

Design and Fabrication of a Pedal operated cutting machine

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Abstract: *The present trend of engineering focuses on expending little effort and expecting maximum mechanical advantage. The simple conventional machines have proved to be more efficient in this area. As the Technology advances, these simple machines will be coupled with electrical, mechanical, solar drives to extract more work. Such equipments are used from household arena to industrial field also. The conventional wood cutting procedure using Tenon saw or wood saw requires more time and more human effort. An attempt to improve the speed, feed, accuracy with less investment will be tried to accomplish in this present project work. The design and fabrication of prototype wood cutting equipment operated with manual source will be under taken in this project. The concept is to cut wood work pieces by pedaling operation with less human effort and comparatively in less time. The principle involved in this equipment is the Rotary motion of pedaling operation (or electrical powered operation) will be converted to the Reciprocatory motion of the shaft attachment. This attachment shaft will be bolted with a hacksaw frame fixed with wood cutting blade. There will be a provision on the work table to measure the length of the work piece to be cut or retained. This can be achieved by fixing a steel rule on the work table by which the time delay for measurement can be avoided.*

Key words: *Frame, Hacksaw, Pedal, Shaft, Bearing-Cam mechanism, Slider crank mechanism*

1. INTRODUCTION

A product is to be made by cutting the material to correct length or dimensions. This operation of cutting the material into correct length is also called sawing. This process can be accomplished either by hand or by power operated machines. Cutting by hand is very slow and laborious. These troubles are overcome by using power operated machine. All the cutting machines use saw blades to cut the stock. Although different in overall form, they all contain a series of cutting teeth that operate in the same basic way. When the teeth are laid out into a straight line, one obtains hacksaw or if the saw blade is flexible and made into an endless loop, a band saw. All these are form tools and the cut progresses by positive in feed or by the pressure exerted on the tool.

When we talk about cutting machines, two major applications of the cutting machines are,

- Metal cutting machines
- Wood cutting machines

Pedal power hacksaw 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. Pedal power is used to power agricultural and hand tool and even to generate electricity. Some applications include pedal powered laptops, pedal powered grinders and pedal powered water wells.

2. DESIGN AND FABRICATION

[A]Design of pedal powered cutting machine:

The design of the pedal operated cutting machine is done by using CATIA. CATIA is well known in the aerospace, automotive and manufacturing sectors for its ability to solve complex geometrical problems in an accurate and user-friendly

The two figures shown represents the fabricated models of the pedal powered cutting machine.



Fig 3: Fabricated pedal powered cutting machine

3. WORKING PRINCIPLE AND OPERATION

➤ *Working principle:*

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.

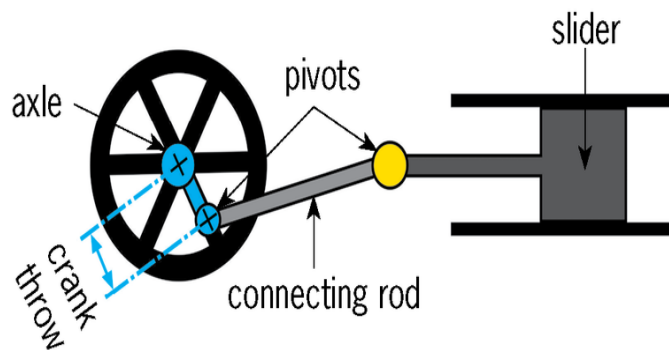


Fig 4: Slider-crank mechanism

➤ *Operation:*

Initially the base frame is arranged and the bicycle frame is fixed over the base frame. The bicycle is modified as per the requirement for the fabrication of the cutting machine. The work table is fabricated at the front end of the base frame in order to accommodate the job in the vice mechanism. The height of the work table is designed in such a way that the bicycle frame can be easily fixed. Here the vice mechanism is made with the help of bolt and clamp arrangement. The work piece is fixed between the clamp with the help of nut and bolt. The bearing-cam mechanism is the major operating element in the project. The sprocket of the bicycle is replaced by bearing-cam mechanism. One end of the connecting rod is connected to the bearing cam mechanism and the other end is fixed rigidly to the hacksaw frame. When the pedaling is done, rotary motion of the bearing is converted into reciprocatory motion to the connecting rod. The hacksaw which is fixed to the connecting rod receives that reciprocatory movement to facilitate the cutting action and works accordingly. The cutting operation in this project is conducted on wood block, cast iron pipe and PVC pipe.

4. RESULTS

By using the pedal operated cutting machine, the cutting operations on wood block, cast iron, and PVC pipe are performed. The time taken for the cutting operation is kept constant and the depth of cut for each material is calculated. The below tables and figures will give the details of the results that are obtained.

Results for wood block:

A 35 mm thick wood block is taken as work piece for the experiment.

Performance of pedal powered hacksaw for light duty cutting operations on wood block

S.NO	rpm	TIME(s)	DEPTH OF CUT(mm)
1	100	60	32
2	80	60	25
3	60	60	19
4	40	60	12

Table 1: Performance on wood block

Results for cast iron pipe:

A 35mm diameter cast iron pipe is taken in the experiment.

Performance of pedal operated hacksaw for light duty cutting operations on cast iron pipe

S.NO	Rpm	TIME(s)	DEPTH OF CUT(mm)
1	100	80	33
2	80	80	27
3	60	80	20
4	40	80	14

Table 2: performance on cast iron pipe

Results for PVC pipe:

A 25mm diameter PVC pipe is taken in the experiment.

Performance of pedal operated hacksaw for light duty cutting operations on PVC pipes

S.NO	R.P.M	TIME(sec)	DEPTH OF CUT(mm)
1	40	15	10
2	60	15	15
3	80	15	20
4	100	15	25

Table 3: performance on PVC pipe

5. CONCLUSION

Pedal driven hacksaw can be used for light duty cutting operations of plywood. Pedal driven hacksaw can be used in remote places where electricity is not available. It is designed as a portable one which can be used for cutting in various places. The plywood can be cut without any external energy like fuel or current. Since PDH uses no electric power and fuel, this is very cheap and best. Experimental result shows cutting depth of about 35mm can be obtained by pedaling around 100rpm. Pedal driven hack saw helps to obtain less effort uniform cutting. The results indicate that the PDH had given better, accurate and faster cuts when compared with hand hacksaw at different rpm.

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