MULTIPLE PARTS UPGRADATION OF LATHE MACHINE

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1]ABSTRACT-

1) The lathe, probably one of the earliest machine tools, is one of the most versatile and widely used machine tool, so also known as mother machine tool .

2) It is the most essential machine tool in an engineering workshop for performing various operations on workpieces as required by the machinist.

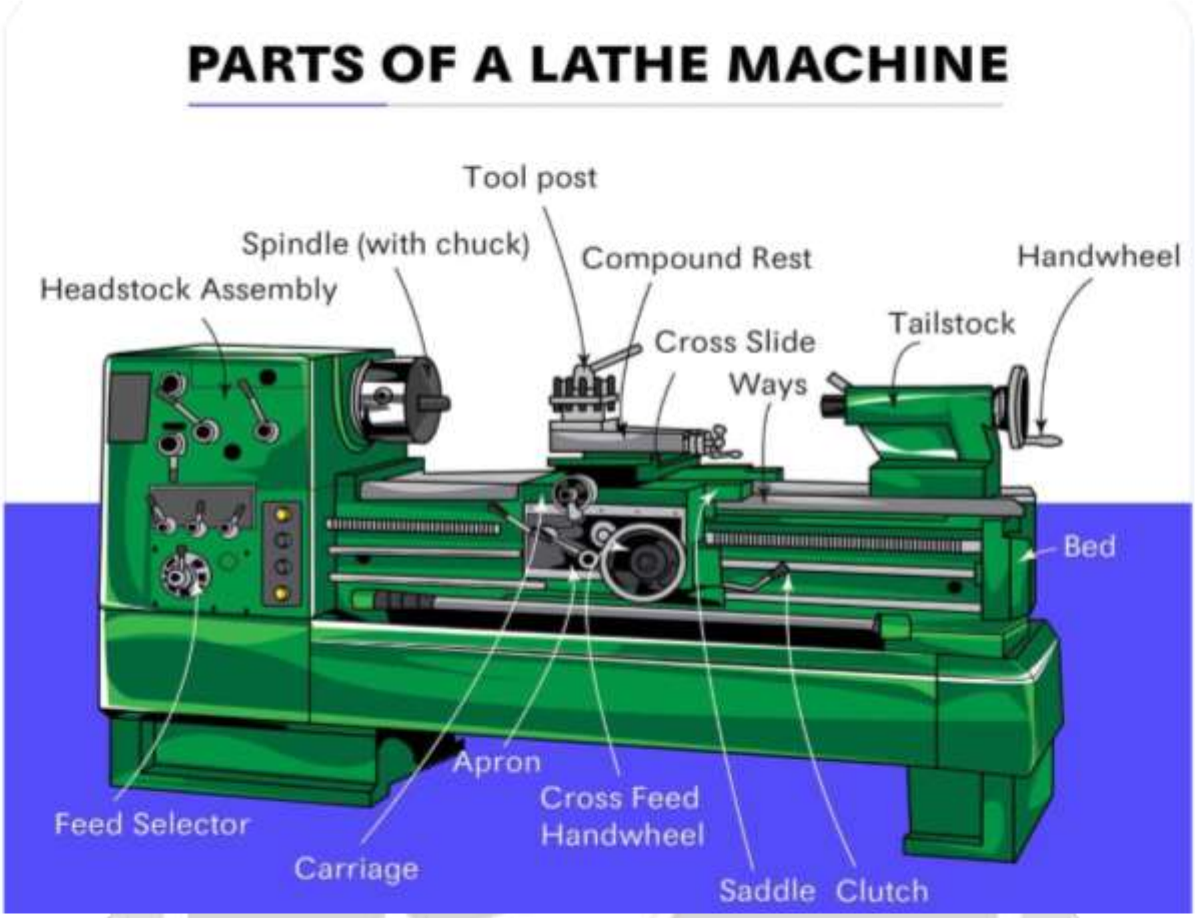
3)In this research paper, we have explained the working parts such as Spindle, Tailstock, Carriage, Chuck and Jaws of lathe machine as well as our study on concept of workholding accuracy and applications of lathe machine in industry.

<u>KEYPHRASES:</u>

Lathe, Carriage, Chuck, Tools, Spindle, Jaws, Work-Holding.

2] INTRODUCTION-

LONGITUDNAL AXIS TOOL HOLDING EQUIPMENT (LATHE) is a machine tool that rotates a workpiece about an axis of rotation to perform various operations such as cutting, sanding , drilling, deformation, facing, and turning, with tools that are applied to the workpiece to create an object with symmetry about that axis.



The primary application of the lathe is to get rid of undesirable parts of material and form the required shape and size. The job to be machined is held and rotated in a lathe chuck; a cutting tool is advanced which is stationary against the rotating job.
Since the cutting tool material is harder than the work piece, the metal is easily removed from the job. A feed refers to the tool's motion in one direction. People have used lathes to make components for different machinery, in addition to forte gadgets like bowls and musical instruments. Whatever the sort and function, all of them perform the use of this simple hold and rotating mechanism. Some of the common operations performed on a lathe are facing, turning, drilling, threading, knurling, and boring etc.
The basic structure of a machine tool consists of base and column arrangement which serves as a balancing support for the entire machine. Here, depending on the machining process, the tool is fixed in the tool post and the

work piece is held on the chuck of a typical lathe structure. The relative motion is achieved by movements parallel to the three spatial axes. This is achieved by means of linear guide ways and bearings, axial movements along the screws, rack and pinion arrangements etc. The machine is built of heavy steel and iron parts. The base of the machine is rigid and usually is of cast iron.

3] REVIEW AND DISCUSSION

3.1]HISTORY OF LATHE MACHINE-

- Lathe is a very ancient tool and its first use dates back to 1300 BC in Egypt.
- Lathe was also known and used in Assyria and Greece. Ancient Romans came to know about this machine and they further developed this machine.
- During the medieval period, the use of this machine had spread to most parts of Europe and it was during the Industrial revolution when this machine gained popularity with its use in all the industries.
- After the development of electronics, automated lathes have been developed.

3.2] PARTS OF LATHE MACHINE-

The essential components of a lathe are the bed, headstock, tailstock, spindles, carriage, chuck, tool holder and motor

3.2.1] BED

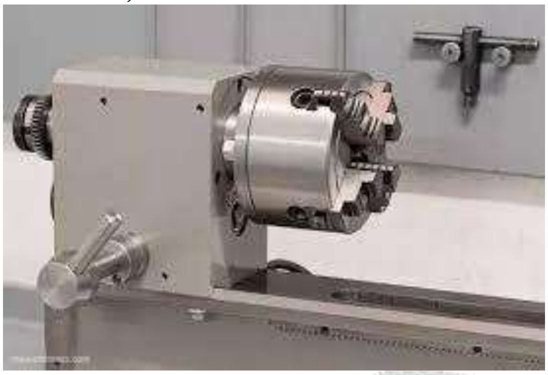
The bed is made up of two heavy metal slides that run lengthwise and have ways or 'V' created on them that are rigidly held by cross girths. It is the lathe's foundation and one of the criteria that determines the piece's size. That is, the maximum diameter limit is determined by the distance between the main spindle and the bed.

It has three main uses:

- It is suitably stiff and has a high damping capability for vibration absorption.
- It prevents the cutting forces from causing deflection.
- It supports the lathe machine's headstock, tailstock, carriage, and other component

3.2.2] HEADSTOCK

The principal action takes place on the headstock. This is where the motor's power is transferred to the workpiece. The drive mechanism and electrical mechanism of a Lathe machine tool are housed in the Head Stock, which is located on the left side of the lathe bed.



- The work is held in place by the spindle nose, which has external screw threads and an internal Morse taper for retaining the lathe centre.
- It rotates at a varied speed thanks to a cone pulley or an allgeared drive. A hole runs the length of the spindle to accommodate long bar work.
- The feed rod, lead screw, and thread cutting mechanism all receive power from the spindle via the Head Stock . Below the headstock is a separate speed change gearbox that reduces the speed so that variable feed rates for threading and automatic carriage lateral movement can be achieved.
- Most turning activities are performed with the feed rod, while thread cutting operations are performed with the lead screw.

3.2.3] SPINDLE

- The machine tool spindle provides the relative motion between the cutting tool and the workpiece

which is necessary to perform a material removal operation.
- In turning, it is the physical link between the machine tool structure and the workpiece, while in processes like milling, drilling or grinding, it links the structure and the cutting tool.
- The spindle is supported by two bearings separated by different spans. The cylindrical work piece is held in this portion of the lathe machine. Different attachments and accessories can be added to the spindles, including the rotating main spindle that holds the workpiece.
- The primary spindle is generally hollow and threaded on the outside to accommodate these fittings. Centre's, chucks, and faceplates are all helpful attachments for the main spindle. These can be used to position and hold the workpiece in place

3.2.3] TAILSTOCK

The tail stock is located above the lathe bed on the right side. The tailstock is a non-rotating spindle that travels down the bedways and is concentric with the main lathe spindle. The tailstock is typically used to support the ends of long workpieces, but it can also be equipped with a drill chuck to perform drilling and other hole

making operations.

3.2.4] CARRIAGE

When the machining is finished, the carriage is utilised to support, guide, and feed the tool against the job. It houses the compound rest over. It is in charge of holding, moving, and controlling the cutting tool. During operations, it provides stiff support for the tool. It uses an apron mechanism to transfer power from the feed rod to the cutting tool for longitudinal cross-feeding. With the help of a lead screw and half-nut mechanism, it makes thread cutting easier.

3.2.5] TOOLPOST

The cutting tool is held in place by a tool post that is firmly secured in the T-slots of the compound rest. Tool posts can have a variety of designs, but the following are the most common:

Types of TOOLPOST

1. Quick Release Tool Post
2. Index Tool Post
3. Pillar Type Tool Post
4. Clamp Type Tool Post
5. Turret (4-Way) Tool Post
6. Super Six Index Turret Tool post

3.2.6] CHUCK

Chucks are accessories that are used to hold a workpiece or cut down tool on a machine tool. The chuck is actually essential to a lathe's functioning as it fixtures the portion to the spindle axis of the work-holding machine . It is connected to main spindle of the headstock. Lathe chucks are used to clamp a workpiece accurately on a lathe for turning operations or on an indexing fixture for milling activities. A screw or pinion opens or closes the jaws of a manual lathe chuck. The jaws of a power lathe chuck are closed by hydraulics, pneumatics, or electricity. They are designed for mass production and have a high grasping

accuracy.

Different types of chuck used in the lathe machine are:

- Three jaw chuck
- Four jaw chuck
- Magnetic Chuck
- Collet Chuck
- Combination Chuck
- Air/ Hydraulic Operated
- Drill Chuck

3.2.7] JAWS

Lathe jaws attach to a lathe chuck to center and hold workpieces within the chuck. They can be tightened to clamp onto the workpiece and loosened to release the workpiece. These jaws are used to swap out the current jaws for harder or softer ones or to replace worn or damaged jaws.

4] CONCLUSION

The lathe machine has proved to be one the most versatile and helping piece of machine tool in a tool room workshop and has variety of applications for making possible operations required to make a workpiece its desired shape and size. We have studied various parts of the workshop lathe giving information about the bed, the tailstock, the toolpost and its types, the headstock, the carriage, chucks and their types, jaws and their types. Also we have worked on workholding accuracy of a 3 jaw chuck that explains the types of errors the jaws show while holding a concentric workpiece. Also, we have explained the day-to-day applications of a workshop lathe in small scale and large scale industries.

5] APPENDIX

5.1] Experimental Investigation on the Advantages of Dry Machining over Wet Machining

In this study, the experiment was conducted to investigate the advantage of dry machining over wet machining during turning of AISI 1020 steel using cemented carbide tool on a CNC lathe machine. Surface roughness and cutting temperature were measured by VOGEL surface roughness tester and infrared thermometer respectively. The experiments were conducted based on Taguchi L9 orthogonal array design. Surface roughness, cutting temperature, tool life, and machining cost were analyzed graphically. The average surface roughness and cutting temperature achieved with wet machining was 2.01 µm and 26.540C, which was 17.41% and 44.86% respectively, lower than dry machining. The high cutting temperature in dry turning result in short tool life, which was 41.15% shorter than wet turning. The machining cost of wet turning was about 56% greater than the cost of dry turning. The cost of coolant in wet turning is 42.88% greater than that of the cutting tools. The highest cost was shared by tool cost, which was 81.33% of the total cost for dry turning, while 70.00% of the total cost was shared by coolant cost for wet turning. Results revealed that dry turning is more economical than wet turning.

5.2] Design and Development of Nonautomatic Tabletop Mini Lathe

Miniaturization of machine tools to size compatible to target products without compromising machining tolerance leads to enormous saving in energy, space, and resources. Recently model techniques are findings an increasingly wider application in the design of small structures and models of actual machines that are made from appropriate materials. tabletop lathes are preferred over lathes by some professionals like lock smith, jewelers, and designers, engineers for prototyping and fabrication work. This chapter describes the design and development of tabletop mini lathe through 3D modeling and actual fabrication made by design calculations based on machine tool Design procedure that utilize a variable speed electric motor for getting various cutting velocities. It is specially designed to turn metals like steel, copper, aluminum, silver, and gold for carrying operations of external turning, facing, and step tuning. This model is analyzed by study behavior of actual behavior predicted from the knowledge of models. It is the first step to fabricate the mini lathe (150 mm length) for turning of small components with degree of accuracy.

5.3] Development of a Low Cost Eco-Friendly Minimum Quantity Lubrication System for Machining Processes

Recently all environmental worries are calling for reducing the usage of fluids in machining operations. One of the promising solutions that appeared lately is minimum quantity lubrication (MQL). This research aimed to develop an eco-friendly cooling system for a lathe machine and assess its performance. After considering the customer needs, the needs were translated into engineering specifications in the conceptual design phase, and then the quality function deployment was developed. Three concepts were generated and evaluated considering the selection criteria, and a final concept was selected using the decision matrix method. Following this, a detailed design and fabrication of the subsystems such as the oil tank and a structure accommodate all the components. The developed system was tested on six different conventional one. In general, the MQL system resulted in lower surface roughness values as well as lower tool wear.

5.4] Study on Heat Sources of Horizontal Lathe Machine by Using Inverse Method

Thermal has significantly effect on high speed machine tools. When temperature growing up, it often causes processing errors and further reduces product quality. This paper aims to investigate magnitude of heat sources and temperature distribution in a horizontal lathe based on inverse method. In present thermal model, there is not only consideration of spindle but also analyzing relative structures. Simulated and experimental temperatures are used as input data to predict heat sources and temperature field. Effects of speed, number measured points, measurement errors and measured distance on predicted results are analyzed. Results indicate that this inverse method can accurately estimate the heat sources based on two measured temperatures at front and rear outer rings. The trend of estimated heat sources is then compared to measured load rate. Results herein are useful information for designing horizontal lathe spindle and reducing thermal errors.

5.5] INCREASING THE PRODUCTION WITH THE HELP OF AI IN CNC MACHINE

Artificial intelligence is among many technological advancements that are changing how industries operate. With its incorporation into CNC machines, industries are now able to streamline and boost their production processes. Smart industries have already adopted AI while still using their old CNC machines. This is made possible by the compatibility of the machines with programs leveraging the use of AI.

- Increases Efficiency and Productivity

The most important things when it comes to the incorporation of AI in CNC machines are efficiency and productivity. With the use of artificial intelligence, CNC machines can analyze all the data they produce during production and provide real-time results to their operators. This is important in boosting productivity.When the data is analyzed, the machines can suggest any changes to their operators. With this, the operators can make the changes, affecting how the machine operates. This ensures that the machines' efficiency is improved.

- Boosts Performance Through Machine Learning

Initially, industries relied on human operators when driving changes in machining. However, this is changing due to AI. Today, they can rely on analytics, real-time data, as well as machine learning to dictate how the CNC machines learn, respond to requests and optimize performance. AI has allowed operators to get insights on things such as how CNC machines operate, function, and perform. In addition, this has opened a wide view into how all the CNC machines work and perform with each other. With that, operators can see the performance of each machine and eliminate anything that slows performance. The machines are also learning about ways to boost their performance and giving suggestions to their operators. This boosts the machine's performance.

- Lowers Production Costs

If you ask any manufacturing plant managers today, they will tell you that their production costs are affected by their ability to service their machines in good time. They need to know when the machines should be tuned, calibrated, and parts adjusted. This always requires time. However, artificial intelligence is making things easier for them. It is making it possible for industries to predict the time needed for servicing or doing any maintenance activities on the CNC machines. AI uses data to drive the machines and offers the operators real-time data on how the machines perform. This allows the operators to predict when the machines might need servicing, or when a certain part might need to be replaced. With that, they are able to save money by making sure that the machines are always operational and servicing them at the right time.

- Transforms the Production Processes

The use of AI is transforming all the industries that rely on CNC machines for their production processes. Introducing artificial intelligence into these machines has not only seen increased levels of production but also a lot of technological transformation.For instance, CNC machine operators can use IoT devices to control the machines, rate their performance, and make any required changes no matter where they are working from. This has been made possible by AI.

- Promotes Automation

The past few years have seen different industries adopting automation to streamline their operations. This has majorly been boosted by advancements in technology. Similarly, some production processes with CNC machines have been automated especially due to the incorporation of AI. These machines are learning what they need to do, and receiving commands from their operators. In addition, industries are using collaborative robots to revolutionize their automation. With AI, these robots can operate the CNC machines, increasing productivity, reducing the chances of human errors, and ensuring that most processes are automated. With that, they are working on their own and streamlining their operations. This is made possible by AI.

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