

# Design And Fabrication of Mini Lathe Machine

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**Abstract**— A lathe machine is used for rotating a workpiece in order to perform sanding, cutting, drilling, knurling and turning operations on the workpiece. Lathes have been used on woodworking, metal parts and also on plastic nylon parts for a long time in the industry. So here we study the design and fabrication of a mini lathe machine. Our machine consists of a motor with belt arrangement used to drive the lathe chuck. The machine consists of a bed with a movable arrangement. We use a chuck attached to the spindle shaft in order to run the motor. Our motor once powered transmits this power to the spindle through a belt mechanism, which is then used to rotate the chuck. This rotates the workpiece in chuck. The machine is built to hold and rotate the workpiece and move the tool in a sliding mechanism, so as to achieve the desired operations. The machine outer frame is designed to hold the workpiece firmly with tool in place so as to achieve desired operations with ease. Thus, we successfully study the design and fabrication.

**Keywords**— Centre Lathe, Ceramic Lathe, Wood Lathe

## I. INTRODUCTION

A mini lathe (also styled mini-lathe or mini lathe) is a machine tool used for the complex shaping of metal and other solid materials. Mini lathes are related to (full-sized) lathes but are distinguished by their small size and differing capabilities, application, use, and locations. Sometimes referred to as desktop lathes or table-top lathes, mini lathes can be comfortably used in areas where a full-sized lathe would be impractical.

Mini lathes are well suited for use in restricted spaces where heavy machining or high accuracy are not requirements. Mini lathes find a place in homes, basements, and garages. As they are a popular tool for hobbyists, they are commonly sold through hobby catalogs and hobby websites. Mini lathes are preferred over larger lathes by some professionals, commonly locksmiths, jewellers, designers, and engineers for prototyping or fabrication work.

Despite a more available price point and lower rigidity than their larger counterparts, mini lathes still operate within the required tolerances of many tasks. This makes them particularly useful in applications where small precision pieces are needed for projects like miniature engines that require fine detail and mechanical accuracy.



Fig 1: Mini Lathe Machine

## II. LITERATURE SURVEY

### TREAD IN LATHE MACHINE FABRICATION:

The emergence of the lathe machine date back to an unknown period, but it gained popularity between the sixteenth and seventeenth centuries. Then opticians used it for cutting lenses used in the construction of astronomical telescope. They modified the relatively rough technique for special purposes. Artisans and furniture makers used the larger lathes in turning frame works though the frames were made of wood and had one or two headstocks depending on the work being done. The wooden frame made it inaccurate.

### CENTRE LATHE MACHINE:

A centre lathe is used to machine metals, by rotating the work piece mounted between centers against a cutting tool. The tool can be fed both transversely and longitudinally with respect to the turning axis of the job. The tool can be operated manually or automatically and many shapes as well as different works can be done on the centre lathe. Such work as cylindrically, eccentric or conical shape can be machined. Also done on the centre lathe are threading turning and boring operations.

### CERAMIC LATHE MACHINE:

The ceramic – lathe is used for ceramic machining along, though the operation is similar to that of the centre lathe.

### WOOD LATHE:

The wood lathe, just like other types of lathes, it can be used to carry out a wide range of machining operations, it saves time and does not wed much ski //s as in the use of hand tools.

### A. Design & Fabrication of Wooden Lathe Machine

In this paper we found about the working principles of the mini wood lathe machine. And the need for the mini lathe machine. As the artist, carpenters and small businesses can't always use big machines or buy a new

lathe machine as they are expensive. or are not mobile. This gives an idea about the necessity of a mini lathe machine which is cheap, lightweight and can run on low operating cost. Also the basic principle behind the working of a mini lathe machine. The basic components present in a lathe machine and their functionality. And what types of operations can be performed on the machine.

#### B. Design and Fabrication of Mini Wood Lathe Machine

This paper we found about the design of the mini lathe. What are the important considerations needed to design a mini lathe machine. Also what speed the lathe should have and what the different sizes of v-belts should be considered. In this project a study has been done on a mini lathe machine to know about its portability, reliability and cost reduction. A basic design of the mini lathe machine has been made and analysis has been done of the tool to determine the cause of failure of the tool. The author also discussed the consideration of cost cutting during the designing phase.

#### C. To Model And Fabrication of Portable Wood Lathe Machine

In this paper we studied the importance of considering vibrations caused by the machine while performing a job. And how the more vibrations can reduce the lifetime of the particular component produced on a lathe machine. Also we got a basic idea about how the development and assembly of a mini lathe machine should be done. The basic components that should be present to perform a basic job. Some of the components are motor for the power supply, Headstock and tailstock for holding and rotating the job, pulleys and V-belts to transmit power from motor to the head stock and finally a tool support to mount tools for precision.

### III. DESIGN CONSIDERATIONS

Several structural design considerations should be taken into account for economical and efficient manufacturing. Many of these apply to other joining methods, and all apply to both subassemblies and the complete structure.

1. The device should be suitable for local manufacturing capabilities.
2. The attachment should employ low-cost materials and manufacturing methods.
3. It should be accessible and affordable by low-income groups, and should fulfil their basic need for mechanical power
4. It should be simple to manufacture, operate, maintain and repair.
5. It should be as multi-purpose as possible, providing power for various agricultural implements and for small machines used in rural industry.
6. It should employ locally available materials and skills. Standard steel pieces such as steel plates, iron rods, angle iron, and flat stock that are locally available should be used. Standard tools used in machine shop such as hack saw, files, punches, taps & dies; medium duty welder; drill

press; small lathe and milling machine should be adequate to fabricate the parts needed.

7. It should make use of standard parts wherever possible.

#### A. Design Procedure

- 1) Definition of problem
- 2) Synthesis
- 3) Analysis of forces
- 4) Selection of material
- 5) Determination of mode of failure
- 6) Selection of factor of safety
- 7) Determination of dimensions
- 8) Modification of dimensions
- 9) Preparation of drawings
- 10) Preparation of design report

#### B. Design Considerations

- Strength
- Rigidity
- Reliability
- Safety
- Cost
- Weight
- Ergonomics
- Aesthetics
- Manufacturing considerations
- Assembly considerations
- Conformance to standards
- Friction and wear
- Life
- Vibrations
- Thermal considerations
- Lubrication
- Maintenance
- Flexibility
- Size and shape
- Stiffness
- Corrosion
- Noise
- Environmental considerations

C. Aesthetic Considerations in Design

- Appearance is an outward expression of quality of the product and is the first communication of product with the user.
- Aesthetics is defined as the set of principles of appreciation of beauty. It deals with the appearance of the product.

Aspects of Aesthetic Design:

- Form(shape)
- Symmetry and shape
- Colour
- Continuity
- Variety
- Proportion
- Noise
- Contrast
- Impression and purpose
- Style
- Material and surface finish

IV. CONCEPTUAL DESIGN

The objective of this project is to design the low cost wood lathe machine. It is described as following work flow alternatives diagram.

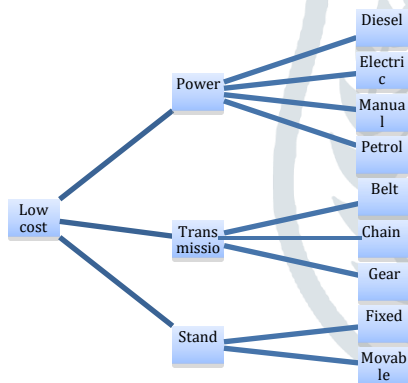
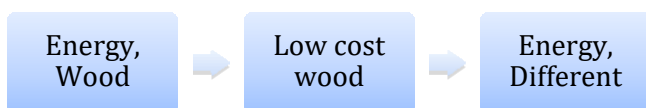


Fig 2 Tree diagrams of work flow alternative

Establishing Functional Structure

To establish the function required and the system boundary new design.



V. CATIA DESIGN

Product Design and Styling

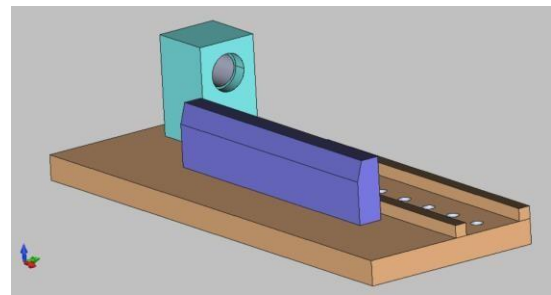


Fig 3: 3D CATIA Model of Base part of Mini Lathe

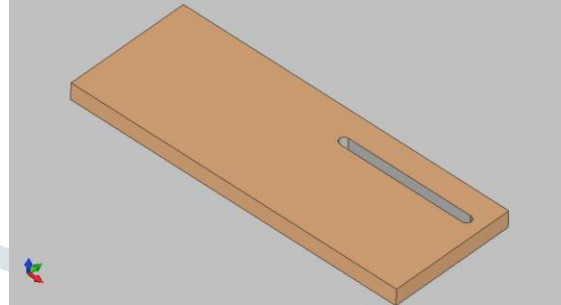


Fig 4: 3D CATIA Model of Mini Lathe Machine Part



Fig 5: Mini Lathe Machine Dimensions

Dimensions and Specifications Below are the dimensions and specifications as regards the fabrication of mini wood lathe machine:

- Total length of the machine 400mm
- Total height of the machine 100mm
- Width of machine 150mm
- The electric motor
- RPM of motor 2820 rpm
- Horse power capacity of the electric motor 3HP
- Power of the electric motor 2.2kW
- The space between the bed rails 250mm
- Width of tailstock 200mm
- Maximum length of work piece 150 mm
- Maximum diameter of work piece 50 mm

## CONCLUSION

In this paper a study has been done on mini lathe machine to know about its portability, reliability and cost reduction. A basic design of mini lathe machine has been made and analysis has been done of the tool to determine the cause of failure of the tool. The fabricated model of the design will be portable, cost efficient and can be assembled and dismantled according to the use which will increase the mobility of the machine and can be easily carried. The ordinary workers who can't afford the conventional lathe machine can buy this portable mini lathe machine and can perform their machining operation effectively. The mini lathe machine can reduce the capital cost of machining reducing the labour cost. The machine would be easy to handle because of its mobility and portability and can easily be maintained. Because of its portability and small size it will consume less power than conventional lathes and at the same time will be simple and compact performing machining operations.

This way we can design and manufacture mini lathe for wood machining. It would be very compact in size and light in weight hence, easy to carry it anywhere. Variety of wood machining can be done on this lathe and it will be easy to use. As it is compact in size, it can be placed anywhere and it occupies less space.

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