

Portable Mini Wood Lathe Machine

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Abstract -To achieve the aim of producing a functional Portable wood lathe machine. We analyzed and as well synthesized the different possible design solutions and concepts. We carried out the analysis of different component part of the machine to determine their suitable dimensions based on loading and stresses due to them. We used available local material and tool from workshop. We also made use of some machine tools in the college workshop. Finally, the parts were assemble and the machine test – run. To ensure the achievement of best performance, interactive procedures, were carried out. The material, labour and overhead costs were determined to get the production cost of a prototype.

Keywords-portable mini lathe machine , drill, Methodology, Design, Fabrication & Working of portable mini lathe machine.

I. INTRODUCTION

Lathe is one of the most versatile and widely used machine tools all over the world. It is commonly known as the mother of all other machine tool. The main function of a lathe is to remove metal from a job to give it the required shape and size. The job is securely and rigidly held in the chuck or in between centers on the lathe machine and then turn it against a single point cutting tool which will remove metal from the job in the form of chips. An engine lathe is the most basic and simplest form of the lathe. It derives its name from the early lathes, which obtained their power from engines. Besides the simple turning operation as described above, lathe can be used to carry out other operations also, such as drilling, reaming, boring, taper turning, knurling, screw-thread cutting, grinding etc. Lathes are manufactured in a variety of types and sizes, from very small bench lathes used for precision work to huge lathes used for turning large steel shafts. But the principle of operation and function of all types of lathes is same i.e. speed lathe, centre lathe or engine lathe, bench lathe, tool room lathe, capstan lathe, turret lathe and automatic lathe.

1.1 MINI WOOD LATHE MACHINE

Mini wood lathe is a portable machine of dimension 60mm*45mm*25mm and made up of using plywood, it is commonly used for machining wooden or plastic work pieces. So here we study the fabrication of a mini lathe machine our machine consist of a drill machine(for high torque) used to drive the lathe chuck. The lathe consist a bed of plywood with movable arrangement, it is also

consist of a ball bearing which is allowed to free rotation and support of job from the other side. It also consist a holder to hold the desired tool and this holder can slide over bed in parallel to axis of job rotation. We use chuck attached to drilling machine shaft in order to rotate the job. The machine is build to hold the work piece and move the tool in sliding mechanism, so as to achieve a desired operations. The machine outer face is design to hold the work piece firmly with tool in place so as to achieve desired operations with ease. Thus we successfully study the design and fabrication

II. METHODOLOGY AND FABRICATION

2.1 METHODOLOGY

The device run with the help of drill machine which gives rotation to workpiece . drill is located at headstock and is main unit of portable mini wood lathe machine . Workpiece is connected between a fixed head stock and movable tailstock tool must be supported on tool most . As it is manual type of lathe machine a human need to hold the tool on tool post . By running the drill various operations can be performed on portable mini wood lathe machine . operations such as turning , taper turning, grooving, champhering, fillet, parting, cutting, knurling, finishing etc.

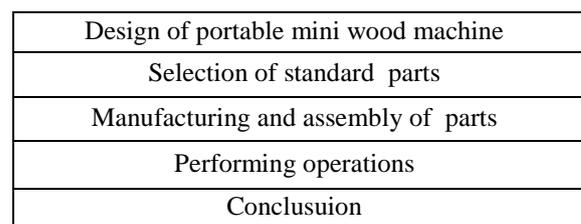


Fig. 2.1 Methodology Block Diagram

2.2 TREND 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.

Discussed below are some related lathe machines:

A. CENTER LATHE MACHINE

A center 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 center lathe. Such work as cylindrically, eccentric or conical shape can be machined. Also done on the center lathe are threading turning and boring operations.

B. CERAMIC LATHE MACHINE

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

C. WOOD LATHE

The wood lather, just like other types of lather, it can be used to carry out a wide range of machining operations, it saves time and does not need much skills as in the use of hand tools.

➤ **STATEMENT OF PROBLEMS**

The continuous quest to have the problems of man and his growing need solved has led to the establishment of factories and others industries, which necessitates an intermediate technology. However, simple hand tools that were in use before are no longer efficient for mass production. In the same manner, the importation of wood lathe machine, as a substitute for these tools, likewise has failed to meet man’s insatiable needs because of our unstable economy. Then, there comes the need for urgent attention to a better and locally made wood lathe machine.

➤ **PURPOSE OF STUDY**

The design and fabrication of wood the lathe machine aims among others thing at justifying a simple way of scraping and cutting off wood at it’s best quality at a minimum cost of labour, so that the financial burden if people can be reduced. The simple design and fabrication of this machine, makes it viable, reliable and easy to carryout maintenance services at the minimized cost

Equipment used

Table 1: Equipment used

S.no.	Name of Equipment	Purpose
1	Bosch handheld Cutter	For cutting plywood
2	Sand paper	For smoothening edges
3	Drill Machine	For drilling holes
4	Rip saw	For cutting small plysheet

5	Boring tool	Create hole for bearing
6	adhesives	For sticking parts
7	Spanner set	Fir fitting nuts and bolts

2.3 BILL OF MATERIALS

Details of the major components and the materials used in portable mini wood lathe machine are listed below.

Table 2: Bill of materials

S.no .	Name of Component	Quantity	Specification	Price estimation
1	Plywood sheet	3feet*3feet	NA	800
2	Drill machine	1	Induction machine	1000
3	Nuts and bolt	As per requirment	NA	100
4	screw	30	NA	50
5	adhesive	2	Araldite and fevical	300
6	Universal Bearing	1	NA	200
7	tools	1	Drill bit , trishul bit and wood lathe tools	800
8	Wood cutting	NA	Drill ,broch ,cutting , groove etc	300
9	workpiece	6	wood	300
10	Transportation And other miscellaneous	NA	NA	1000
TOTAL				4,850

2.4 Material Composition Plywood

Plywood is a sheet material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is an engineered wood from the family of manufactured boards which includes medium-density fibreboard (MDF) and particle board (chipboard).

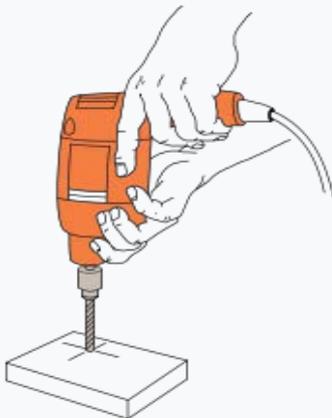
All plywoods bind resin and wood fibre sheets (cellulose cells are long, strong and thin) to form a composite material. This alternation of the grain is called cross-graining and has several important benefits: it

reduces the tendency of wood to split when nailed in at the edges; it reduces expansion and shrinkage, providing improved dimensional stability; and it makes the strength of the panel consistent across all directions. There is usually an odd number of plies, so that the sheet is balanced—this reduces warping. Because plywood is bonded with grains running against one another and with an odd number of composite parts, it has high stiffness perpendicular to the grain direction of the surface ply.



Softwood plywood made from spruce

2.5 MACHINE SPECIFICATION



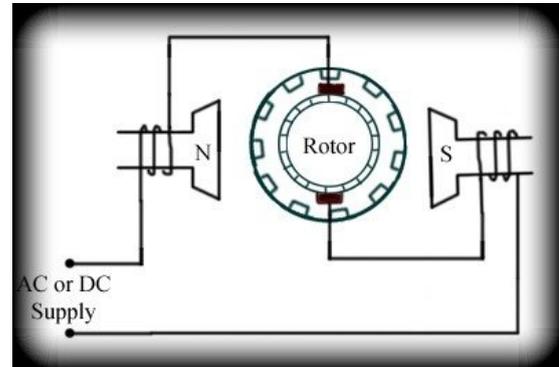
An electric drill

A **drill** is a tool fitted with a cutting tool attachment or driving tool attachment, usually a drill bit or driver bit, used for boring holes in various materials or fastening various materials together. The attachment is gripped by a chuck at one end of the drill and rotated while pressed against the target material. The tip, and sometimes edges, of the cutting tool does the work of cutting into the target material. This may be slicing off thin shavings (twist drills or auger bits), grinding off small particles (oil drilling), crushing and removing pieces of the workpiece (SDS masonry drill), countersinking, counterboring, or other operations.

Drills are commonly used in woodworking, metalworking, construction and do-it-yourself projects. Specially

designed drills are also used in medicine, space missions and other applications. Drills are available with a wide variety of performance characteristics, such as power and capacity.

Universal Motors:



Universal motors have high starting torque, can run at high speed, and are lightweight and compact in design. The various applications of the Universal Motor are Portable drill machine, Used in hair dryers, grinders and table fans. A universal motor is also used in Handheld power tools, blowers, blenders, vacuum cleaners, polishers and kitchen appliances.

A universal motor is defined as a motor which may be operated either on direct or single phase AC supply at approximately the same speed and output. It is a commutated series-wound motor where the stator's field coils are connected in series with the rotor windings through a commutator. It is often referred to as an AC series motor. The universal motor is very similar to a DC series motor in construction, but is modified slightly to allow the motor to operate properly on AC power. This type of electric motor can operate well on AC because the current in both the field coils and the armature (and the resultant magnetic fields) will alternate (reverse polarity) synchronously with the supply. Hence the resulting mechanical force will occur in a consistent direction of rotation, independent of the direction of applied voltage, but determined by the commutator and polarity of the field coils.

Drill machine

Table :3 drill machine specification

Sno.	Parameters	Specifications
1	Nominal Voltage	220V
2	Nominal Power	500W
3	Nominal Current	10A
4	High Speed	2000rpm
5	Low Speed	0rpm
6	Noise	No gear noise
7	Rotational Output	CW

Bed of portable mini wood lathe machine

- Length – 50mm
- Breadth – 30mm
- Height – 15mm

2.6 CONSTRUCTION OF MINI LATHE

Construction of mini lathe is very easy and economical. In construction of mini wood lathe machine wooden material (such as plywood and wood blocks), bearing, nut and bolt drilling machine, fevicol etc are used. here we replace the motor by the drilling machine to avoid belt drive mechanism and also produce high torque. The major parts of mini lathe machine are

- Bed
 - Head stock
 - Tail stock
 - Chuck
 - Carriage
- BED :

The bed of the mini lathe machine is made up of plywood on which all component of the lathe is mounted. It is rigid single piece plywood to support other active parts of the machine. On left of the bed head stock is located and tail stock is located on the right side. Carriage is rest on the bed from left to right and vice versa. On the top of bed a guideways is provided to slide tail stock .

➤ HEAD STOCK

The main function of headstock is to transmit power to the different parts of a lathe. It comprises of the headstock casting to accommodate all the parts within it.

➤ TAIL STOCK

Tail stock of mini lathe machine is show in the fig- it is commonly used for the objective of giving support of circular job being turned on centers. Tail stock can be easily set or adjusted for alignment or non-alignment with respect to the spindle centre and carries a centre called dead centre for supporting one end of the work, The dead centre can be mounted in ball bearing so that it rotates with the job avoiding friction of the job with dead centre as it important to hold heavy jobs

➤ CARRIAGE

Carriage is mounted on the outer guide ways of lathe bed and it can move in a direction parallel to the spindle axis. It comprises of important parts such as apron, cross-slide, saddle, compound rest, and tool post. The lower part of the carriage is termed the apron in which there are gears to constitute apron mechanism for adjusting the direction of the feed using clutch mechanism and the split half nut for automatic feed. The cross-slide is basically mounted on the

carriage, which generally travels at right angles to the spindle axis.

➤ CHUCK

Chuck is one of the most important devices for holding and rotating a job in a lathe. It is basically attached to the headstock spindle of the lathe. The internal threads in the chuck fit on to the external threads on the spindle nose. Short, cylindrical, hollow objects or those of irregular shapes, which cannot be conveniently mounted between centers, are easily and rigidly held in a chuck. Jobs of short length and large diameter or of irregular shape, which cannot be conveniently mounted between centers, are held quickly and rigidly in a chuck



Fig :2.2 lathe machine side view



Fig-2.3 mini lathe top view (showing head stock, tail stock, chuck, motor)

III. WORKING

3.1 OPERATIONS OF MINI LATHE

For performing various machining operations in a mini lathe the job is being supported by any on method

- i. Job is held and driven by chuck with the other end supported on the tail stock centre.
- ii. Job is supported by tail stock and other external medium and tool is fixed in chuck.

By these two methods of job supporting, mini lathe can perform following operations:

➤ TURNING

Turning is a form of machining, a material removal process, which is used to create rotational parts by cutting away unwanted material. The turning process requires a turning machine or lathe, workpiece, fixture, and cutting tool. In turning process the work piece is supported in between the head stock and tail stock and metal is removed by tool, proving feed parallel to axis of rotation of job.

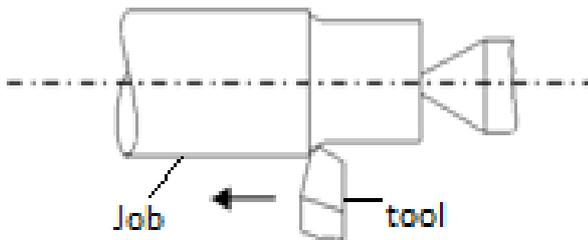


Fig 2.4– turning on mini lathe

➤ TAPER TURNING

A taper is defined as a uniform increase or decrease in diameter of a piece of work measured along its length. In a lathe machine, taper turning means to produce a conical surface by gradual reduction in diameter from a cylindrical job. Taper in the British System is expressed in taper per foot or taper per inch or taper per mili meter.

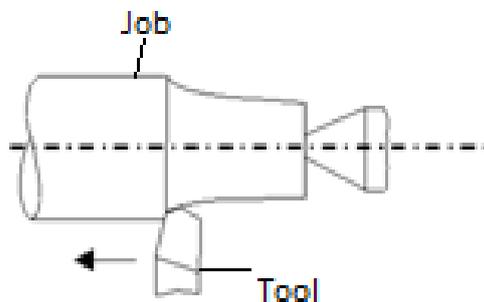


Fig. 2.5 – Taper turning on mini lathe

➤ CHAMFERING

Chamfering is a process of removing the burs and sharp edges, and thus makes the handling safe. Chamfering can be done by a form tool having angle equal to chamfer which is generally kept at 45 degree. Chamfering can be done by supporting one end in chuck and if work piece is long then both end is to be supported.

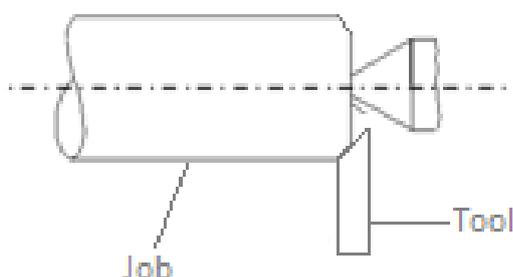


Fig.2.6 – Chamfering on mini lathe

➤ DRILLING

Drilling is an operation of making a circular hole by removing a volume of metal from the job by cutting tool called drill bit. Drilling process is done by fixing the job or work piece in the chuck and the drill bit is in tail stock, but in mini lathe the drill bit is fixed in chuck and the work piece is fixed in tail stock. In the drilling the work piece is fixed and tool is rotating.

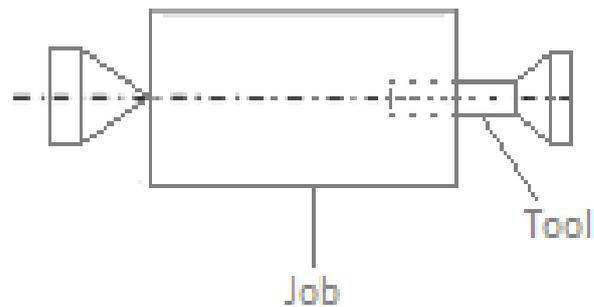


Fig 2.8– drilling on mini lathe

➤ GROOVING

Groove cutting on lathe machine is a multi steps machining operation. The term grooving usually applies to a process of forming a narrow cavity of a certain depth, on a cylinder, cone or a face of the part. The groove shape, or at least a significant part of it, will be in the shape of the cutting tool. Grooving tools are also used for a variety of special machining operations.

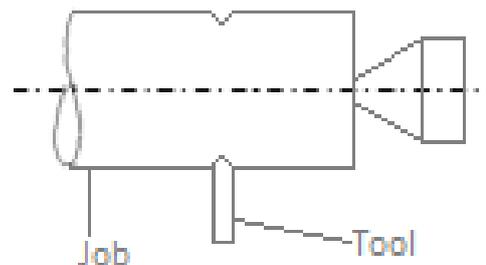


Fig 2.7– grooving on lathe machine

➤ PARTING

Parting uses a blade like cutting tool plunged directly into the work piece to cut off the work piece at a specific length. It is normally used to remove the finished end of a work piece from the bar stock that is clamped in the chuck. Other uses include things such as cutting the head off a bolt

3.2 ADVANTAGES

- It's a portable lathe machine.
- Wood and plastic can be machined.

- It's economical in use.
- Easy to design and fabricate.
- Very less maintenance.
- Its initial cost as well as running cost are less.

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3.3 DISADVANTAGE

- We can not work for long time because of heating problem
- Machining on a mini lathe take more time as compare to other lathe machine.
- Finishing of wooden job or work piece is not so good.
- Hard wood can not be machined on it.

3.4 APPLICATIONS

- It can be used for wood designing operations
- It is low cost as well as portable machine to use
- Design of wood and drill , bore ,etc parts can be prepared easily

IV. CONCLUSION

Portable mini wood lathe machine has a good advantage when compare to other manual machining process. We had done various operations on mini lathe and found that it can machined more number of job in same time in which a carpenter do manually, its fabrication is easy and material required in fabrication is available easily so everyone can made it by himself for their use. Machining on mini lathe was studied and found that it energy efficient and also reduce human effort.

4.1 FUTURE SCOPE

Our project is simply a portable mini wood lathe machine, which is electrically operated. Further modifications can be done to improve the performance of the machine.

Modifications are as follows

1. Instead of fix tool post a movable carriage can be made by rack and pinion operation
2. The size of mazine can be modified according to requiments
3. High power ac machine van be used instead of drill machine

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