

MANUFACTURING MACHINES



SYLLABUS

UNIT – I

- **Introduction:** Classification of machine tools based on application and production rate: General purpose and Special purpose machines, Classification based on-types of machine tools and the processes, Generating and forming.
- **Elements of metal cutting processes:** Elements of tool geometry, cutting tool materials and applications.
- **Lathe:** Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, NC, CNC and DNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a lathe: Bed, headstock, tail stock, carriage consisting of saddle, cross-slide, compound slide, tool post and apron. Work holding devices: self centering three jaw chuck, independent four jaw chuck, collets, face plates, dog carriers, centers and mandrels, Rest (Steady and Moving).
[T1, T2][No. of Hrs: 11]

UNIT - II

- **Lathe Contd.:** Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of half-nut engagement – disengagement, indexing dial mechanism. Operations on lathe: taper turning, related calculations, thread cutting, facing, under-cutting, drilling, boring, parting-off, knurling, chamfering.
- **Reciprocating Type Machine Tools:** Shaper, Planer and Slotter: Constructional features, basic machines and kinematics and related calculations.
[T1][No. of Hrs: 10]

Continued..

UNIT III:

- **Drilling Machines:** Constructional features of bench drilling machine, radial drilling machine, multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations: Drilling, reaming, counter boring and countersinking etc. estimation of drilling time.
- **Milling Machines:** Types of general purpose milling machines: horizontal, vertical, universal and their principal parts. Types of milling cutters and their applications, different milling operations, work-holding devices: vice, clamps, chucks, dividing head and its use, simple, compound and differential indexing. Indexing calculations and machining time calculations. Introduction to machining centers.
[T1,T2][No. of Hrs: 11]

UNIT IV:

- **Grinding Machines:** Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super-finishing processes.
- **Gear Manufacturing Machines:** Gear forming, gear generation, gear shaping and gear hobbing.
[T1][No. of Hrs: 10]
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Suggestive Reading

Text Books:

- [T1] B.S. Raghuwanshi, “Workshop Technology”, Vol.2, Dhanpat Rai & Sons, 2003.
- [T2] S.F. Krar Stevan F. and Check A.F., “Technology of M/C Tools”, McGraw Hill Book Co., 1986
- [T3] Hazra Chandhari S.K., “Elements of Workshop Technology”, Vol.2, Media Promoters, 2003.

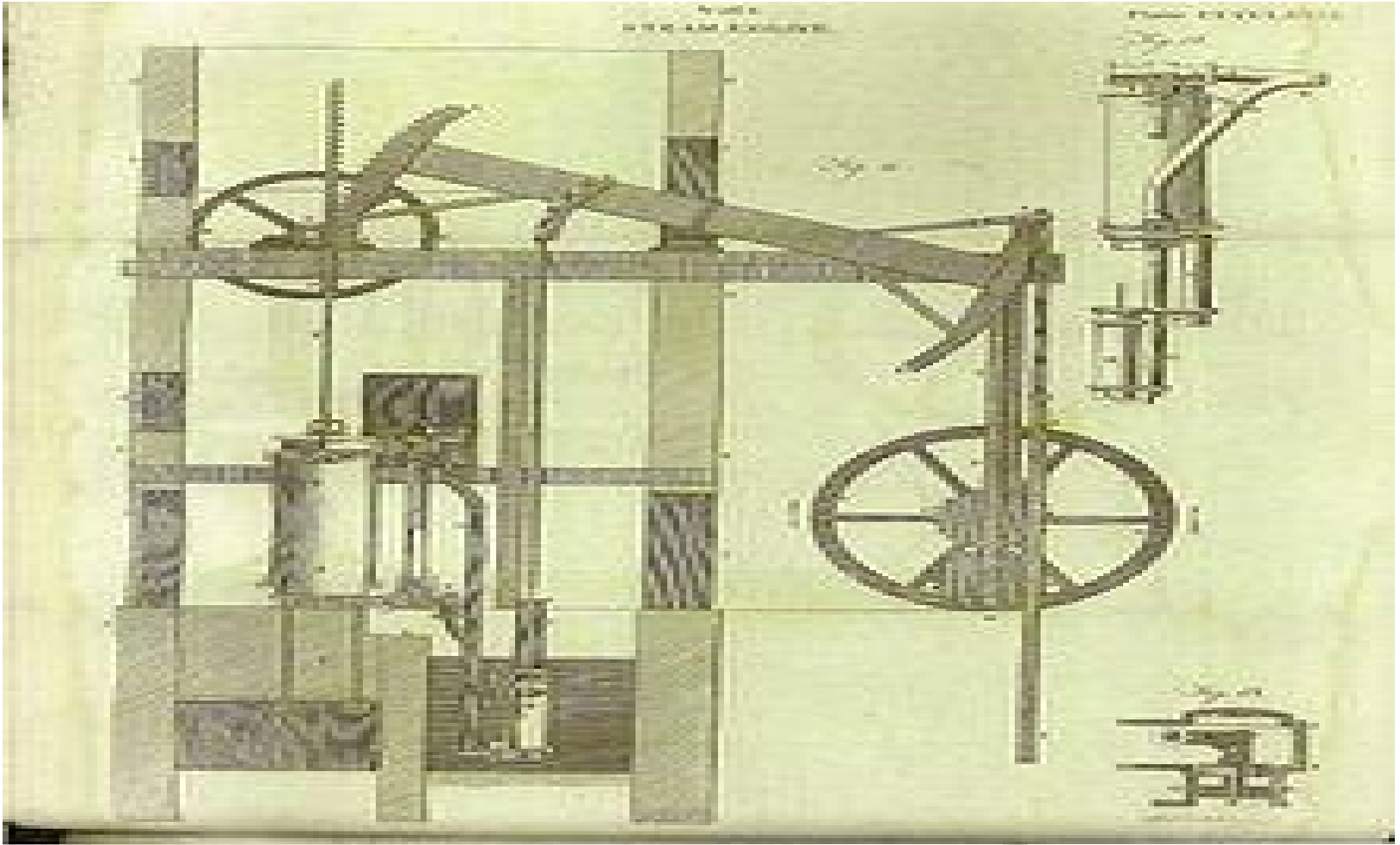
Reference Books:

- [R1] P.C. Sharma, “A Text Book of Production Engineering”, S. Chand, New Delhi, 2004.
- [R2] Bawa H.S., “Workshop Technology”, Vol.2, Tata McGraw Hill, 2004.
- [R3] Juneja & Shekhon, “Fundamental of Metal Cutting”, New Age Publications
- [R4] Kibbe Richard et al, “M/c Tool practices”, Prentice Hall India, 2003.
- [R5] Gerling Heinrich, “All about Machine Tools”, New Age Publication, 2003

Unit -1

Contents:

- **Introduction:** Classification of machine tools based on application and production rate: General purpose and Special purpose machines, Classification based on-types of machine tools and the processes, Generating and forming.
- **Elements of metal cutting processes:** Elements of tool geometry, cutting tool materials and applications.
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Watt steam engine(from 3rd edition
Britannica 1797)

- 1774 [John Wilkinson](#) invented a boring machine in which the shaft that held the cutting tool was supported on both ends and extended through the cylinder, unlike the cantilevered borers then in use.

Machine tools

A Machine tool is a device that utilises the mechanical forces to shape and size a product by removing the excess material in the form of chips, with the help of a cutting tool.



Machine Tools & Machines

- Machine tools and machines are two different things.
- When machine tools taken as a group can produce a machine tool, which is not true for the machines. A lathe, shaper, planer milling machines are machine tools.
- A sewing machine is not a machine tool but a machine.

Most Excepted Definition

“ A machine tool is a power driven machine, capable of holding capable of holding and supporting the work and tool and at the same time guiding and directing the cutting tool or jobs or both to perform various metal cutting operations for providing different shapes and sizes.”

Classification of Machine Tools

Machine tools

Based on the type of surface generated

1. Cylindrical work surface machine tools.
Lathes, Capston, Turrets etc
2. Plain surface machine tools
Shaper, Planer,

Based on the purpose of machine tools

1. Single purpose
2. Multi purpose
3. Special purpose
4. Transfer machine
5. Tape controlled machine

Based on the chip size

1. Machine tools using cutting tools like Lathe, Shaper, Milling etc.
2. Machine tools using abrasives like Honing, Lapping machines etc

In workshop machine tools are broadly classified as :

General Purpose Machine Tools

- A lathe, drilling machine, shaper etc., are general purpose machine tools.
- A general purpose machine tool is meant for *general use* and is adaptable to a *wide variety of jobs*, as regards their shapes, weights, materials etc. They can perform a number of operations, (refer chapter 4 on lathe).
- In a general purpose machine tool, chucking of the workpiece, mounting or changing of cutting tools, adjustments of speed, feed and depth of cut etc. are all done manually by a worker.
- Such machine tools involve the constant attendance of an operator.

Semi-Automatic Machine Tools

- As compared to general purpose machine tools, semi-automatics and automatics have *lesser total product cycle time* and hence increased efficiency.
- *Semi-automatic machines* perform actual *processing operations automatically* as in automatic machines but majority of the *handling operations* are done non-automatically, that is to say an operator loads the

raw material into the machine, starts the machine, checks the work size and removes the completed work by hand.

- Though the machining cycle is automatic, direct participation of the operator is required to start each subsequent cycle.
- Semi-automatics occupy a middle position between the *fully automatic machines* and the *general purpose machines*.
- This term is chiefly applied to *turret* and *screw machines*. Usually several movements are automatic, but not all. Thus, the *stock* may or may not be fed through the hollow spindle and gripped in the chuck by power, the *turret* may be rotated and brought up to its work by hand or by power. The *screwing dies* may be self opening or self closing, by hand or by power. But the point is, that some-where in the cycle of operations, the operator has to interfere to keep the cycle progressing.

-Automatic machine tools

According to the functions of the machines

- Turning Machines
- Drilling Machines
- Milling Machines
- Shaping Machines
- Grinding Machines
- Sawing Machines
- Broaching Machines
- Gear Cutter Machines
- Super Finish Machines etc.

Machine tools.

Single purpose

Multi-Purpose

Special

Transfer

Tape Controlled

1. Producing mainly surfaces of revolution.

2. Producing mainly ruled surface.

3. Gear cutting machines

4. Miscellaneous machines.

A

Using "cutting tools"

Lathes.

Boring machines.
Drilling machines.

Milling machines.
Planing machines.
Shaping machines.
Slotting machines.
Broaching machines.

Spur-gear cutters.
Bevel-gear cutters.
Worm-gear cutters.

Thread-milling machines.
Cam-milling machines.
Die-sinking machines.

B

Using "abrasives"

External cylindrical grinder.
Internal cylindrical grinder.
Honing machines.
Lapping machines.

Surface grinding machines.
Spline grinding machines.
Lapping machines.

Spur-gear grinding machines.
Worm grinding machines.

Thread grinding machines.
Cam grinding machines.
Cutter grinding machines.

generating and forming

Generally the component shape is produced in machine tools by two different techniques namely;

- ❖ Generating

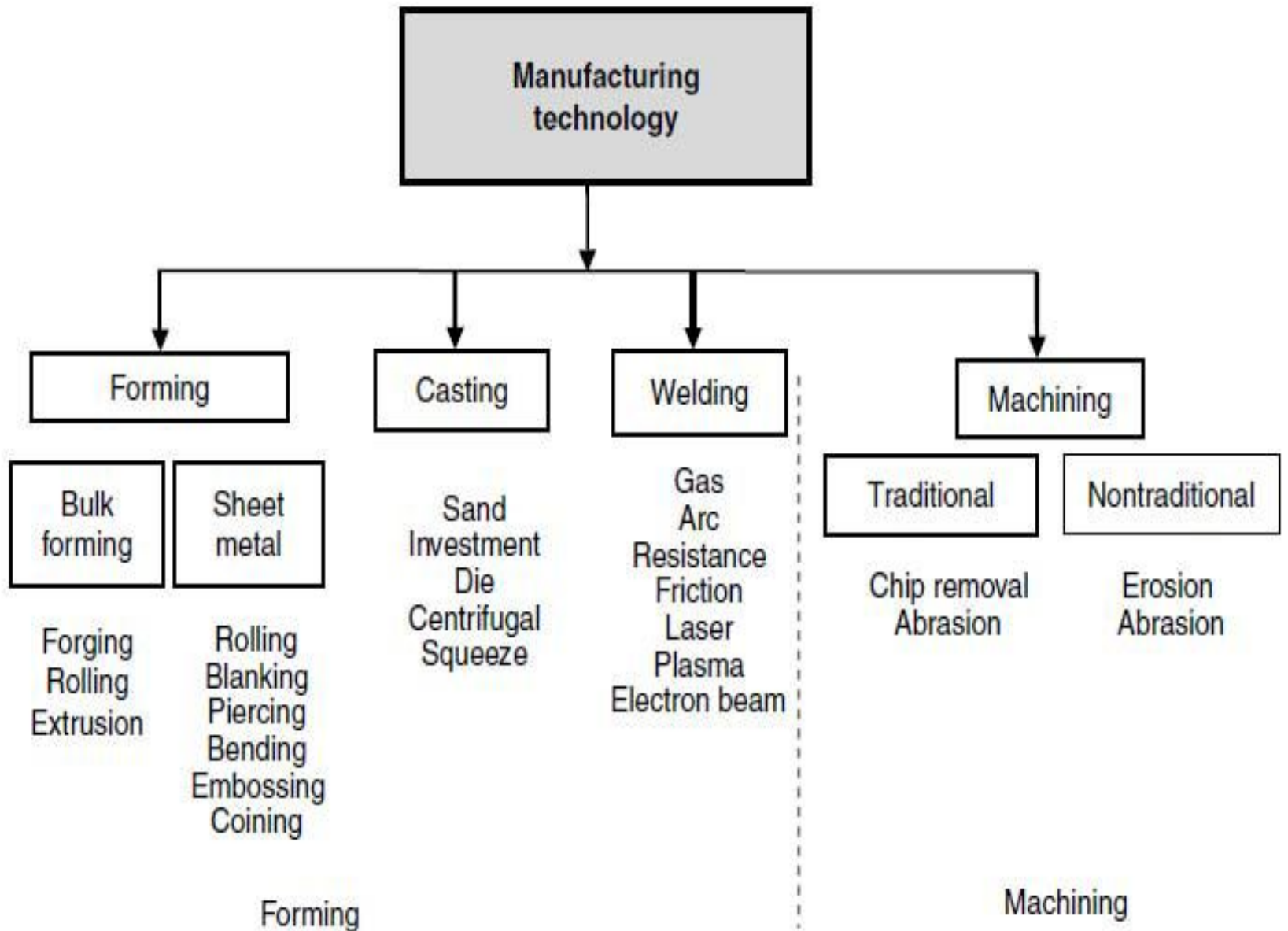
- ❖ Forming

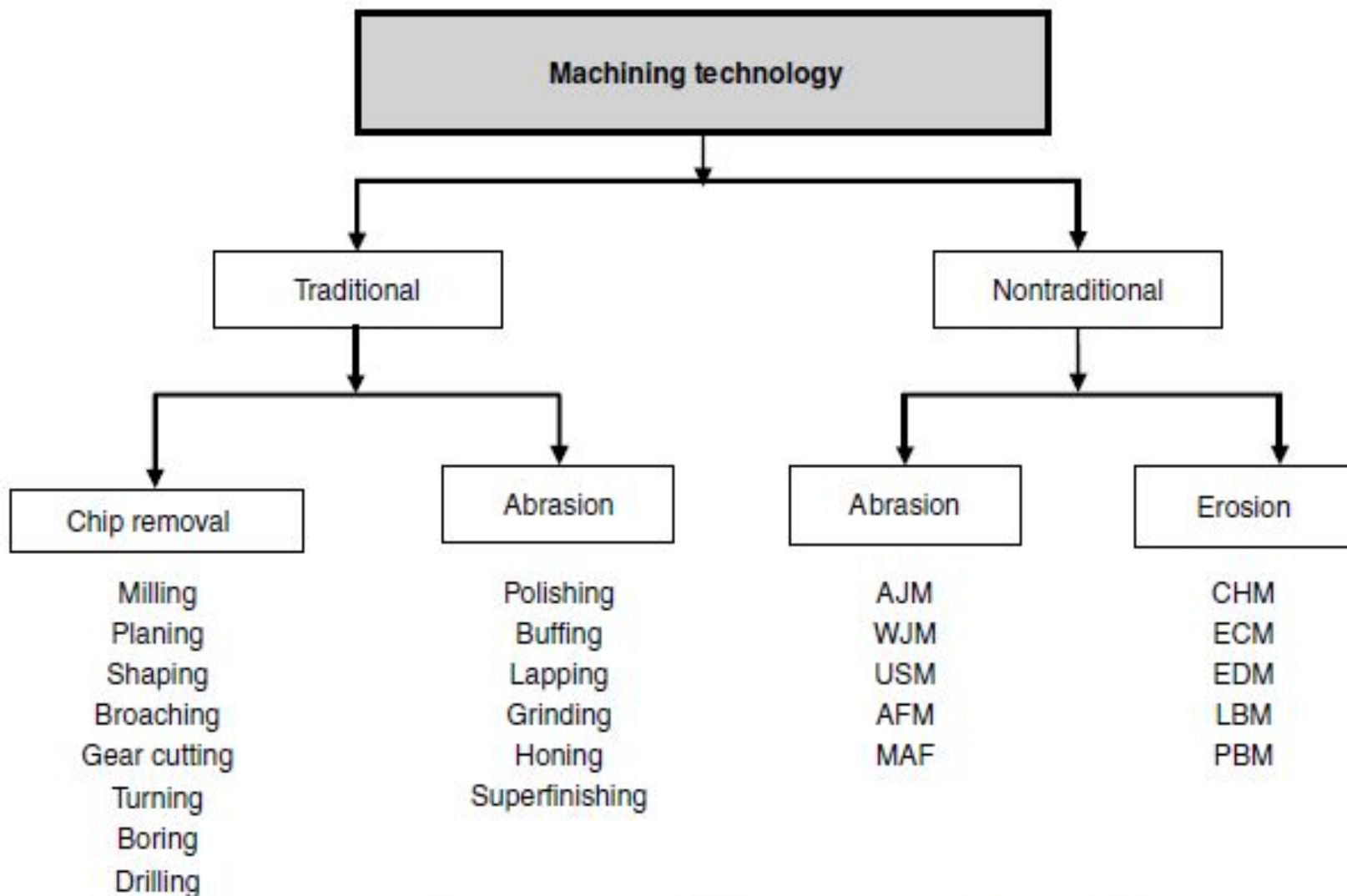
Generating is where the required profile is obtained by the manipulating the relative motion of the cutting tool and the work-piece. Thus, the profile/contour obtained would not

be identical to the shape of the cutting edge. This is used where general profile is required. For example turning with single point cutting tool on lathe

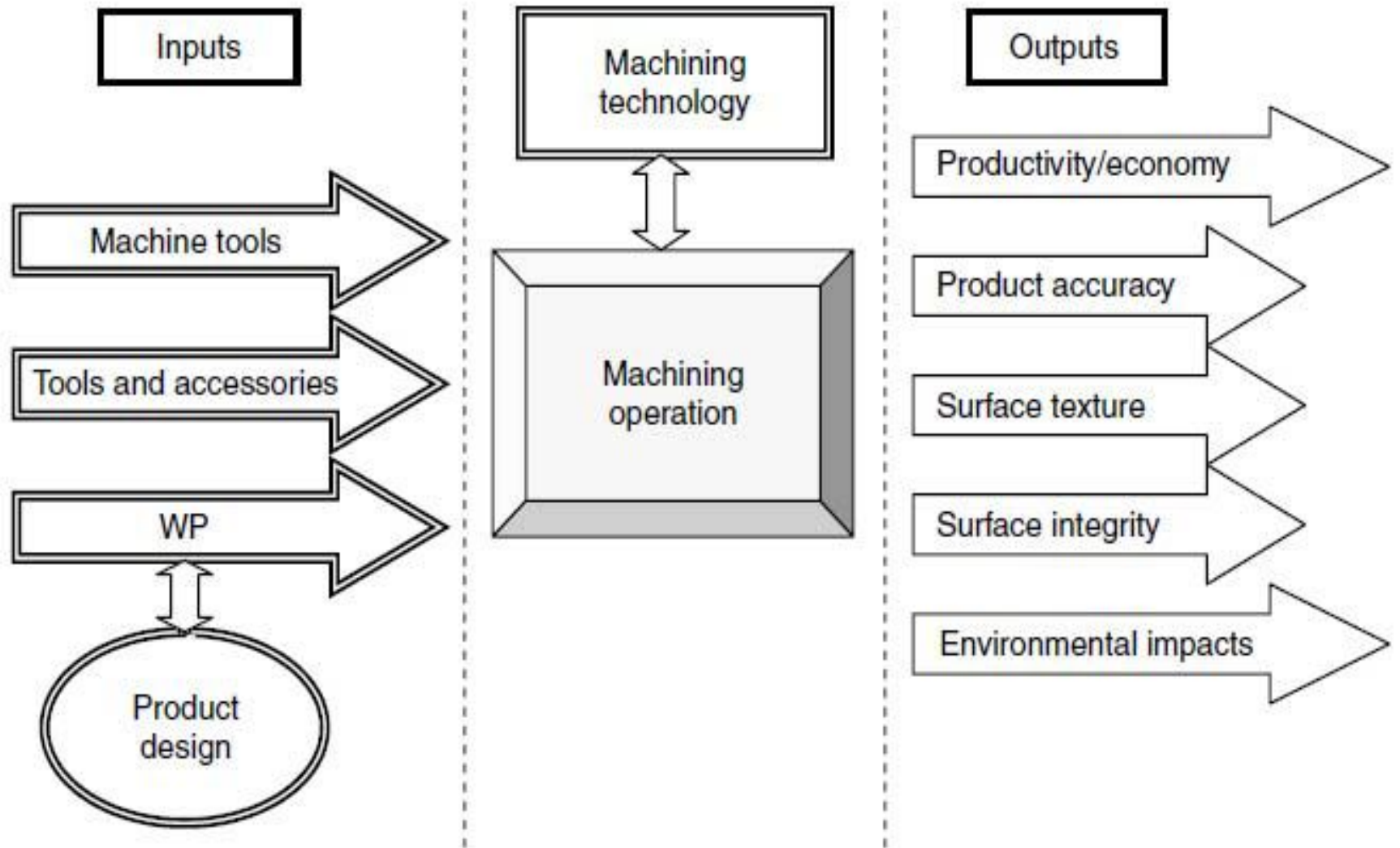
Forming is the process in which given profile is obtained by impressing upon the desired shape cutting tool on the work piece. Thus, the accuracy of the work piece is dependent upon accuracy of the form tool.

However, in many machine operations the combination of the two are used.

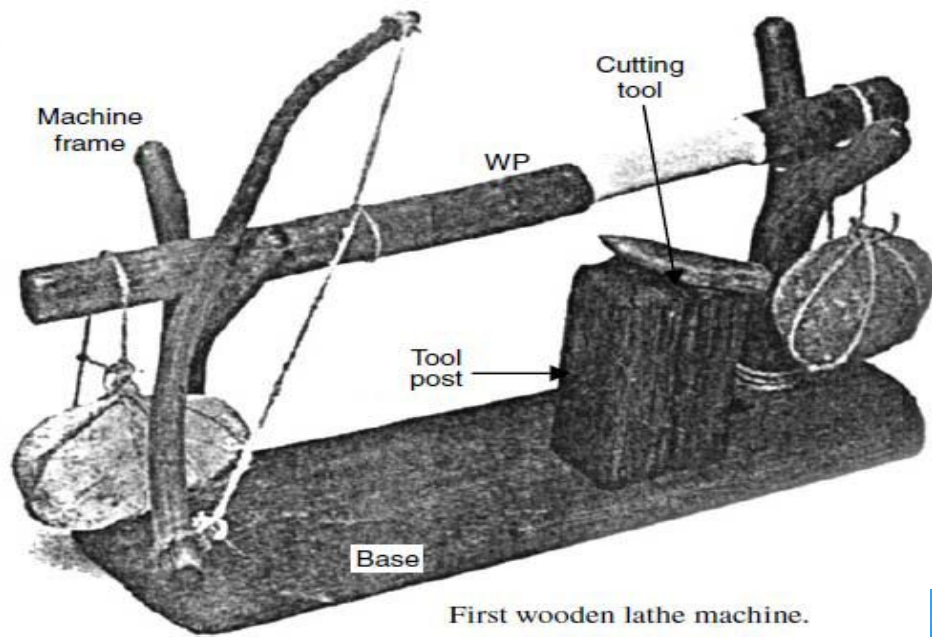




Classification of machining processes. AJM, abrasive jet machining; WJM, water jet machining; USM, ultrasonic machining; AFM, abrasive flow machining; MAF, magnetic abrasive finishing; CHM, chemical machining; ECM, electrochemical machining; EDM, electrodischarge machining; LBM, laser beam machining; PBM, plasma beam machining.



General aspects of machining technology.



First wooden lathe machine.



LATHE

FIRST machine tool for metal cutting

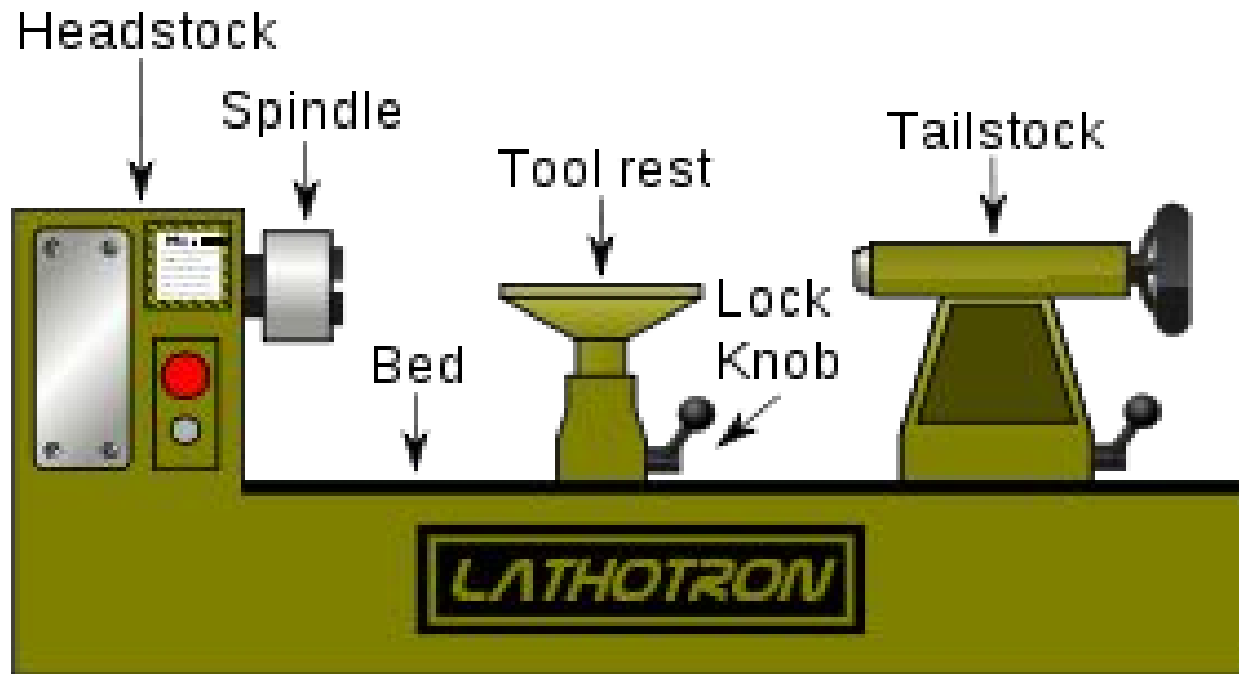
Egypt

Jan verbruggen-1772-U.K.

Henry mandslay-1783

Lathe is a machine, which removes the metal from a piece of work to the required shape & size

LATHE



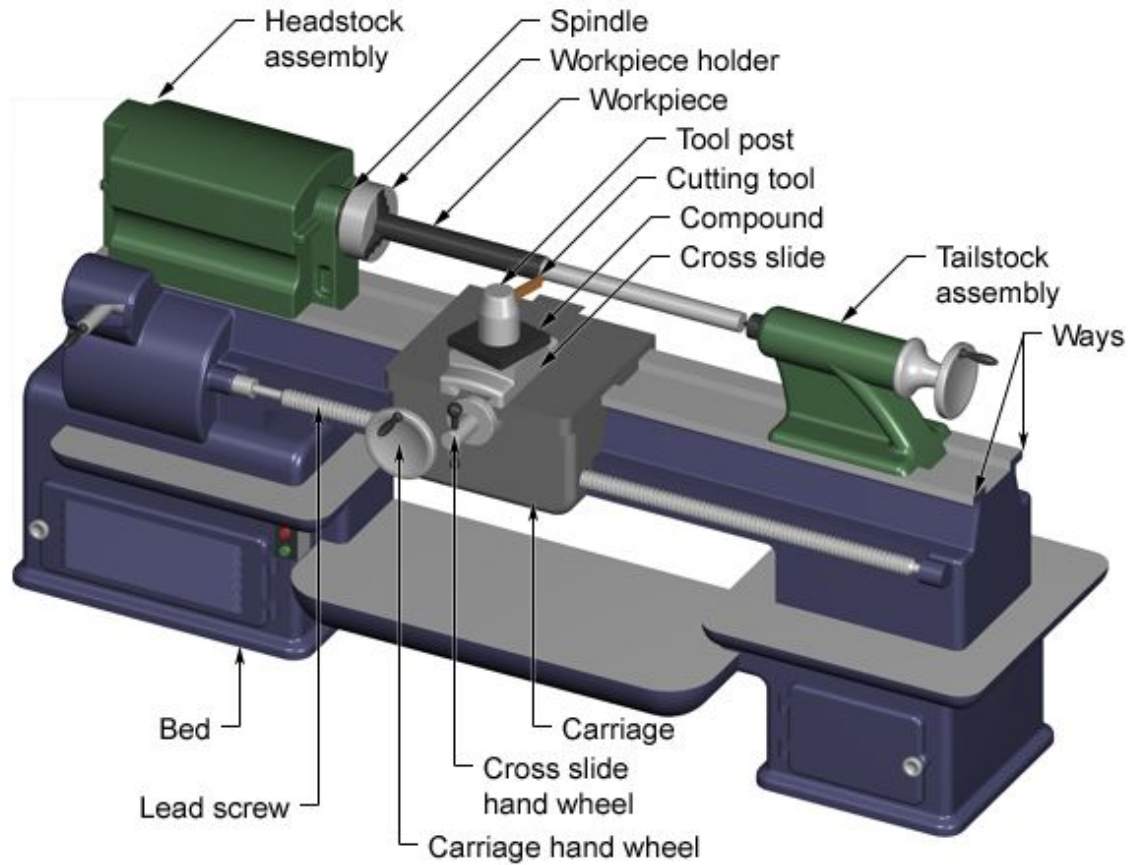
BASIC ELEMENTS OF LATHE

- **BED**
- **HEAD STOCK**
- **TAIL STOCK**
- **CARRIAGE**
- **SADDLE**

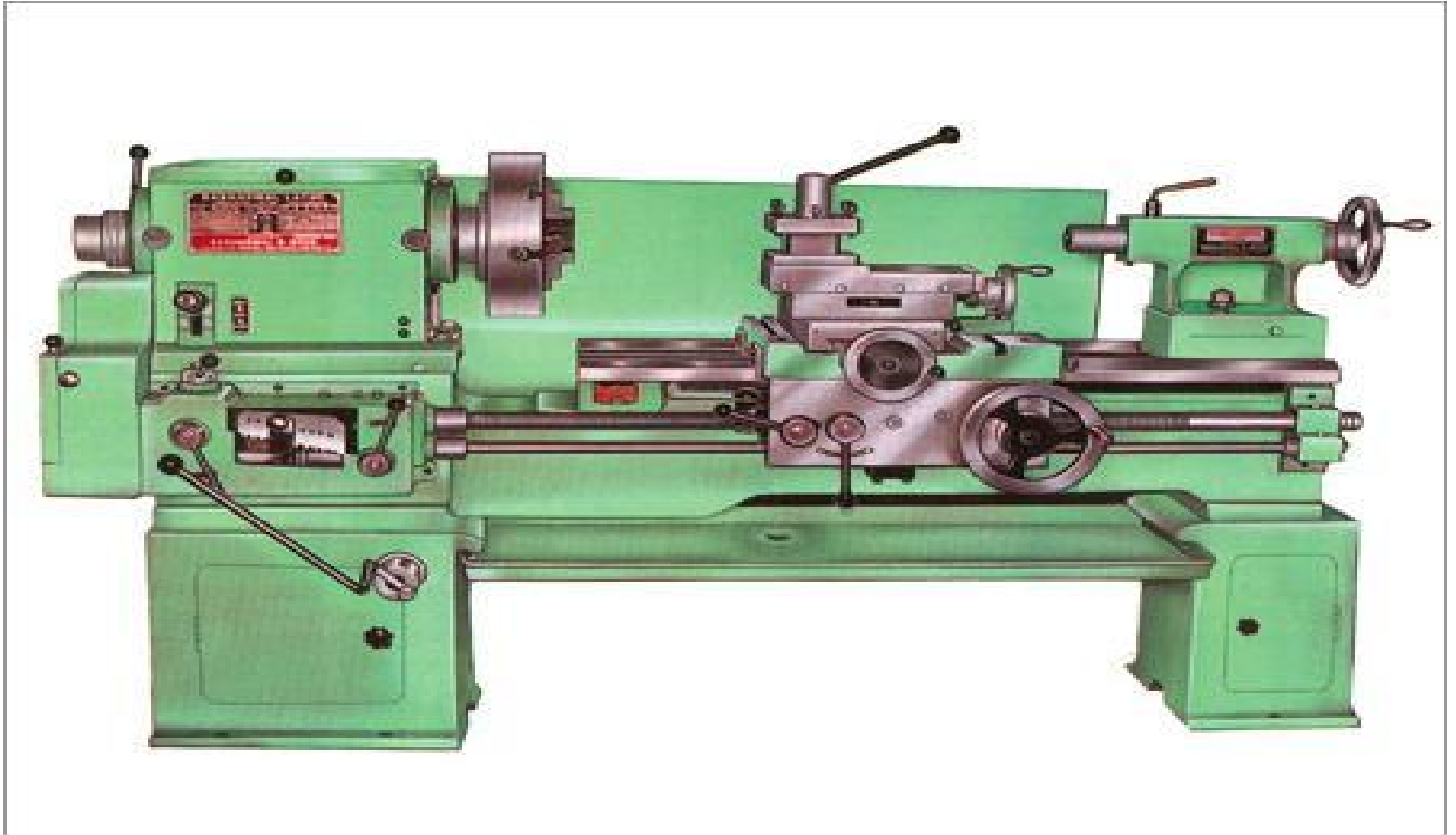
**CROSS SLIDE, COMPOUND REST, TOOL
POST, APRON**

- **FEED MECHANISM**

LATHE



LATHE

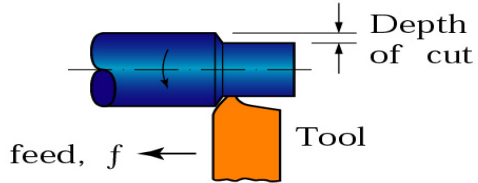


LATHE OPERATION

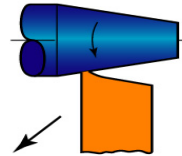
- **Turning:** produce straight, conical, curved, or grooved work pieces
- **Facing:** to produce a flat surface at the end of the part or for making face grooves.
- **Boring:** to enlarge a hole or cylindrical cavity made by a previous process or to produce circular internal grooves.
- **Drilling:** to produce a hole by fixing a drill in the tailstock
- **Threading:** to produce external or internal threads
- **Knurling:** to produce a regularly shaped roughness on cylindrical surfaces

LATHE OPERATION

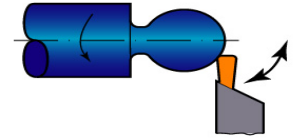
(a) Straight turning



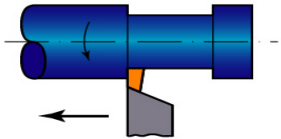
(b) Taper turning



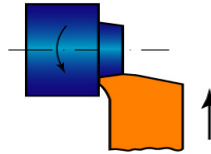
(c) Profiling



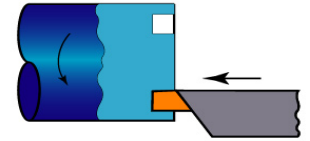
(d) Turning and external grooving



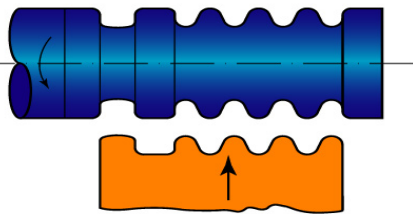
(e) Facing



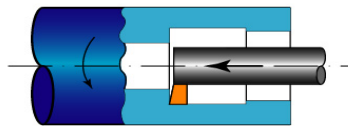
(f) Face grooving



(g) Cutting with a form tool



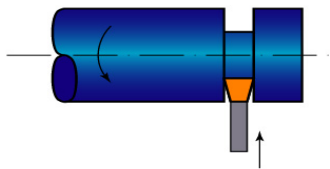
(h) Boring and internal grooving



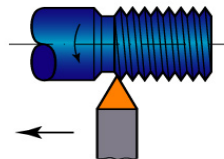
(i) Drilling



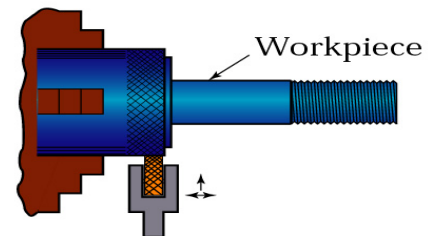
(j) Cutting off



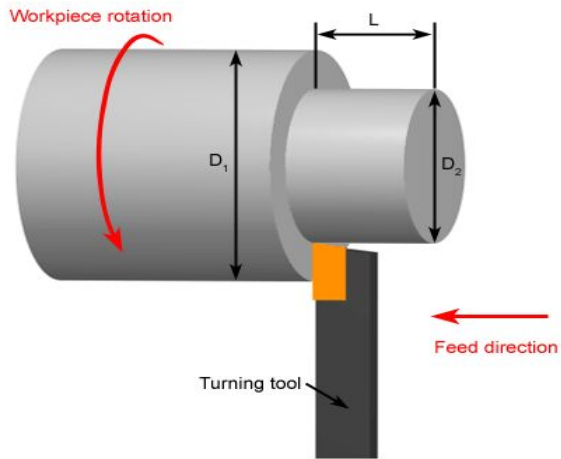
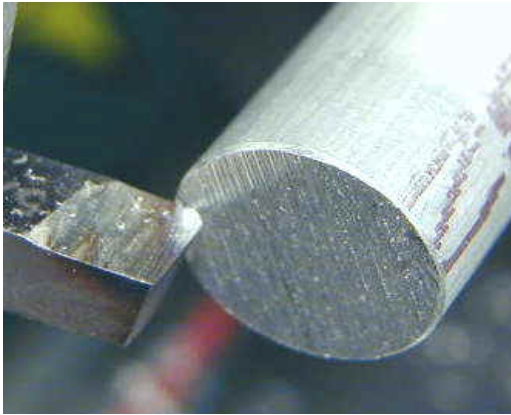
(k) Threading



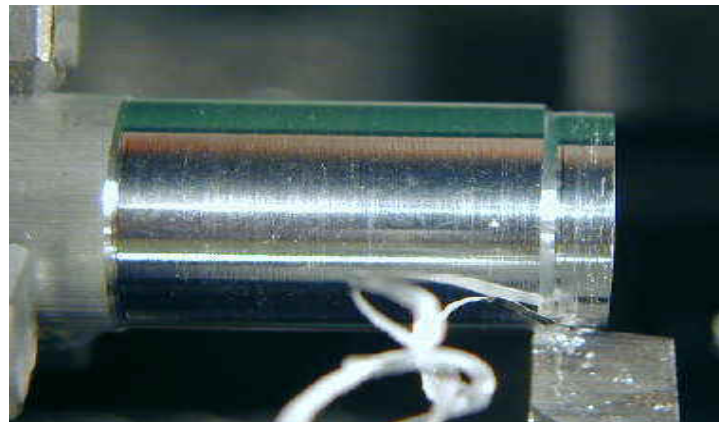
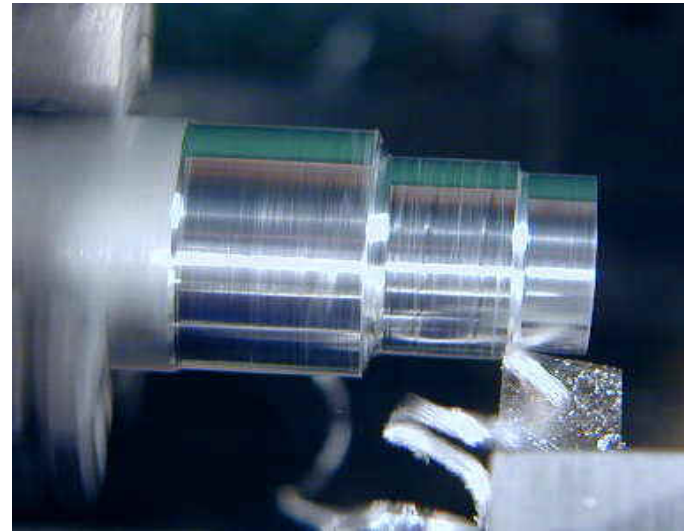
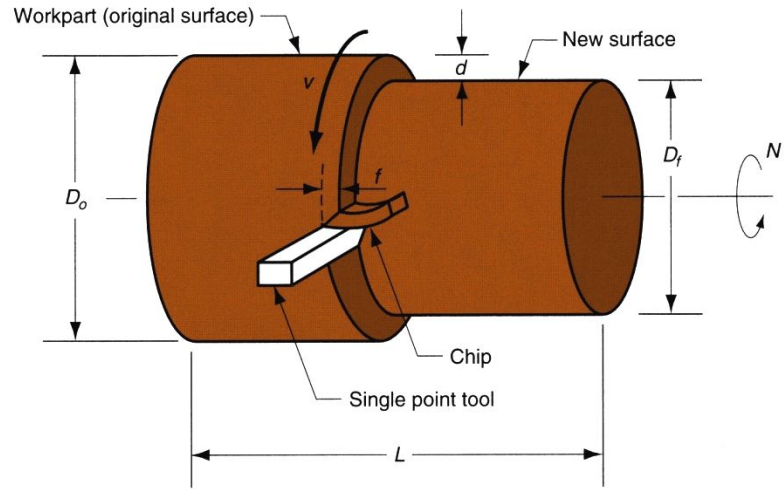
(l) Knurling



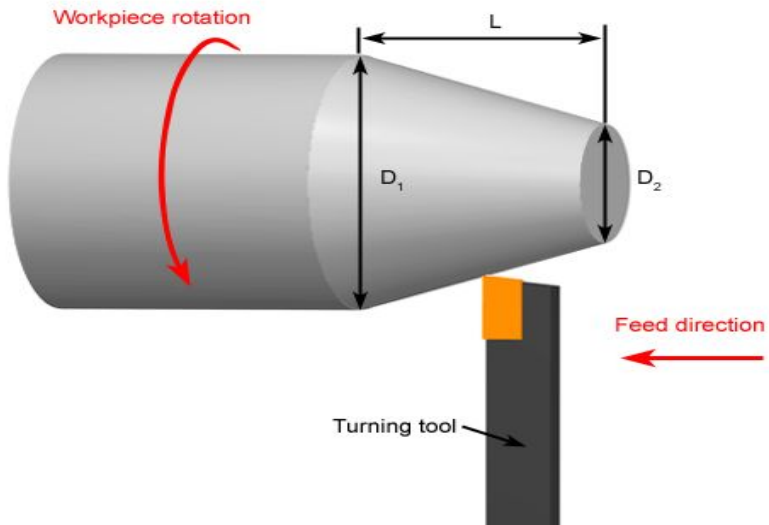
FACING & TURNING



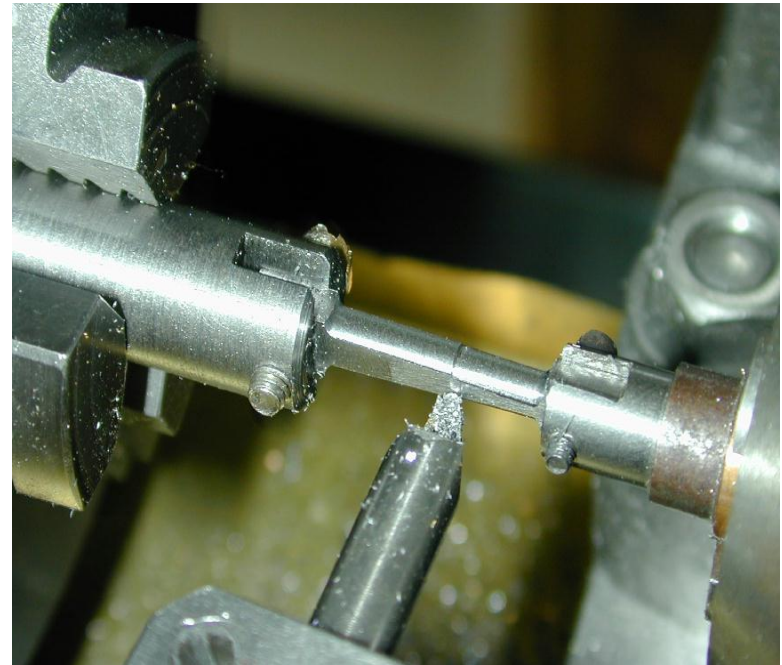
STEP TURNING



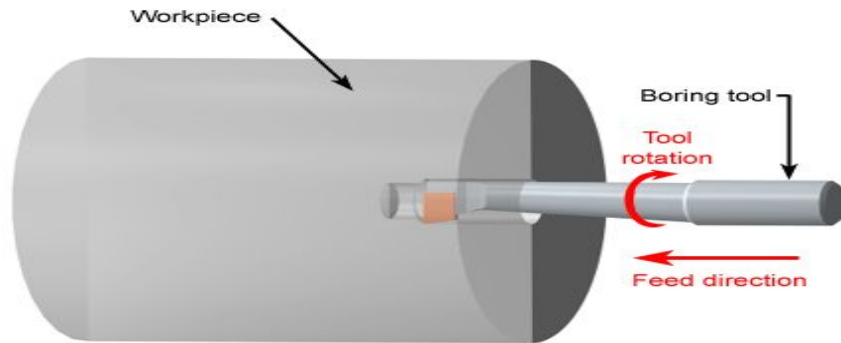
TAPER TURNING



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DRILLING

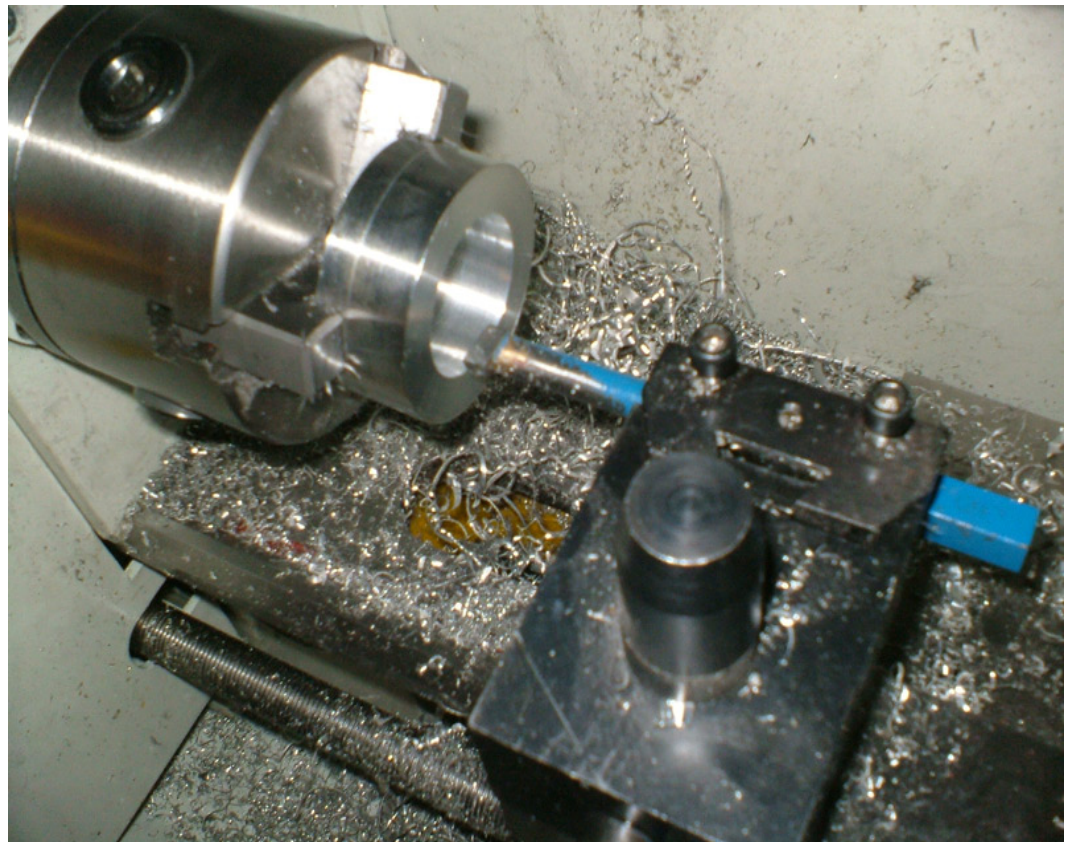
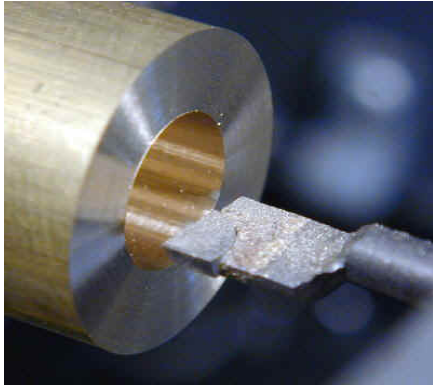


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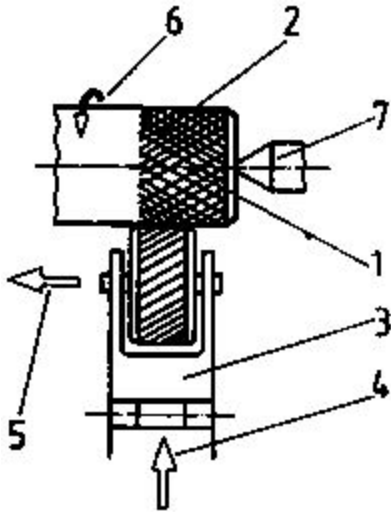
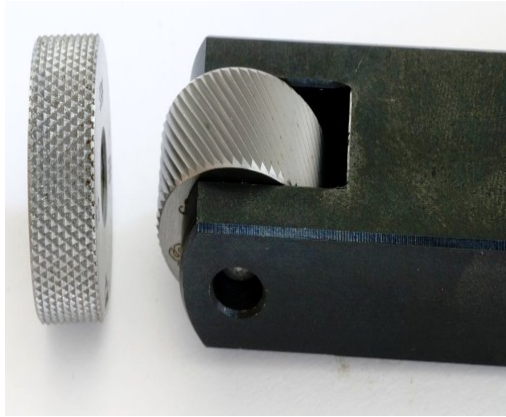
DRILLING



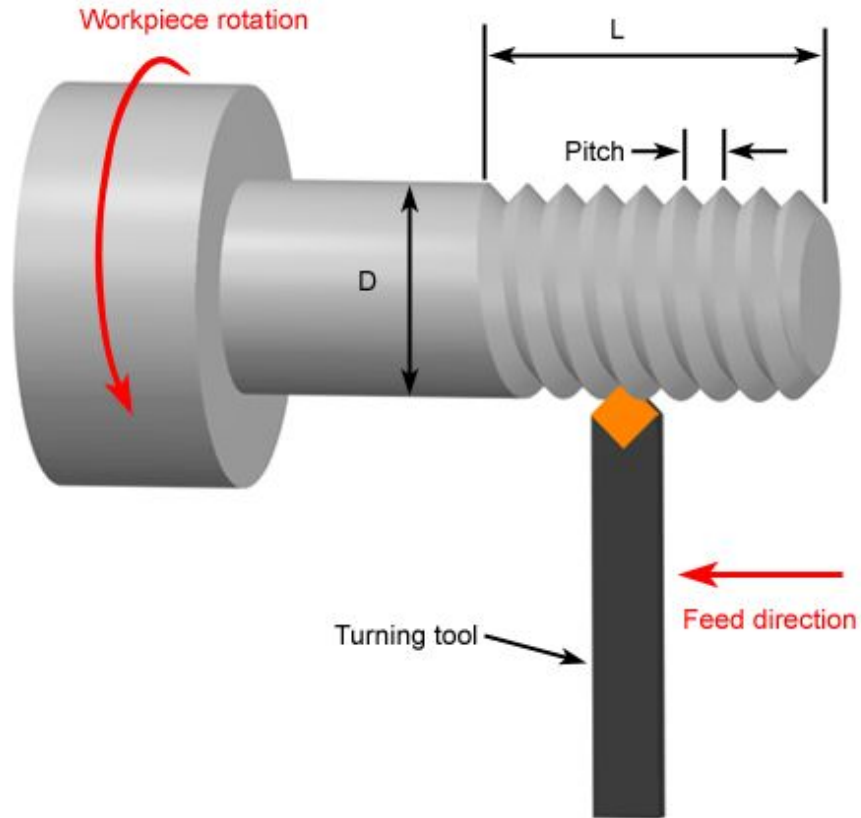
BORING



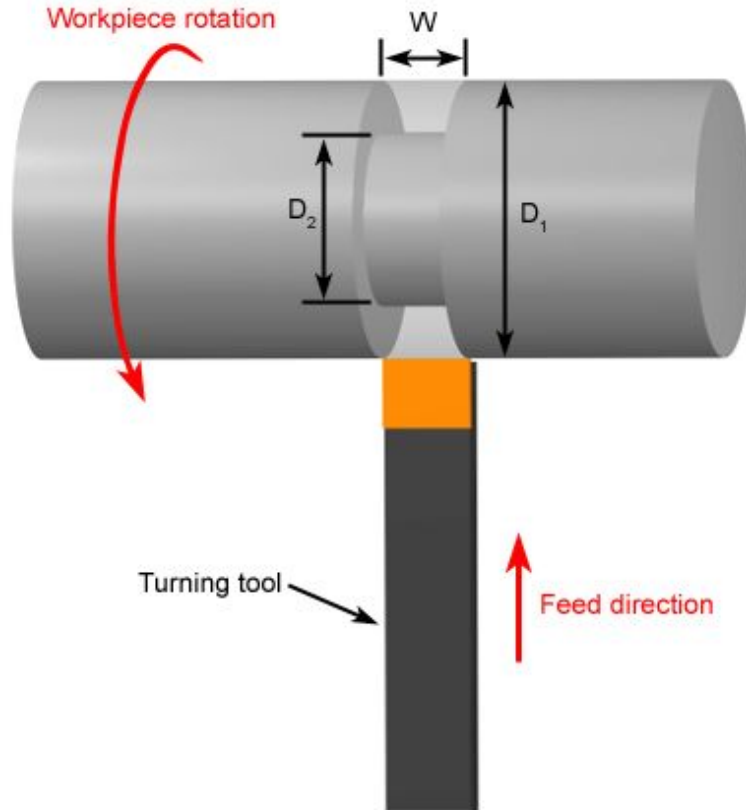
KNURLING



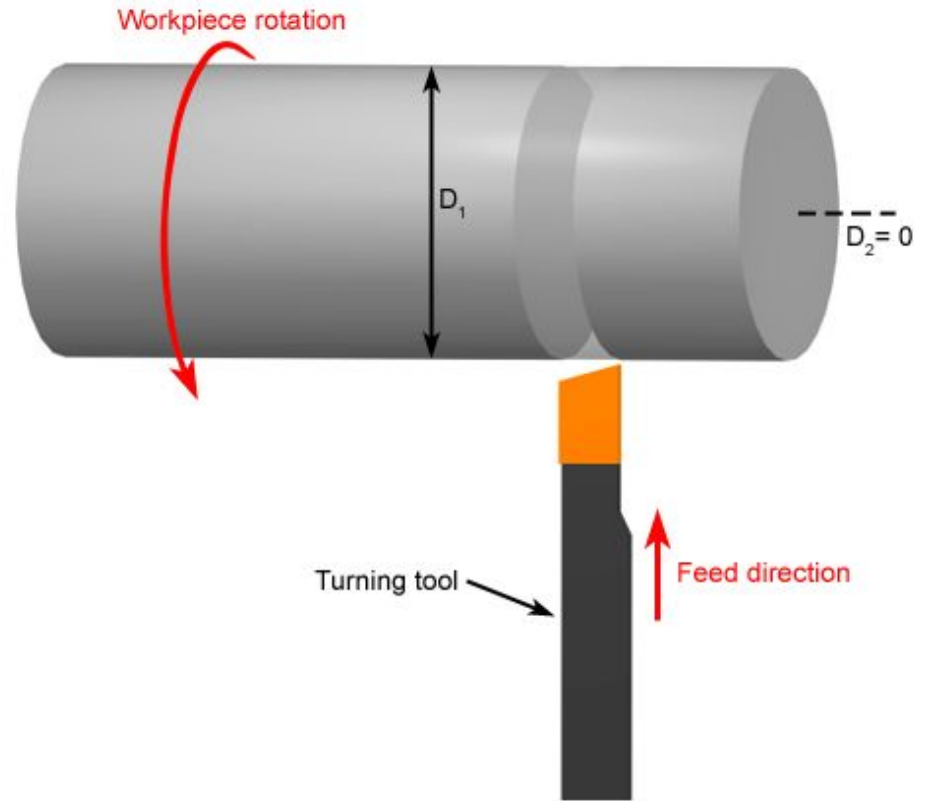
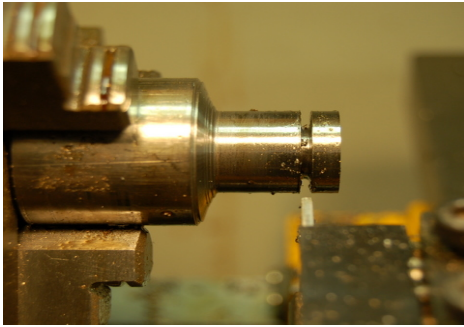
THREADING



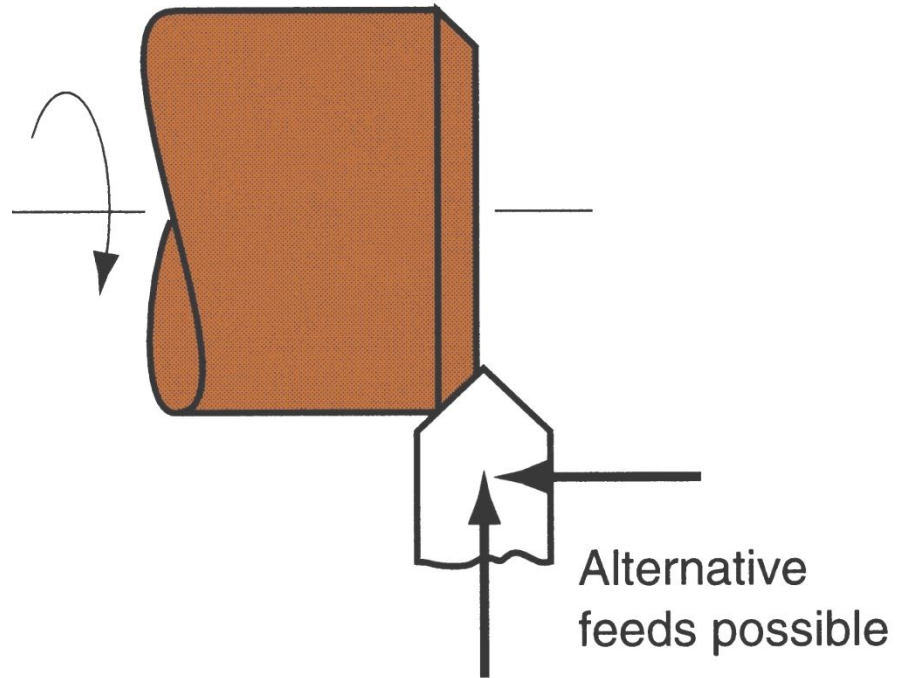
GROOVING



PARTING OFF



CHAMFER



(e)