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Pedal Operated Hacksaw

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Abstract: In this project work an effort has been made to design and developed model of Pedal Powered Hacksaw. The pedal powered hacksaw is a device which is used for cutting wood, plastic and metals. The basic principles of power driven hacksaw is Slider Crank Mechanism which is an inversion of four bar chain mechanism. In this mechanism, the connecting rod is directly connected to the hacksaw for the processing of cutting the wooden blocks. The hacksaw move to and fro motion when the pedal is powered, so as the rotating disc rotates. The main aim of this project is to reduce the human effort for machining various materials.

Keywords: Pedal Powered Hacksaw, Sprocket Arrangement, Slider and Crank Mechanism.

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 produce electricity. Some relevance includes 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. Pedal Powered Hacksaw (PPH) is working on Slider Crank Mechanism. The PPH is used to cut ply wood in small scales. PPH helps to obtain a less effort uniform cutting. It can be used in places where electricity is not obtainable. It is designed as a portable one which can be used for cutting in various places. The main parts of PPH are hack saw, reciprocating rod welded to the pedal of a bicycle, flywheel, sprocket and chain drive. The hack saw is connected with the reciprocating rod. An individual can generate four times more power 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 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. The aim of the work is to 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 as the same time serve as an exercising machine for fitness. It is also done to show the performance difference between hand driven and pedal driven hacksaw.

II. LITERATURE SURVEY

Chaudhary et al. [1], 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 and 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, 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 the 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.

Adarsh and Kushagra [2], Pedal Powered Washing Machine (PPWM) is a low cost washing machine made up of easily and readily available scrap parts in daily life. It is a machine which generates power through human pedalling and with the drive mechanism, converts the pedalling motion into required rotary motion of the drum. Its innovation lies in its simple design, use of inexpensive parts, very low repairing and maintenance cost,

affordability to each member of the society and it does not affect the environment. Intends to directly address the problems faced in washing clothes, and thus have developed a new design for easy effort in washing, rinsing and drying clothes. PPWM is a completely new concept, which in its one laundry cycle does washing, rinsing and drying of clothes similar to that of an automatic washing machine available in the market.

Vishal et al. [3], Pedal operated air compressor with the goal of building a working prototype. Create a mechanical device that can use the mechanical power operated by pedals as in bicycles to run an air compressor and additional water pump. The additional cooling system is used for maintaining the temperature of compressed air. Cycle chain-sprocket system as a basic pedaling power source and connect it to the main shaft joining both the air compressor and a water pump through several gears. The approach will be helpful for saving a sufficient amount of electricity and get a robust portable air compressor system.

III. COMPONENTS REQUIRED

The components consider making a Pedal Operated Hacksaw are listed below:

- Hack saw blade
- Pedal arrangement
- Stand setup parts
- Crank and slider mechanism

- **Hacksaw blade:**

Proper blade selection is important for the proper cutting and selection of blades. Three teeth must be in contact 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 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.

- **Pedal Arrangement:**

A bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclist's foot or shoe and the crank allowing the leg to turn the bottom bracket 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 that transmitted power to the driven wheel by means of chain drive. Pedals usually consist of a spindle 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 bearings with respect to the spindle.

- **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 bicycles. 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. Mitre the corners at 45 degrees so it fit together tightly and form square corners. Weld the rectangle together. Do not weld the center frame member to the rectangle yet. Measure and cut as specified the 5 pieces for each upright support. Carefully assemble the upright support pieces for welding, being sure to leave a 1/8" (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. Place the upright supports onto the base frame, and position the center frame member so that it mates with the gap in the side supports. Mark its position, and weld it in place.

- **Crank and Slider Mechanism:**

A slider crank 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. The Slider-crank mechanism is used to transform rotational motion into translational motion by means of a rotating driving beam, a connection rod and a sliding body. In the present example, a flexible body is used for the connection rod. The sliding mass is not allowed to rotate and three revolute joints are used to connect the bodies. While each body has six degrees of freedom in space, the kinematical conditions lead to one degree of freedom for the whole system. 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 slier crank mechanisms produces ordinary Withworth quick return mechanism.

IV. WORKING PROCESS

The Pedal Operated Hacksaw Machine 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 as shown in Fig. 4.1.

Fig. 4.1 Working

V. CONCLUSIONS

A low cost and simple designed pedal operated hacksaw machine is fabricated, which reduces the human effort. This simple design of conventional type can be used to fulfill in for industrial applications during power shut down scenarios. By using this model one can do cutting operation as per the requirement without the use of electricity. And save the electrical power.

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