneously, there by the life of the battery also enhances slightly when compared with wheel without dynamo.
- Time of cutting is very less as compared to previous methods and it is compacted in size.
- Free movement in hacksaw frame with the sliding motion.
- Up and down moments of the frame will be avoided by knuckle joint provided at the end of connecting rod.

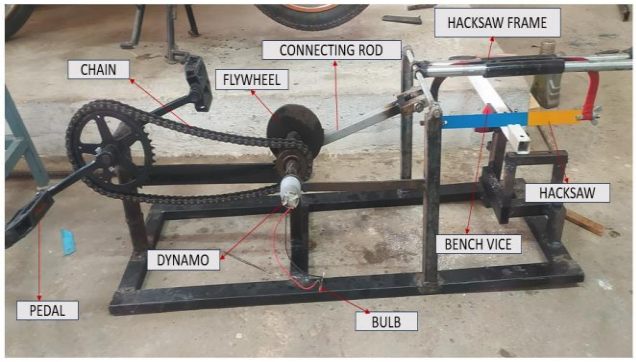

Fig-1: The prepared setup of pedal operated hacksaw

2.3 Components

The following components selected based on the design made to the proposed method and are specified individually based on their function.

- **Pedal:** This pedal powered hacksaw has a direct connection to the pedal. When the pedal is pressed directly, the rotation of the pedal is converted into a reciprocating motion of the cutting tool. The tip of the cutting tool is placed on the work piece. The operation on the work piece is completed thanks to the back and forth movement of the cutting tool.

- **Shaft:** The head is a rotating machine, usually circular in cross-section, used to conduct electricity from one part to another or from a machine that produces electricity to a machine that absorbs it.

- **Supporting's:** Supports are thin MS materials used to support wheels, pedals and vices. These supports are used to balance one wheel and keep the pedals in a fixed position. This helps keep the vise in a fixed position.

- **Chain Sprockets:** The function of the drive chain is to convert the manual force of the pedal into the rotation of the sprocket, thereby rotating the crank wheel. Another function is to accelerate the human power according to the drive gear to control the rapid stroke of the hacksaw. Bicycle pedal is a part of the bicycle using the feet of the passenger. It provides a connection between the rider's foot or shoe and the crank, allowing the legs to rotate under the bracket axle and push the wheel of the bicycle.

- **Connecting Rod:** The bar is attached directly to the hacksaw for cutting wooden blocks. When the pedal is energized, the hacksaw moves back and forth and rotates with the turntable. It helps to reduce the number of workers.

- **Frame:** The basement is prepared by using MS square bar for better fittings and the frame is totally made by MS square bars.

- **Bench vice:** A vise is a work or work holding tool. It is a mechanical device used to work on. The vise has two jaws, one fixed and the other movable, and these can be screwed in and out using screws and levers. The vise is usually fixed to the workbench or workbench to provide the necessary force to clamp the work piece during machining and reduce the vibration generated during machining.

Dynamo: A generator is a device usually located in the hub of a bicycle wheel that converts the energy produced by the rotation of the wheel into electrical energy. This electricity is used to power the bike's front and rear dynamo headlights, providing regular illumination without the need to recharge the headlights. A dynamo is an electrical generator that creates direct current using a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary Power: Electric Power
Motor Voltage: 4V-12V
Model of Dynamo: Circular
Speed: 1000-2000 RPM
Material: Metal

- **Knuckle joint:** A knuckle joint is a mechanical joint that connects two rods or pipes at an angle, allowing limited angular movement and rotation between them. It consists of a spherical ball and socket joint, with a cylindrical extension called the knuckle. The knuckle joint is commonly used in automotive and suspension systems, as well as in machinery and construction applications where angled connections are needed.

  Knuckle joints are frequently used to combine valve rod and eccentric rod, as well as in cycle chain links, levers, tie rod joints for roof trusses, and numerous other links.

- **Hacksaw:** A hacksaw is a hand tool designed to cut materials such as plastic, metal and other metals. They are a variant of the traditional handsaw commonly used for cutting wood and have become indispensable tools for professionals and amateurs alike. A hacksaw is a fine-toothed saw, originally and mainly made for cutting metal. The equivalent saw for cutting wood is usually called a bow saw. Typical full-size hacksaw frame, with 12" blade. Most hacksaws are hand saws with a C-shaped walking frame that holds a blade under tension.

- **Hacksaw frame:** Most hacksaws are hand saws with a C-shaped walking frame that holds a blade under tension. Such hacksaws have a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. The frames may also be adjustable to accommodate blades of different sizes.

- **Bulb:** A bulb is the glass part of an electric lamp, which gives out light when electricity passes through it. The stairwell was lit by a single bulb. Synonyms: light bulb More Synonyms of bulb.

- **Flywheel:** A flywheel is a mechanical device which uses the conservation of angular momentum to store rotational energy; a form of kinetic energy proportional to the product of its moment of inertia and the square of its rotational speed.

After performing many tasks using the pedal operated hacksaw on different materials the following results with discussion presented.

2.4 The following are the steps carried out:
- Planning
- Measuring
- Marking
- Cutting
- Machining
- Bending
- Joining
- Surface Treatment
- Inspection
- Assembly

2.5 Marking process
The marking tool is used to mark on a job or work piece to obtain accurate si.ze and shape. Before using marking tools on a job or work piece, firstly we should use marking media on it so that we can clearly see when marking. The marking tool is also called a marking out tools.

2.6 Cutting tools
There are cutting processes used in metal fabrication. Cutting processes involve separating a metal work piece either partly or completely into two or more sections. Shearing is a common cutting process used in metal fabrication. Using an alligator shear or bench shear, a worker can perform a clean and straight cut through a metal work piece. Torching is also considered a cutting process because, like shearing, it can separate a metal work piece. Torching in metal fabrication can be performed using an oxy or plasma torch as well as laser cutters.

Types of cutting tools:
- Hand Portable Cutting Cutter
- Hack Saw
- Gas Cutting

2.7 Machining process
Machining is manufacturing process that involves removing materials using cutting tools for getting rid of the unwanted materials from some work piece and converting it into the shape you desire. A large piece of stock is used for cutting the work piece. The large stock might be in any shape such as solid bar, flat sheet, beam or even hollow tubes. The process can also be performed on some existing part like forging or casting

Types of Machining Device:
- Lathe Machine
- Radial drilling Machine
- Grinding Machine

2.8 JOINING PROCESS
Joining processes are characterized by their ability to fuse or "join" two or more components for the purpose of creating a different object, such as a ready-to-sell consumer product. Most materials can be joined and there are typically multiple ways to join them. Two-by-fours, for instance, can be nailed or bolted together, whereas sheet metal can be welded or soldered together. All joining processes involve joining two or more components, and most joining processes require the use of a separate tool or tools. With the help of a wool, such as a nail gun, the components are joined.

Types of joining process
- Welding
- Brazing
- Soldering
- Bonding
- Nailing
- Screwing
- Bolting
- Riveting
- Clinching
- Stapling
- Press fitting

3.1 Dynamo Results in Multi meter

A digital multi meter is an indispensable tool for testing, diagnosing, and troubleshooting electrical circuits, components, and devices. The first digital multi meter was introduced in the late 1970s, and has proven much more accurate and reliable than the old needle-based analog meters. It's used primarily to measure voltage (volts), current (amps), and resistance (ohms). But that's just the beginning of what this surprisingly useful tool can do.

By this multi meter we observed that the voltage generated by the dynamo in time of pedaling.

We connected the probes directly to the dynamo wires to test the dynamo power during the time of cutting the different materials

Fig-2: Multi meter

Table -1: Cutting test observations

S. No	Material	Dimensions (mm)	Time taken for cutting (sec)	No. of pedal revolutions
1	WOOD	20x20x23	30	25
2	UPVC PIPE	⌀32	31	22
3	MS ROD	⌀10	120	90

3.2.Calculations :

Driven Sprocket
Radius of Driver Sprocket = R1= 90mm
Radius of Driven Sprocket = R2 = 40mm
No. of teeth's on Driver Sprocket = T1= 40
No. of teeth's on Driven Sprocket = T2= 18
Pitch of the Chain = P = 15mm
Teeth Ratio = T1/T2 = 40/18=2.22
Velocity Ratio = (T1/T2 = N1/N2) = 2.22
R1 = P/2 cosec (180 / T1)
R1 = 95.5mm
R2 = P/2 cosec (180 / T2)
R2 = 43.12mm
Length of the chain = π (R1 + R2) + 2x + (R1 – R2)2/x
=1140m

3. CONCLUSIONS

Based on the above results and discussion, we conclude that the problems of the traditional hacksaw machine can be overcome by the four-way hacksaw due to its high efficiency and easy operation. This versatile hacksaw model is useful and can meet all the needs of a small business. Therefore, good results such as long tool life, easy flow and better machining quality can be achieved with strong. This project is recommended for construction industries, where the cutting and fabrication of pipes of different materials such as Steel and PVC are required.

4. Future Scope

Above conclusions found in the present work directs to the following scope and it can be considered in the future for further implementations as mentioned below.

Rice Threshing: Threshing of paddy crop is carried out using manual, animal or mechanized power sources depends on the farmland size. In a thresher, rasp bar, spike tooth, peg tooth and wire-loop type threshing elements can be fitted with the threshing cylinder irrespective of direction of crop feed and flow.

Peanut Shelling: According to the shelling principle of the scraper peanut shelling machine, it can be known that the peanuts pass through the collecting hopper, shelling box, screen grid, lower box outlet, sorting port, and peanut kernel collecting bucket in order from top to bottom, so the design The basis for the overall structure of the Sheller comes out. This channel and the bottom surface of the peanut shell collection channel are designed as a whole. This design allows the peanut kernels blown away by the wind to roll back by its own weight.

Winnowing: is a process by which chaff is separated from grain. It can also be used to remove pests from stored grain. Winnowing usually follows threshing in grain preparation. In its simplest form, it involves throwing the mixture into the air so that the wind blows away the lighter chaff, while the heavier grains fall back down for recovery. Techniques included using a winnowing fan (a shaped basket shaken to raise the chaff) or using a tool (a winnowing fork or shovel) on a pile of harvested grain.

5. Advantages

1. Time saving as compared to simple hacksaw
2. Power saving as it is manually operated
3. Easy machinery used
4. As it is pedal operated so good for health
5. Comfortable then ordinary hacksaw
6. It is portable.
7. 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.

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