

Design and Fabrication of Wood Shredder

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Abstract:- This paper titled “wood shredder” focused on the Wood is widely used as a fuel source both domestically and industrially. The sliced wood is mainly used as firewood. Making wood into suitable small sized logs was a tedious task. Nowadays, different machineries are used for this purpose. Most widely used such machineries are manual wood splitter, hydraulic wood splitter and gas wood splitter. While manual wood splitters require human effort hydraulic wood splitters are costly, Gas wood splitters running on gas engine have the disadvantage of polluting emissions. The wood shredder design we are proposing is electricity driven thus making it environment friendly and less costly. This equipment is able to split big wood piece into smaller pieces within very short amount of time.

Keywords:- Wood shredder, wood splitter.

I. INTRODUCTION

Nowadays making of fire wood from large wood pieces is either expensive or time consuming. Various kinds of wood shredding machines are used to overcome this issue. While various kinds of wood cutting machines are available on market our design is different from them. When compared to normal cutting machines, our wood shredder machine has the advantages of being less expensive, highly efficient and have little maintenance cost.

The main parts of wood shredder are roller wheels, diesel engine, electric motors, axes etc. Power is generated by diesel engine. Wood shredders rely on energy stored in roller wheels to do the work. The axes are mounted on the wheels, and the wheel is accelerated by an electric motor or diesel engine. The main aim of this project is to simplify the work of wood shredding and making everyone capable to do this work. One of the main advantage is that the machine do not require skilful personnel to handle it.

II. OBJECTIVE

The machine is aimed for domestic use and small industries in rural areas where such machines are not available. The main objective is to fabricate an economically efficient wood shredder. If we can achieve our goal successfully in completing this project, it will be a better practically dependable solution for homely and industrial needs. In pursuit of the practical works of the project we'll be able to practice and develop our expertise in several machining process and different machineries. Needless to say, we hope to put our theoretical knowledge into practical systems.

III. LITERATURE REVIEW

In search for related material, we were able to collect some data on currently available firewood processing machines in the market. The CS27-40 firewood processor manufactured by Cord King LTD has the advantage of very short cutting time. But as this machine is powered by a diesel engine, it emits flue gases which is not good for the environment. Another wood processor to be reckoned with is Splitta 400 manufactured by Fuelwood LTD. The Unique splitting blade in the form of an 'X' is pushed into the end grain of the log. This machine require a 415V AC supply. Also this machine is very expensive. While both the wood processing machines possess unique meritorious properties, they also have their own downsides of being extravagantly pricy and not being suitable for small scale applications. The journal paper 'Log splitter design and construction' by MariánMinárik and JúliaHricová put forward certain insights in the tool characteristics of wood processing machines. The paper focused on how to apply a screw type log splitter in wood splitting. The experimental apparatus has been developed to determine the validity of the splitting tool and its geometry design.

IV. WORK PLAN

Stage 1 - Literature Survey:

A comprehensive study of relevant scientific data available is carried out to gain knowledge in the available firewood processing machines. The study was also helpful in giving insights on how to efficiently and economically fabricate a wood shredder.

Stage 2 – Design the Machinery Design various mechanisms and the elements used in the wood shredder.

Stage 3 - Cost estimation

Cost estimation is done by calculating the market price of each elements, processes required, transportation costs etc.

Stage 4 – Purchase of Inventory

Materials required are procured based on availability, price and quality.

Stage 5 – Fabrication of Machinery

The wood shredder is fabricated by using the raw materials and several machining processes carried out under the guidance of project guide.

Stage 6 – Carrying out real time tests on the machinery

Different types of large pieces of wood are fed to the machine to analyze the shredding capability of the machine.

Stage 7 - Establishing necessary changes based on test result

If necessary, make changes in the components based on the feedback from previous step.

V. DESIGN OF MACHINE

The machine frame is made up of rigid mild steel. The motor can be housed at the base of the frame. The motor is coupled with the gear assembly using pulley and belt mechanism. The table on the frame consists of a rectangular slot. Shafts from the gears rotate the cutting wheels. The rotary cutting wheels split wood piece into two when passed between them.



Gear 1, (2) Gear 2, (3) Gear 3, (4) Gear 4, (5) Gear 5, (6) Shaft 1, (7) Shaft 2, (8) Shaft 3, (9) Shaft 4, (10) Cutting Wheels

➤ Components

A. Main Frame

The frame is made of hot rolled steel. This material is readily available, cheap yet possess high strength. All the essential components are mounted on the main frame.



B. Table

The 145cmx90cm steel Table is welded to the frame. Table has a rectangular slot for allowing the rotary wheel to come in contact with the wood to be split.

C. Electric Motor



The wood shredder has the following parts, which forms the main elements of the machine.

- Main frame
- Table
- Electric Motor
- Belt and Pulley
- Gears
- Shafts
- Cutting Wheels
- Switch

Given below is the front view of the wood shredder.



A 3 HP electric motor is used to drive the gears and finally the cutting wheels. Motor is placed at the provision on the base of the frame.

D. Belt and Pulley

The drive has two pulleys and a nylon V belt connecting them. The driving pulley drives the wheel of 51cm diameter. The two wheels in this arrangement has a center to center distance of 152cm.

E. Gears

The machine consists of 5 gears. The specifications of the gears are shown in the table 1.

F. Shafts

The cutting wheels are coupled with the gears by 4 shafts. This provide proper reduction in speed. The specifications of the shafts are given in table 2.



G. Cutting Wheels



Both the cutting wheels have 12 number of teeth and 35cm diameter. They rotate at a speed of 25 rpm. The cutting wheels rotate in the opposite direction with respect to one another.

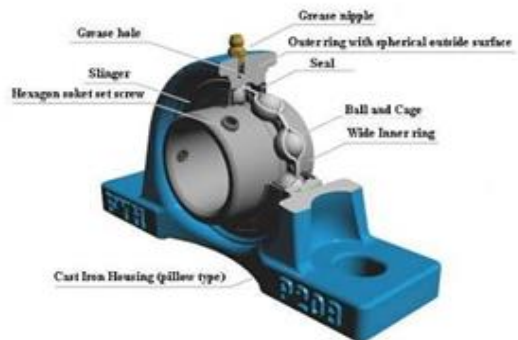
H. Starter Switch



Function of the motor starter switch is to turn the machine on or off by controlling the electricity flow to the 3HP electric motor.

I. Bearing

Bearing constrains relative motion to only the desired motion, and reduces the friction between the moving parts. Pillow block type bearings are used here.



Sl. No.	Gear (As in Figure 1)	Gear diameter	Number of teeth
1	Gear 1	35	56
2	Gear 2	13	20
3	Gear 3	12	19
4	Gear 4	33	54
5	Gear 5	33	54

Table 1. Specification of gears

Sl. No.	Shaft (As in figure 1)	Shaft Diameter	Length
1	Shaft 1	12	27
2	Shaft 2	16.5	115
3	Shaft 3	12	107
4	Shaft 4	12	107

Table 2. Specification of shafts

VI. OPERATING PROCEDURE

- First connect the machine to the alternating current supply.
- Start the motor with the on/off switch.
- Take a piece of wood and feed it to the cutting wheels by pushing the wood towards the cutting wheels.
- The wood split into two pieces can be collected from the other side.
- If further size reduction of the log is required, feed the log to the cutting wheels again.
- Collect the split logs from behind the machine.
- Switch the motor to off position and disconnect the alternating current supply.

VII. ADVANTAGES

- Cheap compared to other means of splitting wood.
- No harmful emissions to the environment as the machine runs on electricity.
- Simple construction and no superfluously complex parts.
- Applicable in domestic and small scale industrial environments.
- Less maintenance cost.

VIII. SCOPE AND DISCUSSION

The Wood Shredder fabricated is of very huge potential. In a country like India where most of the domestic food preparation is based on firewood wood shredder will serve to reduce human effort in making wood logs out of huge wood trunks. The fact that wood shredder keeps one from the dangers

of joint and muscle fatigues and injuries in wood shredding makes it a machine of great value.

The wood shredder was tested for different wood types of varying dimensions and satisfactory results were obtained. The machine can admit wood piece up to 25 cm cross sectional diameter. By mounting provisions for wheels, the machine can be made easily portable. Also, if proper speed controlling means are introduced, the machine can be operated with a higher degree of control.

IX. CONCLUSION

In this project we conclude that there are many parameters on which the total project is dependent, i.e. total knowledge about the system, design of cutting wheel and its arrangement of the main shaft, reduction in rotation. The motion study was successfully carried out when the whole assembly was completed. The frame needed some basic analysis to check whether it could take over the load or not. The following analysis was done and the results were positive. There was a problem in gear alignment and bearing fitting. Also we need to change our gear position at the end due to pulley arrangement. These difficulties were overcome by some expert advices. Finally the Wood Shredder is fabricated successfully. The project is completed within the expected financial and time constraints. Hopefully this machine will be a good and dependable solution for making firewoods in domestic and industrial purposes. In the process of making this concept a reality, we as a team were able to gather more practical knowledge in machining discipline.

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