

Design and Development of Pedal Powered 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.

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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.

LITERATURE SURVEY:-

R. Subash, K. Samuel Jayakaran, (2014), In this paper author has designed 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 sprocket arrangement, the crank and slider mechanism, the chain drive. In the mechanism, chain drive is directly connected to the hacksaw for the processing of cutting the wooden blocks. The objective of the paper 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.

Girish T. , Parameswaramurthy D., (2014), In this paper author has designed to development of conceptual model of water pumping and battery charging cross trainer which is user friendly, easy to do exercise, save & stores the energy of the users muscle efforts. When the human operates the lever and the pedal, the Centrifugal Pump is actuated and the water is pumped from ground sump to the tank. At the same time the attached dynamo (i.e., is mounted near the V-belt) operates and the mechanical energy is converted in to electrical energy, the generated electrical energy is stored in battery with the help of wires. The stored electrical energy is used when we are needed.

Umesh Bokade, Zakiuddin Syed Kazi and Girish D Mehta, (2013), The author proposed the designed model which will convert the dirty/saline water into pure/ potable water using the renewable source of energy (i.e., Human power). The machine consists of a human-powered flywheel motor using a bicycle-drive mechanism with speed-increasing gearing and a flywheel, which drive the process unit through a spiral jaw clutch and torque increasing gearing. The operator puts energy into the flywheel at a convenient power level for about one minute. After enough energy is stored, pedaling is stopped and the energy in the flywheel is made available to the process unit.

S.G.Bahaley, Dr. A.U. Awate, S.V. Saharkar,(2012), In this paper the author 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

David Gordon Wilson, (1986), According to the author, a person can generate four times more power (1/4 horsepower (hp)) by pedaling than by hand-cranking. At the rate of 1/4hp, continuous pedaling is for can done only short periods, about 10 minutes. However, pedaling at half this power (1/8 hp) can be sustained for around 60 minutes. Pedal power enables a person to drive devices at the same rate as that achieved by hand-cranking, but with far less effort and fatigue. Pedal power also lets one drive devices at a faster rate than before (e.g. winnower), or operate devices that require too much power for hand-cranking (e.g. thresher). The main use of pedal power today is still for bicycling, least in the high-power at range (75 watts and above of mechanical power). In the lower-power range there are a number of uses of pedal power-for agriculture, construction, water pumping, and electrical generation-that seem to be potentially advantageous, at least when electrical or internal-combustion engine power is unavailable or very expensive.

PROBLEM DEFINITION: - In the earlier days, using of hacksaw from hand, required more effort so that to overcome this effort, it has tried to make a device (pedal powered hacksaw) which can reduce the effort because powered transmit through the human leg to the pedal. This device makes less effort as compared to the earlier devices.

DESIGN AND CONSTRUCTION: - The exercise bicycle frame is fixed with the base mild steel by the process of welding. The chain sprocket is connected to the cycle frame and it is connected to the pedals. The one end of the connecting rod is connected to the big sprocket and the other end is connected to the hacksaw. The circular rod is inserted into the bearing and is welded with the sprocket at one end. The connecting rod is connected to the rotating disc at one end and to the hacksaw at the other end.

The hacksaw moves in fro motion when the pedal is powered, so as the rotating disc rotates. The vice is fixed at the stand to hold the work piece tightly in a straight position. As the pedal is powered by the human energy, the hacksaw blade to move in one and fro motion. When the hacksaw moves, the work piece metal will be cut into a desired shape.

Step of Construction: - Design and construction of pedal powered hack saw are completed in mainly four steps.

1. DESIGN AND IMPROVEMENT
2. MODIFICATION AND DEVELOPMENT
3. DESIGN AND DEVELOPMENT OF WORK PIECE STAND FRAME
4. COMPLETE ASSEMBLY OF EQUIPMENTS

Step 1: - Design and Improvement: - Old exercise bicycle frame is taken and modified for further design.

COMPONENT REQUIRED	SIZE(L×W×H)	MATERIAL USED
Bicycle Exercise Frame	(1.2 × 0.5 × 1)m	Chrome Steel



Fig.1. Modification of Exercise Bicycle Frame

Step 2: - Modification and Development: - Connecting rod is attached at one of its end with bearing and other end is connected with hack saw.

COMPONENT REQUIRED	SIZE	MATERIAL USED
Circular Disc (Bush)	(620Z/38mm)	Phosphor Bronze
Hack saw Blade	(315 × 11 × 0.5)mm	High Carbon Blade



Fig.2. Attachment of Connecting rod and Hacksaw

Step 3: - Design and Development of Work Piece Stand Frame: - According to the measurement of connecting rod and hacksaw. A stand is prepared for cutting the work piece.

COMPONENT REQUIRED	SIZE(L×B×H)	MATERIAL USED
Connecting rod	(317.5 × 5 × 5)mm	Grey Iron
Hacksaw Frame	(300 × 18 × 5.5)mm	High-Grade Tool Steel



Fig.3. Construction of Work piece Frame

Step 4: - Complete Assembly of Equipments: - For holding and supporting the work piece vice and other accessories are mounted on the stand.

COMPONENT REQUIRED	SIZE(L×B×H)	MATERIAL USED
Vice	(105 × 35 × 30)mm	Plain Carbon Steel



Fig.4. Assembly of Equipment

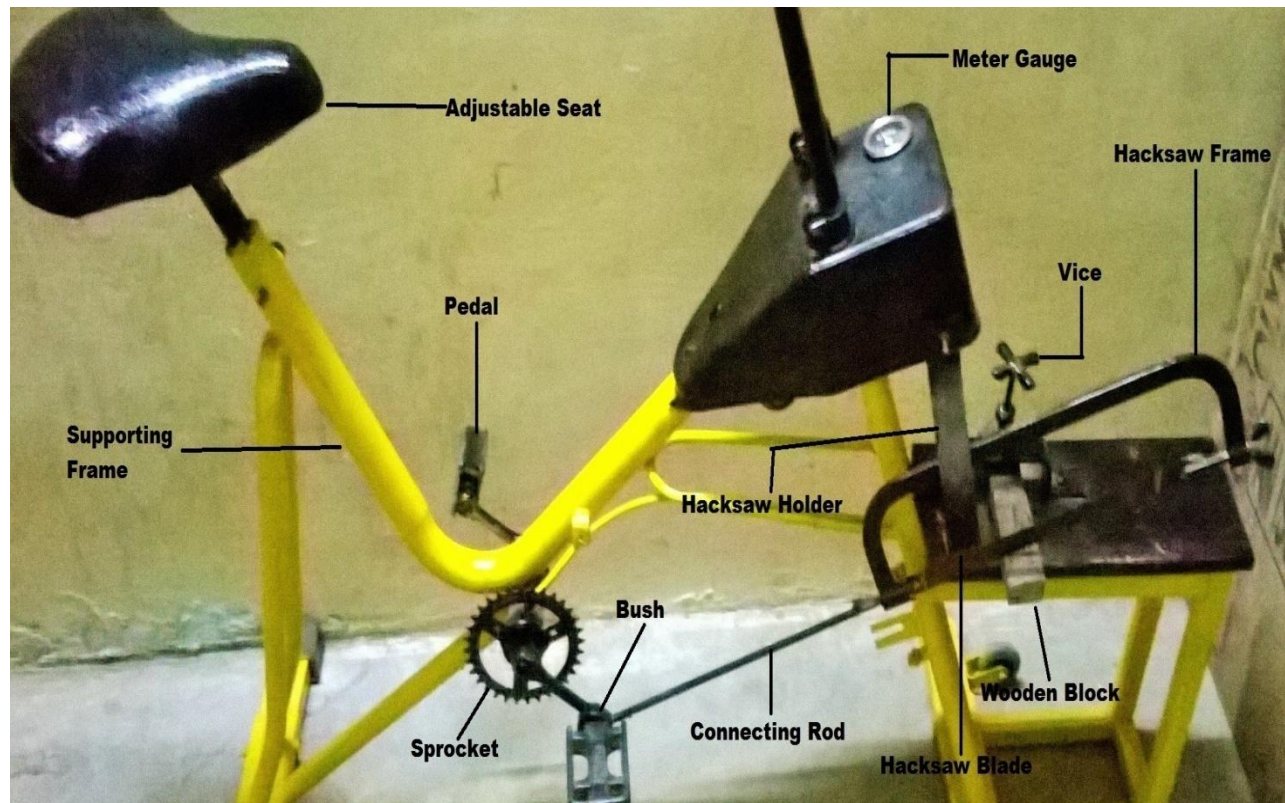


Fig.5. Complete Assembly and Final Presentation of PDH

DESIGN CALCULATION: -

Hacksaw frame: $(L \times W \times H) = 300 \times 18 \times 5.5$ mm

Hacksaw blade (hole to hole): $(L) = 300$ mm

Connecting rod: $(L \times W \times H) = 317.5 \times 5 \times 5$ mm

Circular disc (Bush): 6203z (38mm diameter)

Vice: $(L \times W \times H) = 105 \times 35 \times 30$

A solid shaft 4130 (chrome molybdenum steel alloy) of diameter 16 mm. The shear stress must not exceed 150 MPa.

Maximum torque transmitted $(T) = \{(\pi/16) \times \tau \times d^3\} = 120$ N-m.

Maximum Power applied $(P) = (2 \times \pi \times N \times T) / 60 = 1.515978$ KW.

DESIGN CONSIDERATIONS: -

When designing our attachment, the following considerations were taken into account:-

1. The device should be appropriate for local manufacturing competence.
2. The attachment should employ low-cost materials and mechanized methods.
3. It should be accessible and reasonable by low-income groups, and should accomplish their basic need for mechanical power.
4. It should be simple to manufacture, maneuver, maintain and repair.
5. It should be as multi-purpose as possible, on condition that power for various agricultural implements and for small machines used in rural industry.

RESULT AND OUTCOMES: -

[1]. PDH can be used in distant places where electricity is not accessible. It is designed as a transportable one which can be used for cutting in various places.

[2]. The plywood can be cut devoid of any peripheral energy like fuel or current. Since PDH uses no electric power and fuel, this is very economical and best.

[3]. PDH can be used for light duty cutting process of plywood. It is also effective for the human health.

[4]. Pedal driven hack saw helps to obtain less effort uniform cutting. The results specify that the PDH had given better, accurate and faster cuts when evaluate with hand hacksaw at different rpm.

[5]. This machine reduces the human endeavor and hence we don't need two persons to cut the wooden logs.

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