INTRODUCTION TO LATHE MACHINE

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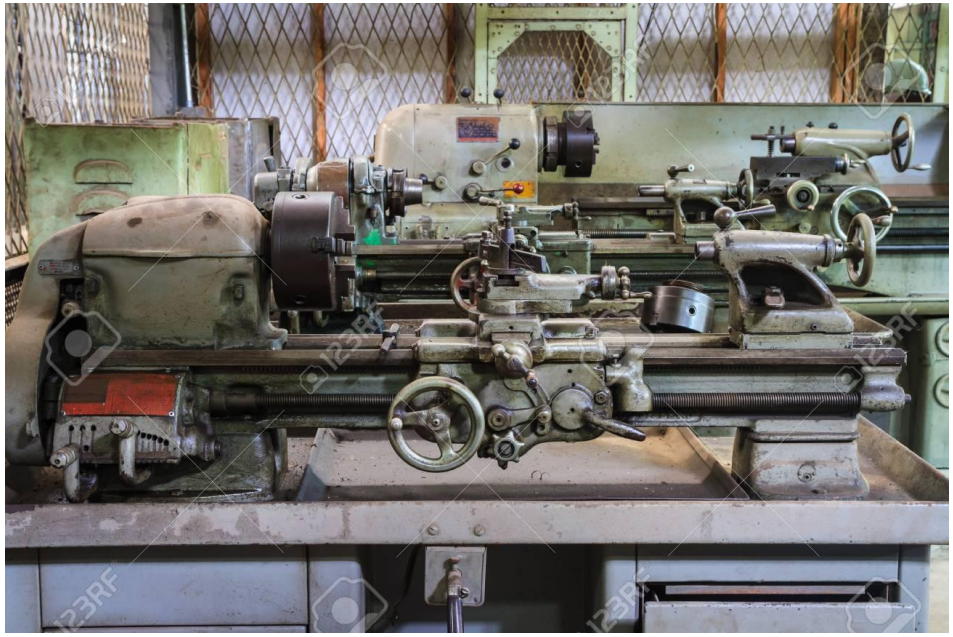
WHAT IS A LATHE MACHINE?

Lathe machine is a machine tool that is use to remove all the unwanted materials from a work piece while rotating work piece in the from of chips. It is used to accomplish all fundamental operations, including drilling, sawing, tapping, and turning, among others, with the aid of various tools located in the work area.

HISTORY OF LATHE MACHINE

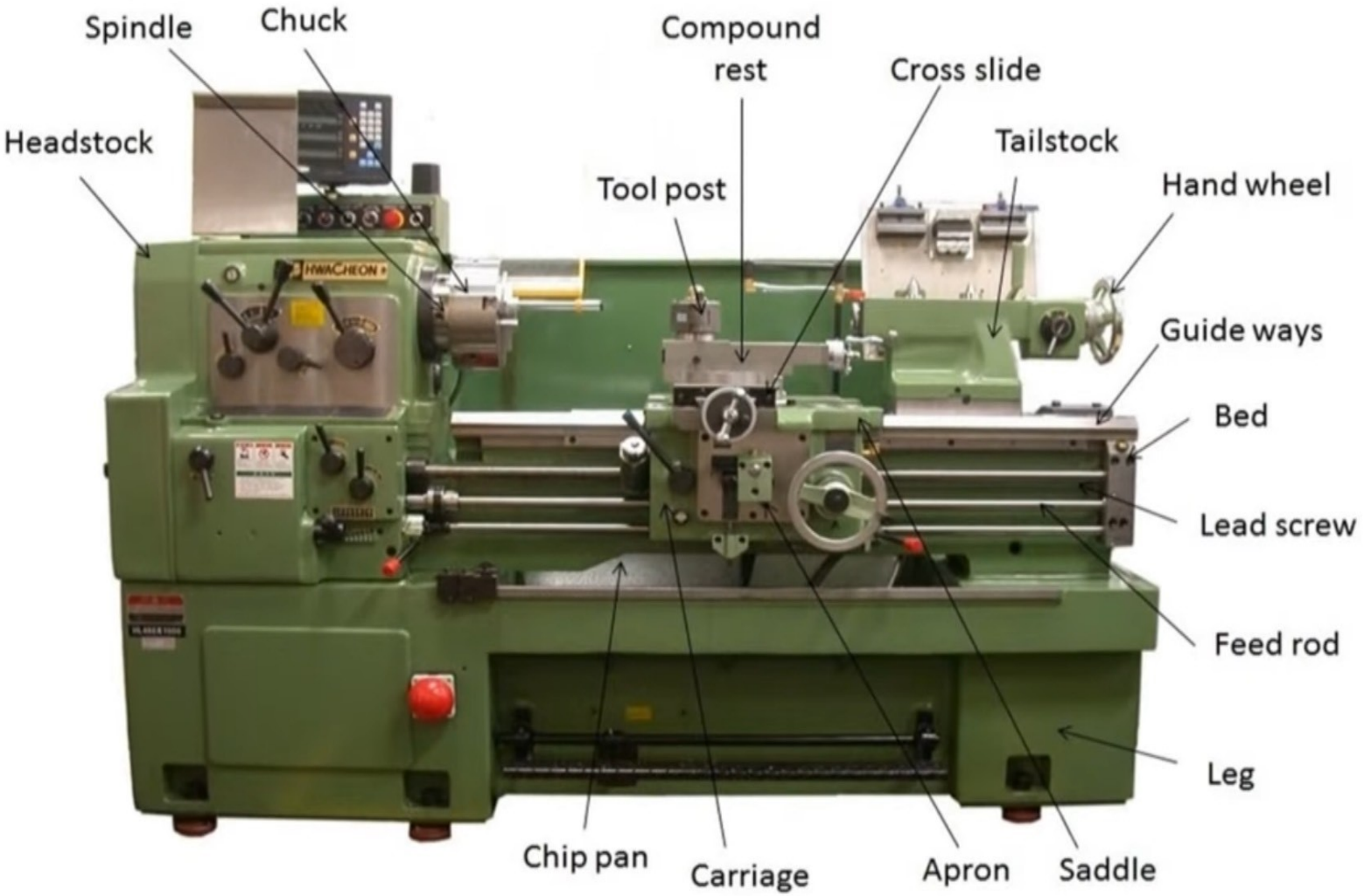


The history of lathe machine started in the 13th century when the Egyptians first designed a two-person lathe. Later after some years, the Romans improved the Egyptians lathe machine by adding a turning bow. Now it is a famous saying that "improvement in technology with time is sustainability". Hence, the precision metal lathe machine is developing since the 13th century.

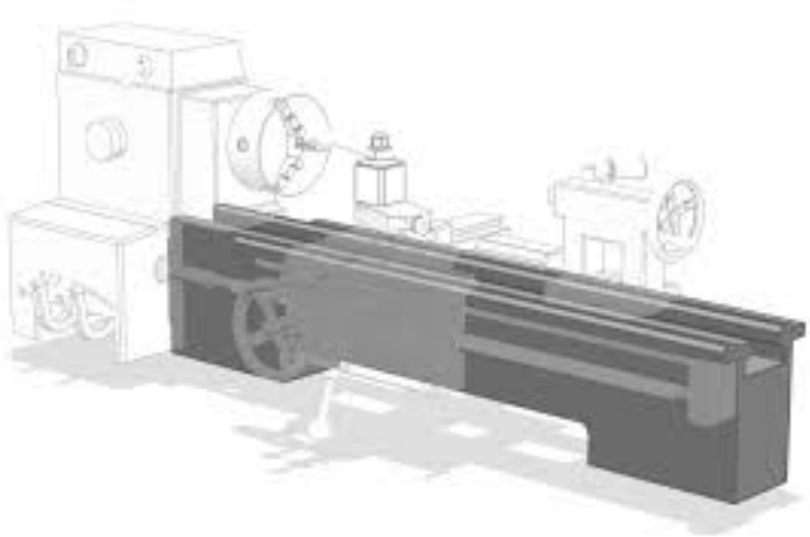
Lathe Machine – A Mother Of All Machine Tools

Lathe machines are known as the mother of all machine tools for a specific reason, which was that the heavy-duty lathe was the first machine tool which led to the invention of other machine-based tools.

Main Parts of lathe Machine

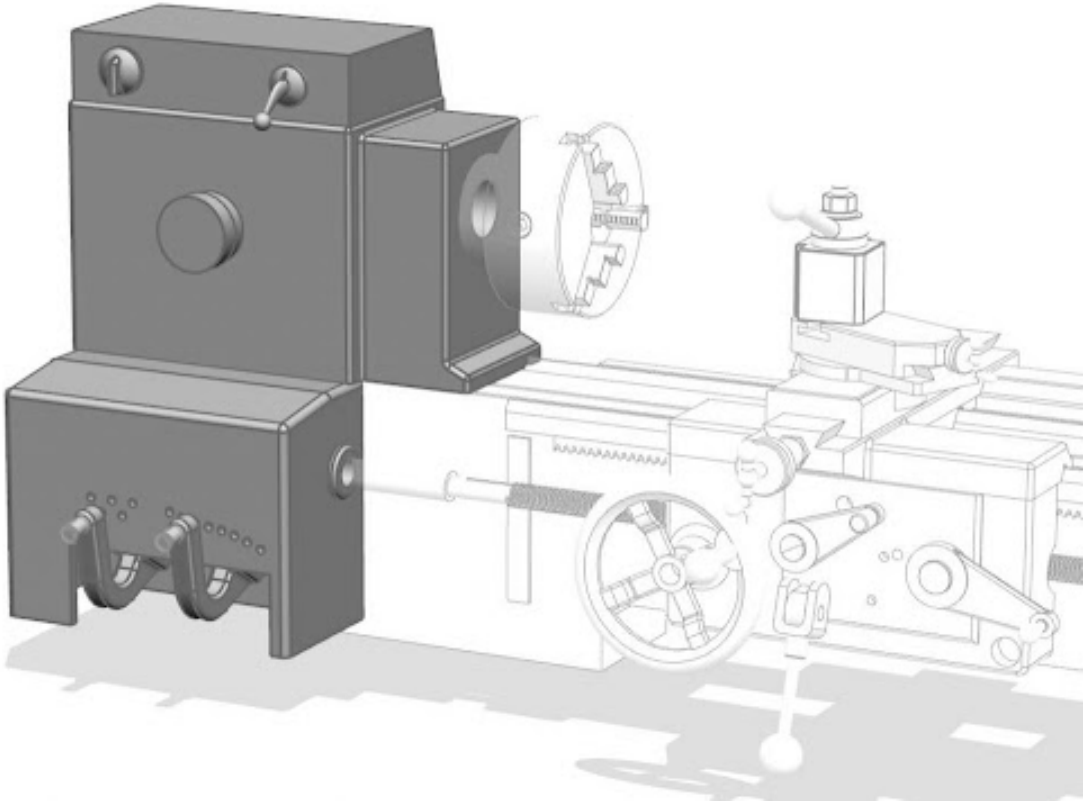


Bed



The bed of the lathe machine serves as the foundation upon which all other components are installed. The bed is supported by large box-section columns and is made of cast iron or a nickel cast iron alloy. The bed itself is mounted on the legs which are bolted to the ground.

Headstock



Headstock is one of the first parts of lathe machine located at the foot of the bed. Its duty is to supply rotational power for the lathe's operations after it has clamped to the end.

Chuck

Chucks are a convenient way to hold work pieces the lathe. A three-jaw scroll chuck is shown here installed on the spindle nose.

Chucks are specialized clamps made to hold objects having radial symmetry such as cylinders. They typically have jaws to secure the work piece. The jaws (or dogs) are organized in a star-like configuration with radial symmetry.

Lathe Spindle

An essential rotating part of a headstock is the spindle. It contains a shaft that transfers rotary motion to the chuck, thereby turning the work piece. It is supported by two sets of angular contact ball bearings to help handle both radial and axial loads.

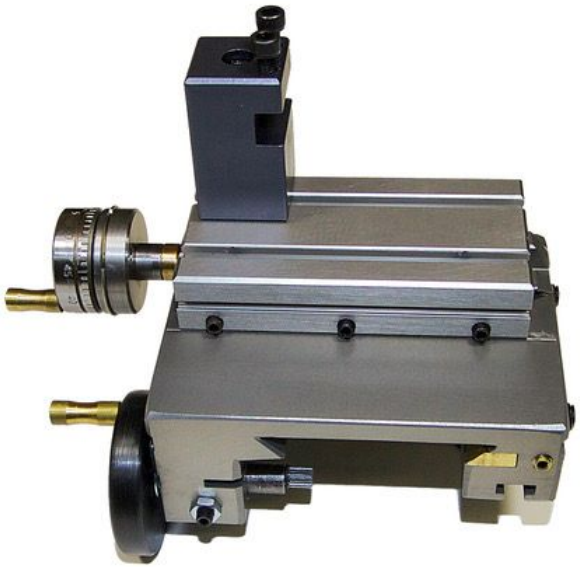
Tailstock

The tailstock is a moveable casting opposite to the headstock that is mounted on the guide ways on the bed. It holds tools for operations like drilling, reaming, tapping, etc., and supports the opposite end of the work piece during machining. It includes the dead center, adjustment screws, and hand wheel.

Dead Centre

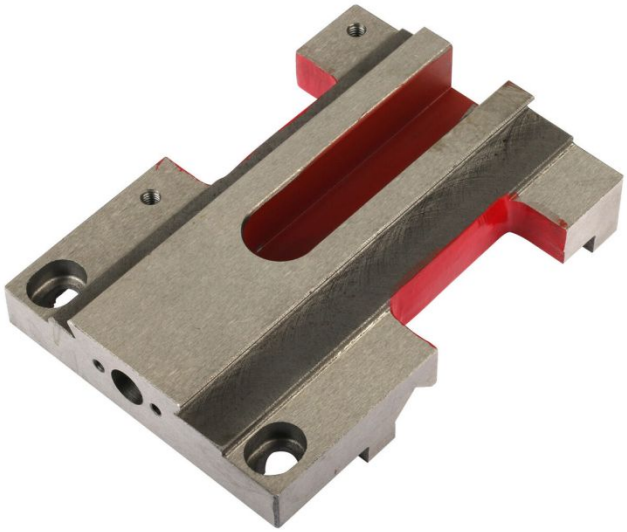
The work piece is held in place while it is rotating using a dead center (not freely rotated, i.e., dead). There may be friction on the dead center due to the rotation of the work piece when employed in the stationary position. The pointed end of it is placed touching the other end of the work piece to avoid an abrupt stop in rotation and reduce friction.

Carriage



The carriage can be found in the area between the tailstock and headstock. During operation, the carriage serves as a guide, supports, and feeds the tool against the work piece. The following parts are on the carriage.

Saddle



It is cast in the shape of an H and installed on top of the lathe. It supports the cross-slide, the compound rest, and the tool post. Manual or automatic feeding is employed to move the saddle.

Cross Slide

It is positioned on the saddle such that it is perpendicular to the bed. One side of the cross slide is equipped with a female dovetail, and it is joined on top of the saddle using its male dovetail. The cross slide hand wheel is turned to move the cross slide at a right angle to the axis of the lathe.

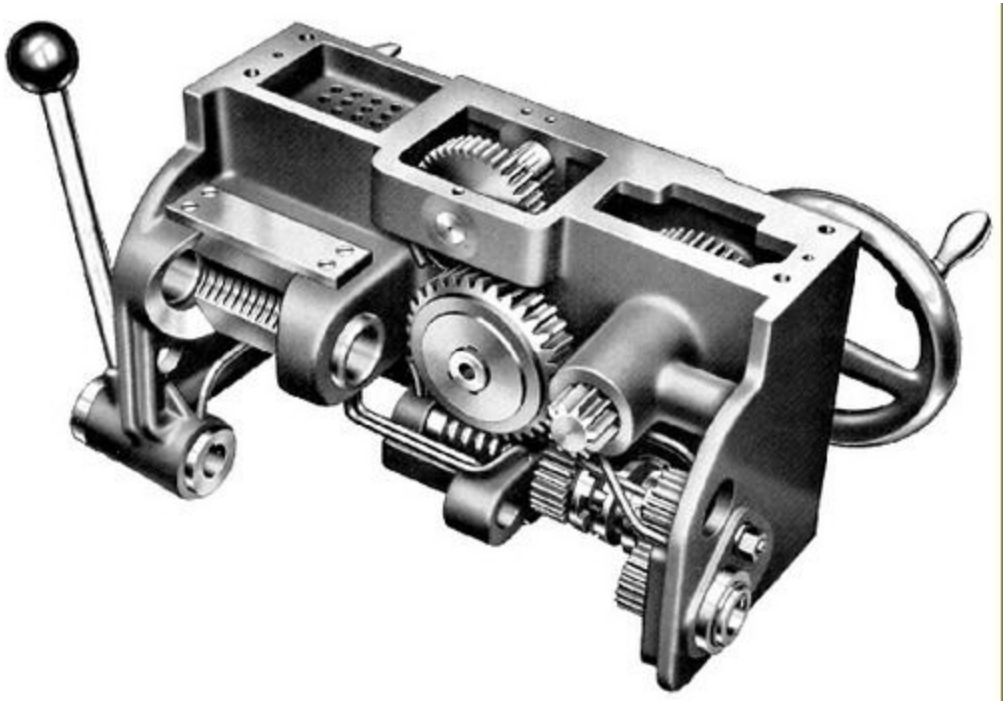
Compound Rest

The compound rest joins the cross slide with the compound slide using a tongue-and-groove joint. It supports the cutting tool and tool post during the drilling of short tapers and shapes on forming tools.

Tool Post

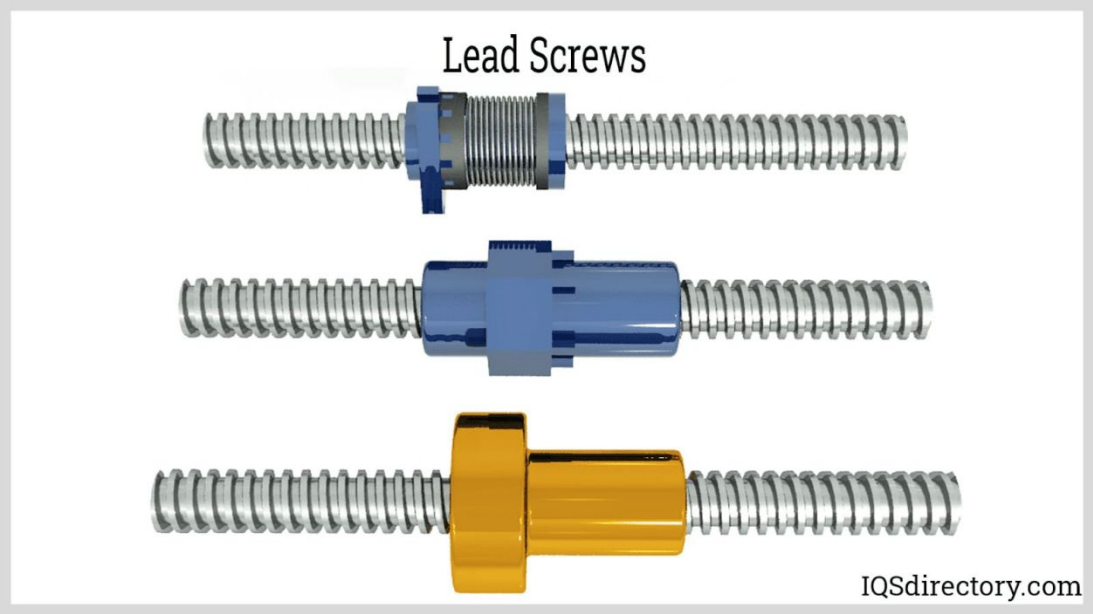
The tool post is mounted on the compound rest and is used to carry cutting tool holders. The holders are supported by a wedge with a bottom that fits into a ring with a concave surface. It is attached to the upper slide. The tool post is positioned on the top of the compound slide to securely hold the tools.

Apron



An apron is the front section of a carriage. It includes all control keys. The apron is made up of split nuts that engage with the lead screw when cutting threads, as well as gears and clutches for transferring motion from the feed rod to the carriage.

Lead screw



A lead screw is used as a linkage in a machine to convert turning motion into linear motion. It is also referred to as a power screw or translation screw. The lead screw in a lathe machine is used to move the carriage along with the revolution of the spindle. Using various gears between the lead screw drive and spindle, threads can be created.

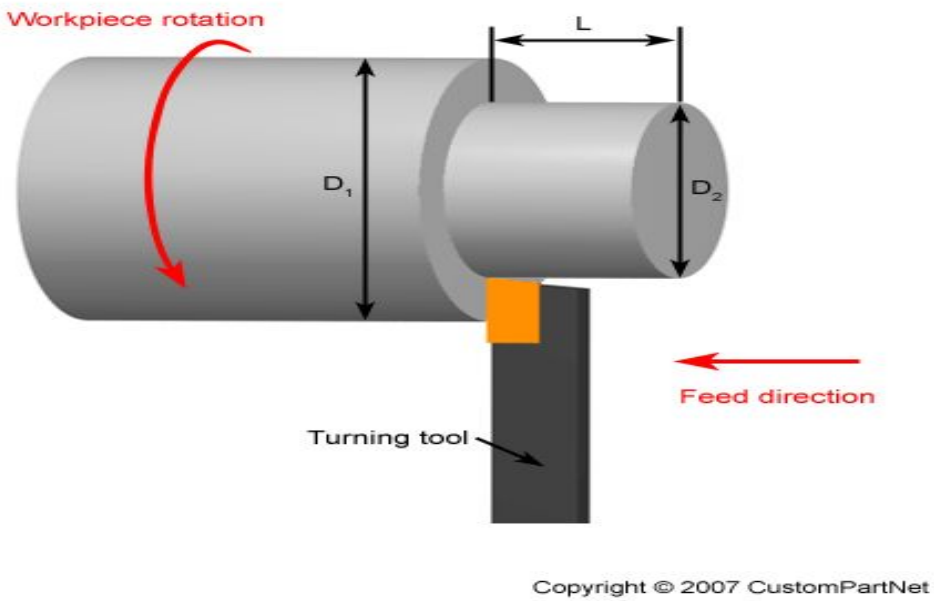
WORKING PRINCIPLE OF LATHE MACHINE

A work piece is rotated against a stationary cutting tool as part of the operating principle. The work piece to be machined is held in place by the tailstock (dead center) and the chuck (living center). To make deep cuts or circumferential (cylindrical) cuts, the tool is moved around the work piece's surface either vertically or horizontally.

The work piece is given tapered surfaces by moving the tool in an inclined plane along the vertical. Aside from this, the lathe is used for standard cutting operations with the work piece securely fastened between the center.

LATHE MACHINE OPERATIONS

Turning



The process of reducing the external diameter of a cylindrical work piece using a single-point cutting tool, as shown in the diagram, is called turning. The process has types such as taper turning, straight turning, profiling, and external grooving.

Facing

The process of reducing the overall length of the work piece and producing a flat surface as a result is called facing operation. We can use a normal turning tool for this operation as shown in the diagram.

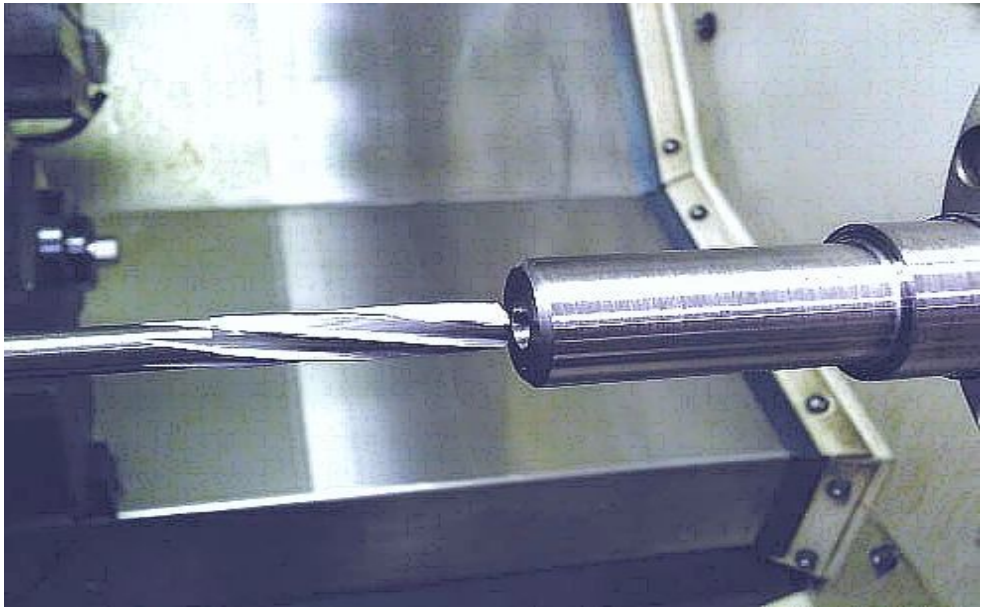
Drilling

The process of creating a cylindrical hole in a work piece by rotating the cutting edge of a drill is called Drilling. The tool used is called a drill bit which is mounted to the tailstock or dead center instead of the tool post as shown in the diagram.

Boring

The boring operation on lathe machine involves enlarging a hole previously drilled, sometimes to create circular interior grooves. Holes can be drilled straight (Counter-boring) or tapered (Taper-boring). In this process also, the boring tool is attached to the tailstock.

Reaming

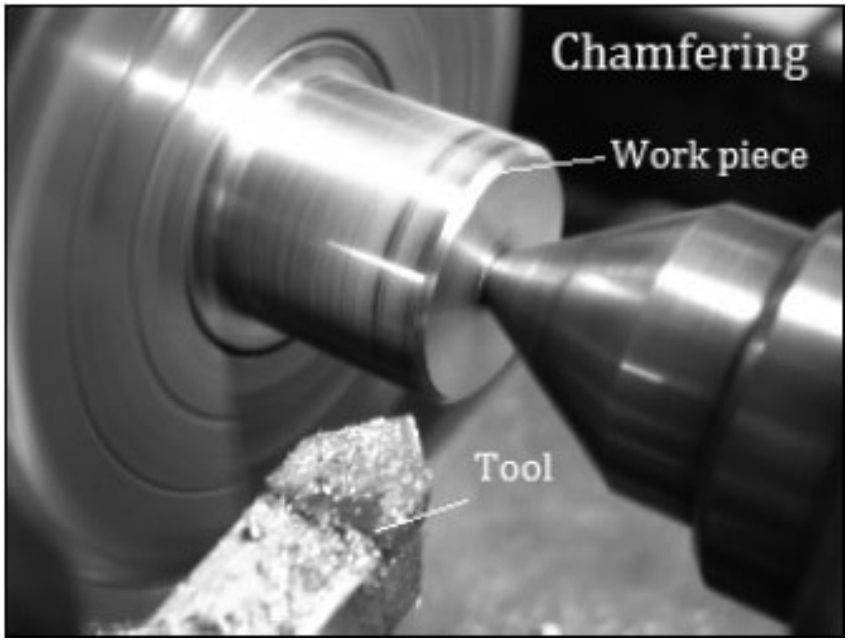


The process of sizing and completing a hole that has already been drilled or bored is called reaming. A tool with several cutting edges called a ‘reamer’ is used specifically for this operation.

knurling

The process of knurling involves embossing a pattern, usually diamond-shaped, on the surface of the work piece mounted on the lathe machine as shown in the image. The knurling process is usually done to provide the work piece with a good gripping surface.

Chamfering



The process of creating a symmetrically sloping edge or corner on an object is called chamfering, also known as the ‘beveling’ procedure. The purpose of the chamfer is to protect the end of the work piece from damage by removing burrs from uneven surfaces to create an even surface.

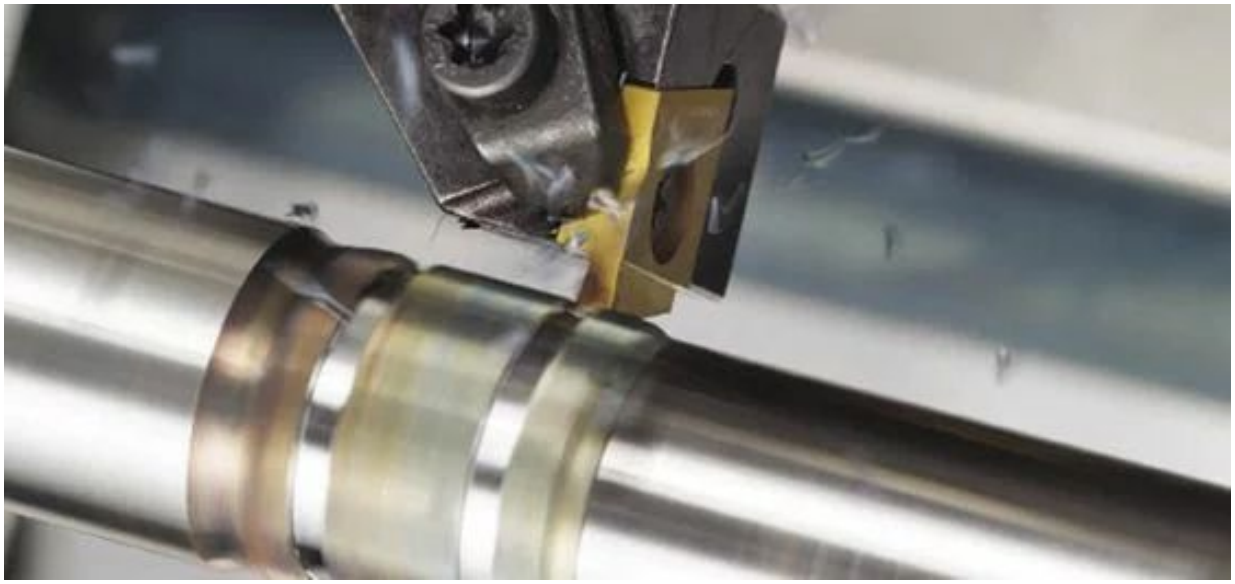
Parting

A machining process that produces a cut-off portion from the work piece at the end of the machining cycle is called parting. While the work piece rotates, a tool with a certain shape penetrates the work piece in a direction that is perpendicular to the rotating axis. ‘Parting-off tool’ is used for this process.

Thread Cutting

The operation of creating a helical groove on a conical or cylindrical surface of the work piece by feeding the tool longitudinally is called threading or thread cutting operation.
The left-hand thread is obtained when the tool is moved from the right to the left and vice versa. Thus, the lead screw is responsible for the motion of the carriage. It also allows adjusting the depth of the cut.

Grooving



The grooving operation involves reducing the external diameter work piece to a relatively small surface area. It is done to leave a thin margin at the end of a thread or close to a shoulder. The grooving usually consists of three types: Square, Round, and Beveled

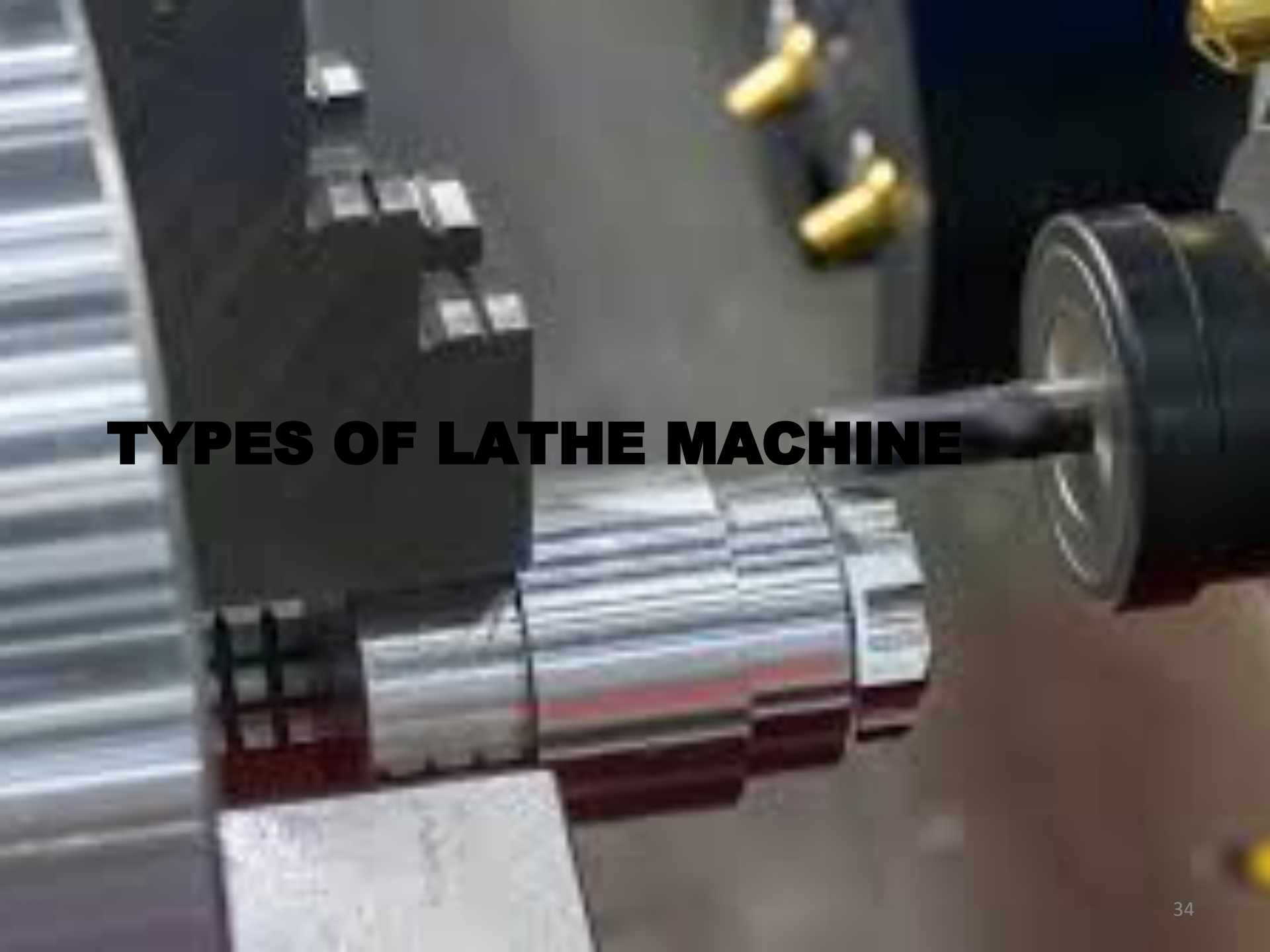
Forming

The process of turning concave, convex, or other asymmetrical shapes is called forming operation. It can be done by:

- Using a dedicated forming tool
- Tracing a template onto the work piece.
- In general, straight and circular shaping tools are utilized. The straight type is used for wider surfaces while the circular form is utilized for narrow surfaces.

Polishing

It is usually done as a final process. The operation involves smoothening the external or internal surface of the work piece after all necessary machining operations. A sandpaper or emery cloth is used for this process while the lathe machine runs at higher speeds ranging from 1500 to 1800 RPM.


TYPES OF LATHE MACHINE

CENTRE OR ENGINE LATHE

The engine lathe is the most significant and popular tool in the lathe family.
The tailstock can be attached or removed based on the length of the work piece.

Speed Lathe

As the term speed implies, the spindle of the headstock is revolving at a rapid rate.

This machine lacks a feed mechanism like an engine lathe and has a speed range of 1200 to 3600 RPM.

It is utilized for wood polishing, spinning, centering, and machining

Turret Lathe

It is a manufacturing tool employed in mass manufacturing or batch production. It handles heavy-duty materials.
The turret lathe has a hexagonal turret instead of a tailstock. This turret houses six tools for various lathe machine operations.

Capstan Lathe

It is similar to the Turret lathe where the capstan is used for the mass manufacture of lightweight work pieces.
It includes a capstan slide that may be clamped in any position.

Tool room Lathe

It is a cutting-edge engine lathe that is equipped with all the tools required for precise tool room operations, to manufacture small tools, dies, gauges, etc.

Its speed can fluctuate from extremely low to extremely high, up to 2500 rpm

Bench Lathe

It is a compact lathe machine that is put on a workbench and consists of all the components of a speed lathe and an engine lathe.

It is usually used for the quick machining of small parts in the workshop.

Gap Bed Lathe

A gap is formed above the bed, in this lathe, near the headstock to accommodate jobs with flanges or other projecting elements.

Hollow Spindle Lathe

The cut and chamfer in the tubing can be cut easily in this lathe. It can also be used to remove welds from existing shafts so that new tubes, yokes, and splines can be installed.

Vertical Turret Lathe

With vertical turret lathes, the work piece is held vertically, allowing the faceplate to function as a horizontal rotating table.

The headstock rests on the floor helping with the handling of extremely long and heavy work pieces.

CNC Lathe Machine

The computer numerical control (NC) lathe machine is the most sophisticated compared to other types of lathe machines.

Programs are fed into the computer system in this machine, which manages functions.

CNC lathes provide the most accurate output and can be used in mass production.

APPLICATIONS OF LATHE MACHINE

The application of a lathe machine is generally dependent on the type of machine. However, some common applications are listed below.

1. Kitchenware like huge utensils and pressure cookers
2. Woodworking industry
3. Almost every manufacturing industry that deals with cylindrical metal parts
4. Metal restoration industries
5. Precision part manufacturing like customized cutting tools.

ADVANTAGES OF LATHE MACHINE

1. A lathe machine's output is consistently of a high caliber, particularly when using CNC s.
2. Every operation covered above can be completed quickly. As a result, switching between different dedicated machines for a little task saves a significant amount of time.
3. Since most lathes are inexpensive, the initial investment is lower than the profit.
4. The machine's ease of thread cutting is by far its greatest benefit.

DISADVANTAGES OF LATHE MACHINE

As the advancements in technology made so many improvements to these ancient machines, the disadvantages of these machines became evident. Some of them are discussed below.

1. There should be constant maintenance of these machines like lubrication, cleaning, and checking the fasteners.
2. Obviously, this demands skilled laborers to operate.
3. CNC machines need operators who know to program the operations. This infers a demand for training.
4. Shape and structure are limited, and hence the weight of the machines remains almost the same

SAFETY PRECAUTIONS TO BE APPLIED WHILE USING LATHE MACHINE

The New York Times

Yale Student Killed as Hair Gets Caught in Lathe

By Lisa W. Foderaro

April 13, 2011

As a Yale undergraduate majoring in astronomy and physics, Michele Dufault was used to extreme physical environments. She worked on underwater robotic vehicles last summer as a fellow at the Woods Hole Oceanographic Institution in Massachusetts. She also traveled to Houston as part of a team of undergraduates chosen by NASA to perform a plasma physics experiment in reduced gravity.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PRECAUTIONS

1. Keep all body parts away from all rotating parts. Never wear loose-fitting clothing or jewelry while operating a lathe. Tie back and contain all long hair. Use guards to protect from accidental contact with rotating parts.

2. When the lathe spindle is set at too fast of an RPM, it will take longer for the spindle to stop rotating in an emergency situation. Limit spindle to 1000 RPM and use the lowest RPM applicable to the task.

3. Rotating and other moving parts can create pinch points. Pinch points can crush, bruise, lacerate, or amputate body parts. Utilize guards and avoid contact with these points.

4. Cutting Tools, drill bits, machined edges, chips, and cutoffs are potential cut and laceration hazards. Handle all sharp parts and tools with care. Do not clear chips with bare hands. Use a brush or compressed air (< 30psi).

TO CONCLUDE

THANK YOU