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Design and Fabrication of Mini Wood Lathe Machine

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Abstract: Disclosed is a system for forming a variable speed pulley, a variable speed drive system, a variable speed lathe, a lathe having a slidable, horizontally-rotatable headstock, and a variable speed lathe having a slidable, horizontally-rotatable headstock.

I. INTRODUCTION

A. *Mini Wood Lathe Machine*

The wood lathe machine is introduced to lessen the human suffering and to improve economical and technological standard, and for years now Nigeria recognized that she was economically and technological poor and has been economically dependent on the western world for survival in terms of technology. To dis-encourage this importation of technological equipment placed enlarge on the importation of certain goods and this inspired our people to recognized indigenous technology through our fore father used axe, cutlass and some other sharp tools for designing woods. But, as time goes on, technologist introduced mini wood lathe machine, which comes in various designs and models as technology improves. Thus, the importance of wood lathe cannot be over emphasized. It is the acknowledgement of this fact that led to the design of mini wood lathe machine, even though this project of design and fabrication of wood lathe machine is a copied design, we tried to improve more on this machine so that it can design wood with little or no stress, utilizing the available material in order to reduced cost for production purposes and durability being of utmost important. For the mini wood lathe machine to function and perform its operations, various important parts are integrated together. These essentials parts make up the lathe machine and include the following Stand (or legs)**.** Stand or legs is used in holding the lathe machine and in elevating the lathe bed to a working height.

1) *Bed.* The bed of a lathe machine is the base on which all other parts of lathe are mounted. It is massive and rigid single piece casting made to support other active parts of lathe. On left end of the bed, headstock of lathe machine is located while on right side tailstock is located. The carriage of the machine rests over the bed and slides on it. On the top of the bed there are two sets of guide ways-inner ways and outer ways. The inner ways provide sliding surfaces for the tailstock and the outer ways for the carriage. The guide ways of the lathe bed may be flat and inverted V shape.
2) *Headstock.* 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 including gear train arrangement. The main spindle is adjusted in it, which possesses live centre to which the work can be attached. It supports the work and revolves with the work, fitted into the main spindle of the headstock. The cone pulley is also attached with this arrangement, which is used to get various spindle speed through electric motor.
3) *Spindle.* Spindle is a hollow horizontal axle with interior and exterior threads on the inboard by which the woodworking pieces can be mounted on.
4) *Tailstock.* Tailstock is commonly used for the objective of primarily giving an outer bearing and support the 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. Both live and dead centers have 60° conical points to fit centre holes in the circular job, the other end tapering to allow for good fitting into the spindles. 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.
5) *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.

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6) *Cross-slide.* The cross-slide is basically mounted on the carriage, which generally travels at right angles to the spindle axis. On the cross-slide, a saddle is mounted in which the compound rest is adjusted which can rotate and fix to any desired angle. The compound rest slide is actuated by a screw, which rotates in a nut fixed to the saddle.
7) *Tool Post*. The tool post is an important part of carriage, which fits in a tee-slot in the compound rest and holds the tool holder in place by the tool post screw.
8) *Tool Rest.* Tool rest is a horizontal area in line with the spindle and the tailstock from which hand tools are braced against and levered into the work pieces. The tool rest assembly has a base which rides on the ways. In a similar manner as the tailstock, the tool rest clamps to the ways to keep it in one place. The tool rest base has a means of holding a vertical shaft and enabling it to be adjusted up and down. The tool rest itself is made up of the vertical shaft and a horizontal bar (or some other resting edge). The tool rest must be moved often while turning almost any object, so easy adjustment is critical.



Fig 1:- Conventional Lathe

II. OBJECTIVES

A. *Apart from putting into Practical the theoretical Knowledge Acquired from the Class Room, The Main Objectives of the Project Are*

1) To use available local materials in fabrication.
2) To achieve a reduction in the cost of production of the machine.
3) To reduce the labour cost and time spend on using hand tools for wood dressing.
4) To create awareness for and encouragement of indigenous technology.
5) Increase productivity and creativity.
6) The Portable Mini Lathe is a simplest wood turning machine having simple constructional parts which favours less effort to operate.
7) The wood lathe machine is introduced to lessen the human suffering and to improve economical and technical standards.

The vital need for the fabrication of a wood lathe is significant in the much delay and times as well as energy wasted in using simple hand took to carry out operations moreover, the cost of importation of mini wood lathe machine, is too high for average user.

Similar to the use of other machine tools, the wood lathes machine will help to reduce cost, save time and consequently increase the rate of production and craftsman's skill. It is also important to explore the design of machines to improve on the ones already in existence.

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B. Trend In Lathe Machine Fabrication

The emergence of the lathe machine dated back to some thousand years B.C, but it gained popularity between sixteenth and seventeenth centuries. Then opticians used it for cutting lenses, used in the construction of astronomical telescopes. They modifies the relatively rough technique for special purposes. Artisans and furniture makers used the lathes in turning fancy wooden works, though the frames were made of wood and headstocks depending on the work being done. Nowadays, small carpenters who can't afford large wood lathe machine go to workshops and perform their operation of wood on those lathes machine only. So, for those mini wood lathe machines came into trend and is used to machine wood, by rotating the work piece mounted between centres against cutting tool. The tool can be operated manually or automatically and many shapes as well as different works can be carried out on the mini wood lathe machine. The mini wood lathe, just like the other types of lathe, can be used to carry out a wide range of machining operations. It saves time and cost and does not need much skill as in the use of hand operated tools.

C. Dimensions And Specifications

Below are the dimensions and specifications as regards the fabrication of mini wood lathe machine.

1) Total length of the machine 1000mm
2) Total height of the machine 600mm
3) Width of machine 500mm
4) The electric motor
5) RPM of motor 2820 rpm
6) Horse power capacity of the electric motor 3HP
7) Power of the electric motor 2.2kW
8) Frequency on which the motor will work 50Hz
9) Voltage to be supplied to the electric motor 240V
10) The space between the bed rails 100mm
11) Diameter of the headstock's pulley 120mm
12) Diameter of electric motor's pulley 20mm
13) Width of tailstock 200mm
14) Maximum length of work piece 500mm
15) Maximum diameter of work piece 100mm

III. LITERATURE REVIEW

The present application discloses a variable speed lathe having a sliding, horizontally-rotatable headstock. The present variable speed lathe is less complicated and expensive than typical prior art variable speed lathes which comprise typical prior art variable speed pulleys and/or typical prior art variable speed drive systems. Furthermore, in a preferred embodiment, one or more of the variable speed pulleys of the variable speed drive system within the lathe may comprise a conical face which extends substantially to the diameter of the central aperture. In such an embodiment, a greater range of speeds can be obtained for the same pulley size than can be obtained in typical prior art variable speed lathes which comprise typical prior art variable speed drive systems having variable speed pulleys in which the sheaves are positioned onto one or more sleeves and/or other hardware for supporting and interconnecting the sheaves. The preferred lathe comprises a lathe bed and a headstock positioned on the lathe bed. The headstock comprises a variable speed system including two variable speed pulleys formed by sheaves, a driving shaft and a driven spindle shaft. Support means associated with the headstock operationally supports the two shafts in positions substantially parallel to one another. A V belt operationally connects the two pulleys. Each variable speed pulley comprises two fixed sheaves, one on each shaft. Each fixed sheave comprises a conical face for forming one V belt bearing surface. The fixed sheaves further comprise means for securing the sheaves onto the driving or driven shaft so that the sheaves are prevented from both axial and rotational movement on the shafts. The means for securing each fixed sheave comprises a central aperture defined by a surface of the sheave. The central aperture has a diameter substantially corresponding to the diameter of the shaft so that the surface of the sheave which defines the central aperture is configured to be in direct contact with the shaft when the sheave is positioned on the shaft. The fixed sheave on the driving shaft and the fixed sheave on the driven shaft are positioned so that a tracking plane of the V belt is established to be substantially perpendicular to the axis of each shaft.

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Each variable speed pulley also comprises first and second moveable sheaves, one on each shaft. Each moveable sheave comprises a conical face for forming one V belt bearing surface. The moveable sheaves further comprise means for securing the sheaves onto the driving or driven shaft so that the sheaves may move in the axial direction while being prevented from rotational movement on the shaft. The means for securing each moveable sheave comprises a central aperture defined by a surface of the sheave, the central aperture having a diameter substantially corresponding to the diameter of the shaft so that the surface of the sheave which defines the central aperture is configured to be in slidable direct contact with the shaft when the sheave is positioned on the shaft. The present lathe further comprises control means for controlling the position of each moveable sheave so that the speed of the lathe spindle shaft can be controlled. longitudinal axis. The lathe bed comprises rails oriented parallel to the longitudinal axis. The rails define a horizontal plane. The lathe bed has a side in front of which a user normally stands. A headstock is located on the lathe bed rails. The headstock comprises a spindle shaft having a stock turning end for l movement to stock to be turned on the lathe. The spindle shaft has a length along a central axis. The central axis of the spindle shaft is located a predetermined distance above the rails. The headstock further comprises an adjustment mechanism for selectively adjusting the orientation of the spindle shaft axis in at least two orientations including parallel to the longitudinal axis of the lathe bed or perpendicular to the longitudinal axis of the lathe bed. The spindle shaft axis in each orientation is parallel to the horizontal plane defined by the rails.

The adjustment mechanism further comprises means for slidably locating the headstock along the length of the lathe bed so that, when the headstock is oriented in the second orientation with the stock turning end of the spindle shaft turned toward the front side of the lathe bed, stock which is too large in diameter to be turned between the central axis of the spindle shaft and the rails can be turned on the front side of the lathe bed with the headstock located substantially in the center of the bed in order to achieve maximum stability of the lathe while turning.

In its preferred form, the headstock comprises a surface which rests on the rails, and the surface which rests on the rails defines first and second mutually perpendicular slots formed in the bottom of the base. The lathe bed comprises a clamp key which fits between the rails and into the first and second slots. The clamp key comprises means for securing the headstock to the rails so that the spindle shaft can be oriented in either of the two mutually perpendicular orientations anywhere along the length of the lathe bed.

B. Summary

The analysis is the main and the most important part of any designing phase, without analysis we cannot determine the failure point of any tool or object. Knowing the failure point helps us to do some improvement in design before manufacturing which will save a lot of money. Now, in any machine the most important part is the cutting tool because it resists a lot of temperature and bears a lot of force acting on it. We have performed two types of analysis on the cutting tool of this mini wood lathe machine i.e the thermal analysis and the force analysis.

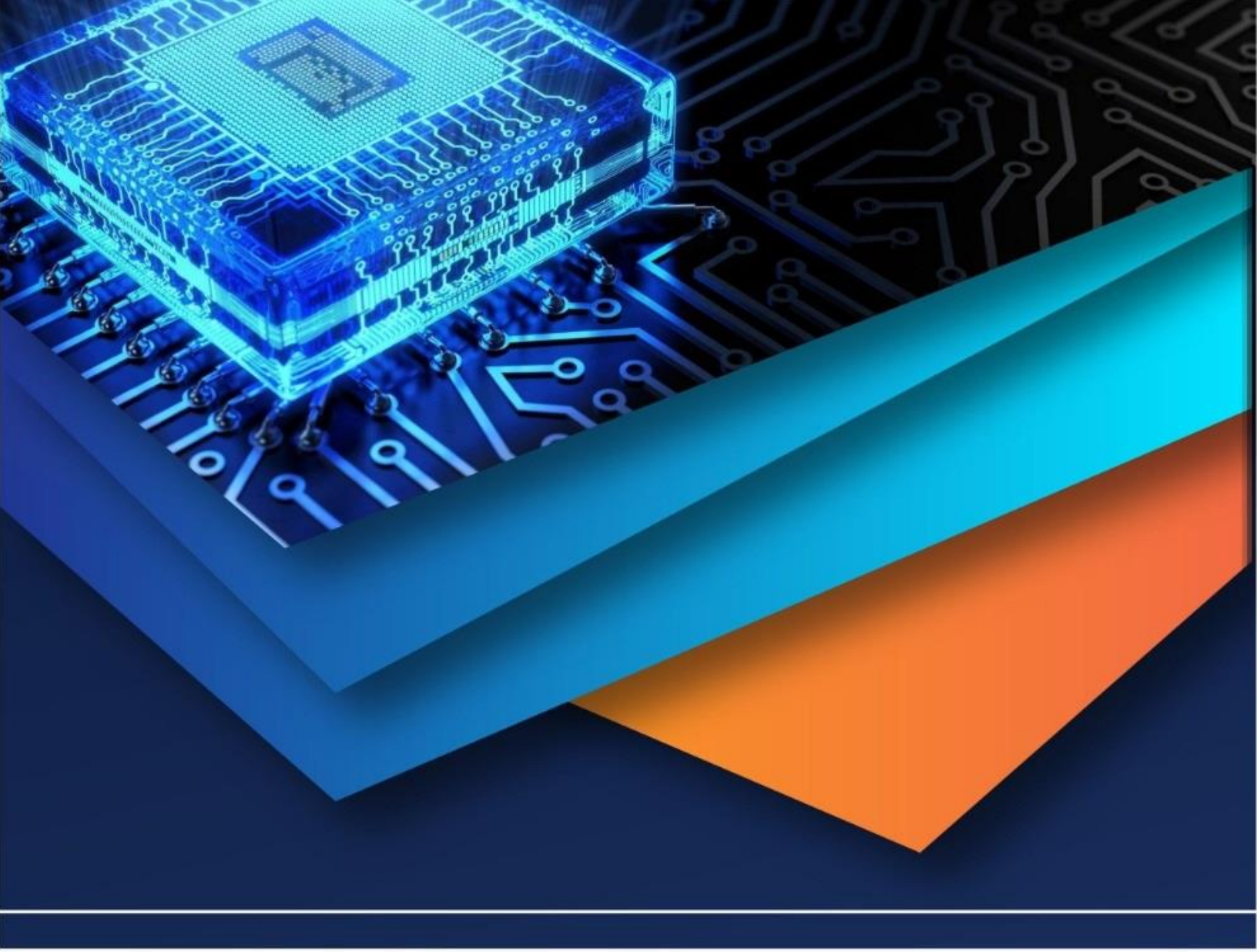
IV. CONCLUSION

In this project 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 dismantle 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 labor 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 in size it will consume less power than conventional lathes and at the same time will be simple and compact performing 24various machining operations.

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