

# ***Lathe Machine***

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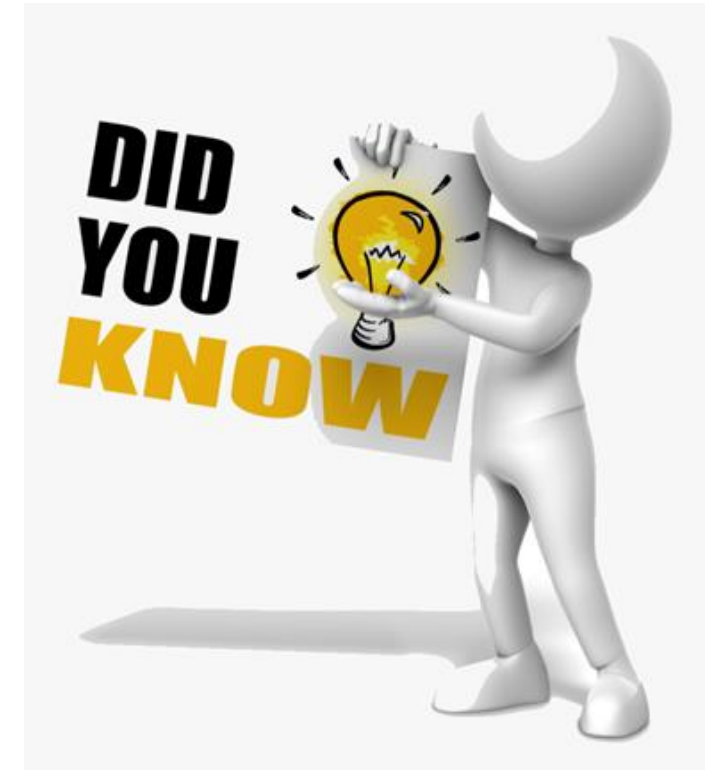
## ***Definition and Applications of Lathe***

***Upon completion of the course the student shall be able to:***

- ***Know the use of Lathe Machine .***
- ***Understand the applications of Lathe machine.***

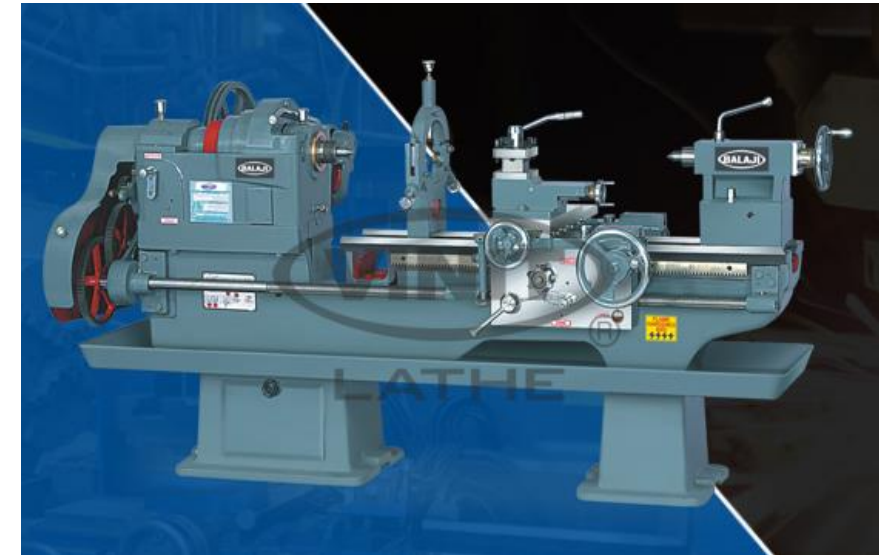
# *Did you Know?*

- *A lathe is a machining tool that is used primarily for shaping metal or wood. It works by rotating the workpiece around a stationary cutting tool.*
- *The main use is to remove unwanted parts of the material, leaving behind a nicely shaped workpiece.*



# Introduction to Lathe Machine

- *A lathe machine is a machine tool that removes the undesired material from a rotating workpiece in the form of chips with the help of a tool that is traversed across the work and can be feed deep into the work.*
- *It one of the most versatile and widely used machine tools all over the world.*
- *This is also known as the ‘Mother of all Machines’.*



# Introduction to Lathe Machine

## *Definition :*

- *Lathe machine is one of the most important machine tools which is used in the metalworking industry. It operates on the principle of a rotating work piece and a fixed cutting tool.*
- *The cutting tool is feed into the work piece which rotates about its own axis causing the workpiece to form the desired shape.*
- *A lathe may be small and sit on a workbench or table, not requiring a stand.*



# *Specifications of Lathe Machine*

*A Lathe machine can be specified as per:*

- *Distance between centers*
- *Swing over the bed*
- *Swing over the cross slide*
- *Horsepower of the motor*
- *Number of speeds*
- *Feed Given*



# *Applications of Lathe machine*

- *Woodturning: Used to make wooden objects such as ornate table legs, baseball bats, wooden bowl, and platters; operators use a variety of tools to form*
- *Metalworking: Used to create precision parts; most often associated with a multistep process requiring different tools for each step*
- *Metal Spinning: A process where metal spins on a spindle, while the operator works it with tools; an automated process*

# *Applications of Lathe machine*

- *Acrylic Spinning: Involves spinning acrylic on a spindle to form items from acrylic; most often used in the making of the top pieces for trophies*
- *Thermal Spraying: Combines the rotating spindle with the painting process; the paint sticks to the stock via processes involving heating the paint materials*
- *Pottery: By using a potter's wheel, artisans can make a variety of pottery pieces; though formed mainly by hand, crafts persons also use tools*



*From the above Topic we learnt about :*

- *The uses of Lathe machine*
- *Applications of Lathe machine*
- *The specification of Lathe machine*

# Check Your Understanding

1. *The horizontal feed in a lathe is controlled by?*
2. *The included angle of lathe centre is ?*

- A. Apron*
- B. Head stock*
- C. Cross-slide*
- D. Tailstock*

- A.  $30^{\circ}$*
- B.  $60^{\circ}$*
- C.  $90^{\circ}$*
- D.  $45^{\circ}$*

# *Check Your Understanding*

***3. Lathe is also known as the ‘Mother of all Machines.’***

***A. True***

***B. False***

***4. In lathe machine the workpiece is always stationary.***

***A. True***

***B. False***

# Check Your Understanding

**5. Three jaw chuck is also known as..... ?**

- A. Magnetic Chuck**
- B. Face Plate**
- C. Universal chuck**
- D. None of these**

**6. .... is preferred for holding an odd-shaped workpiece ?**

- A. Live and dead centers**
- B. Three jaw chuck**
- C. Lathe dog**
- D. Four jaw chuck**

# *Check Your Understanding*

***7. Which of the following operations can be done on Lathe?***

- A. Dilling***
- B. Turning***
- C. Both A and B***
- D. None of them***

***8. Which is correct about Lathe Machine ?***

- A. Tool is stationary***
- B. Workpiece is rotating***
- C. Workpiece clamped on headstock***
- D. All of These***

# ***Answer Key***

- 1. A. Apron**
- 2. B. 60°**
- 3. A. True**
- 4. B. False**
- 5. C. Universal chuck**
- 6. D. Four jaw chuck**
- 7. C. Both A and B**
- 8. D. All of These**

# ***Lathe Machine***

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## ***Important parts of Lathe machine***

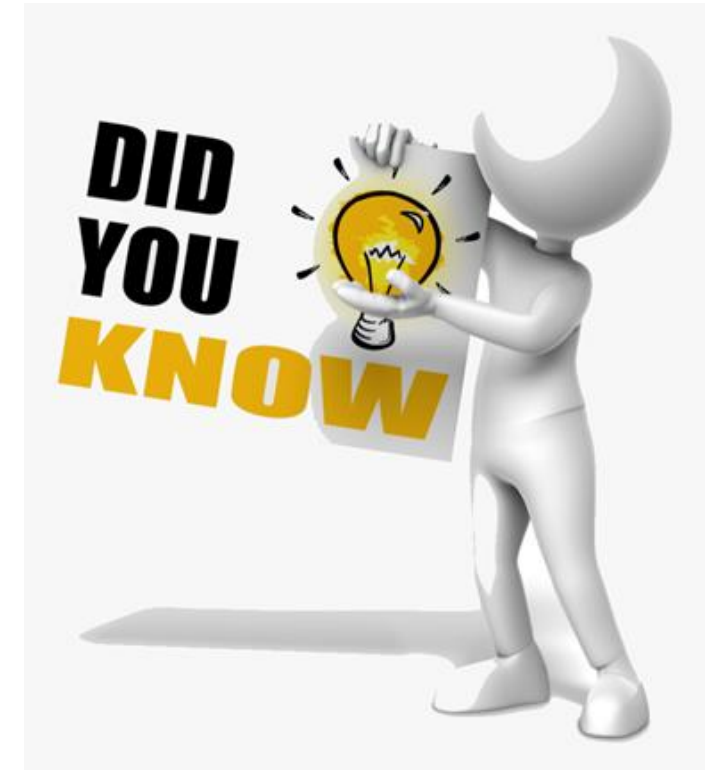
***Upon completion of the course the student shall be able to:***

- ***Know the parts and their working of Lathe machine.***
- ***Understand the functions of chuck and gear mechanism.***



# *Did you Know?*

- *Lathe machine has different parts and the role of every part is crucial with respect to the working applications.*
- *Generally the base is made up of cast iron which have very good damping property.*



# Parts of Lathe Machine

**Headstock :** The headstock is generally located on the left side of the lathe and consists of gears, spindles, chucks and feed controllers.

**Tailstock:** Usually located on the right side of the lathe. Fits on the inner ways of the bed and can slide towards the headstock to fit the length of the workpiece.

**Bed:** Bed is commonly made up of cast iron with heavy rigid frame on which all the main components are mounted.

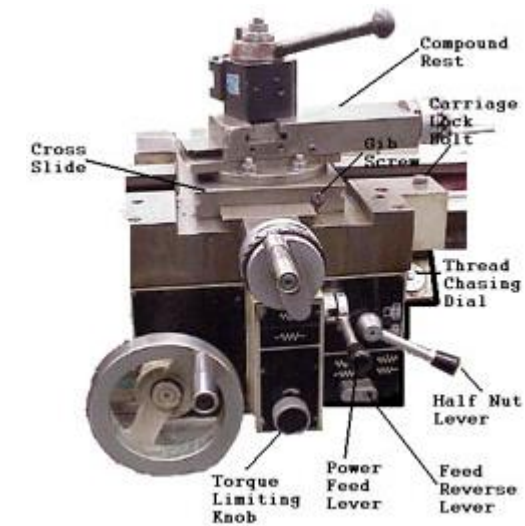


# Parts of Lathe Machine

***Carriage:*** The carriage is located between the headstock and the tailstock . This part contains an apron, saddle, compound rest, cross slide, and tool post. Moves on the outer ways. Also Used for mounting and moving most of the cutting tools.

***Chuck:*** This allows the mounting of workpieces that are in round, square, or triangular shape.

***Feed rod:*** Supports the carriage during transverse movement.



# Parts of Lathe Machine

**Lead screw:** This helps to move the carriage in transverse direction by the mechanism called rack and pinion. It has ACME thread through out length of the rod.

**Chip Pan:** Usually chip pan is present at the bottom of the lathe. A chip pan is used to collect the chips that are produced during machining.

**Hand Wheel:** It is the wheel that is operated by the operator to move cross slide, carriage, tailstock, and other parts that have hand wheels.





# Parts of Lathe Machine

***Legs:*** These are the supports that carries entire weight of the machine.

***Gearbox:*** Inside the headstock, Gear mechanism plays an important role to control the speed with levers.

***Spindle:*** It is the part which rotates continuously during machining and attached with chuck.

***Tool Post:*** Holding point of cutting tools.

***Guide ways:*** To ensure the movement of tailstock and carriage on the bed.



*From the above Topic we learnt about :*

- *The uses of Lathe machine parts*
- *Applications of lathe machine parts*
- *Function of gear box and carriage.*

# Check Your Understanding

1. *In drilling operation on a lathe, the tool is held by?*
2. *Carriage in a lathe machine, is mounted between ?*

- A. Headstock*
- B. Tailstock*
- C. Tool post*
- D. None of the above*

- A. Tool post and chuck*
- B. Headstock and tailstock*
- C. Tool post and tailstock*
- D. Tool post and headstock*

# *Check Your Understanding*

*3. In facing operation on a lathe, the tool is held in Tool post.*

*A. True*

*B. False*

*4. Usually chip pan is present at the bottom of the lathe.*

*A. True*

*B. False*



# *Check Your Understanding*

***5. Lathe bed is made of .....?***

- A. Plastic***
- B. Aluminium***
- C. Wood***
- D. None of these***

***6. ....is a long threaded shaft on the lathe?***

- A. Spindle***
- B. Lead screw***
- C. Cross slide***
- D. All of these***

# *Check Your Understanding*

*7. Which of the following is a part of lathe machine?*

- A. Bed*
- B. Carriage*
- C. Lead screw*
- D. All of These*

*8. To cut threads using a lathe machine which is required ?*

- A. Headstock*
- B. Tool post*
- C. Lead screw*
- D. All of These*

# ***Answer Key***

- 1. B. Tailstock**
- 2. B. Headstock and tailstock**
- 3. A. True**
- 4. A. True**
- 5. D. None of these**
- 6. B. Lead screw**
- 7. D. All of These**
- 8. D. All of These**

# ***Lathe Machine***

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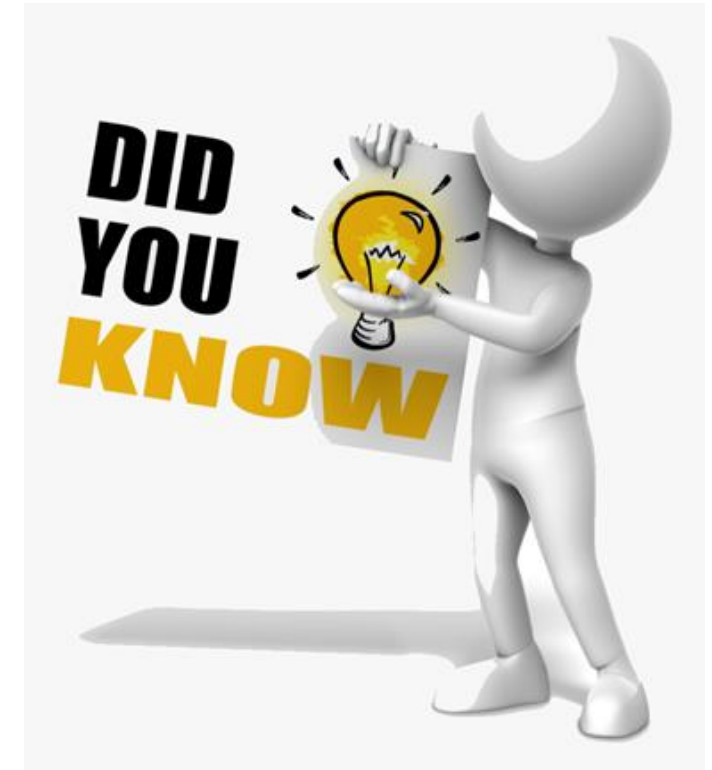
## ***Work holding devices***

*Upon completion of the course the student shall be able to:*

- *Understand the Work holding devices used in lathe machine.*
- *Know the Types of work holding devices and their uses.*

# *Did you Know?*

- *Work holding devices are the apparatus used to keep a workpiece stable and immobile.*
- *The means of holding and supporting a work or tool on a lathe machine is called a lathe machine accessories ; which are used for various operations.*



# *Introduction to Work holding Devices*

- *Work holding devices are used to locate, support, and secure workpieces for various types of manufacturing operations.*
- *These accessories are the integral part of machining .*
- *The choice of the device depends on the shape, length, diameter, and weight of the workpiece.*
- *The type of cuts you take also plays a important role in the selection of work holding devices.*



# Work holding Devices

*These are the some of work holding devices used for late operations ;*

*Chucks: Chucks are used to hold the workpiece on lathe machine*

*Chucks can be divided into four main types:*

- *Three Jaw Chucks – self-centering and hold regular shapes*
- *Four Jaw Chucks – not self-centering and hold eccentric type work*
- *Magnetic Chucks - hold the job by magnetic force.*
- *Collet Chucks - used for holding small or very long*





# Work holding Devices

## *Face plate:*

- *Faceplates generally have a circular shape and have a threaded hole at their center.*
- *They are used to hold large, heavy and irregular-shaped workpieces.*



## *Driving Plates and Catch Plates:*

- *Driving plates and catch plates are generally used to drive a workpiece that is held between centers. While both types of plates have a disk shape, driving plates have a driving pin on the face that is used to engage with straight tail carriers.*



# Work holding Devices

## *Lathe Dogs:*

- *Also known as carriers, are used along with driving plates.*
- *The workpiece is inserted into the eye of the lathe dog and then firmly secured with a screw.*
- *They can be divided into two categories depending on the type of tail:*
  1. *Straight tail (paired with driving plates)*
  2. *Bent tail (paired with catch plates)*



# Work holding Devices

## ***Centers:***

- *Centers are useful in holding the workpiece in a lathe between centers.*
- *The shank of a center has Morse taper on it and the face is conical shape.*
- *There are two types of centers.*
  1. *Live center – rotates with the workpiece*
  2. *Dead center – doesn't rotate with the workpiece*



# Work holding Devices

## *Rests:*

- *Rests are used to support a long workpiece.*
- *They are typically placed at some intermediate point to prevent the workpiece from deflection.*



## *Arbors:*

- *Also called Mandrels, are used to hold previously drilled or bored holes for outer surface machining.*
- *The workpiece is loaded over the mandrels between the centers. Mandrels are generally tapered, and their ends are slightly smaller than the original diameter for easy gripping.*



*From the above Topic we learnt about :*

- *The work holding devices used in lathe machine.*
- *Functions of work holding devices.*

# Check Your Understanding

**1. Lathe dogs are also known as ?**

- A. Effectors**
- B. Carriers**
- C. Refractors**
- D. None**

**2. Which is used to hold large, heavy and irregular-shaped workpieces ?**

- A. Face Plate**
- B. Allen Key**
- C. Chuck**
- D. All of These**

# *Check Your Understanding*

*3. Work holding devices are the apparatus used to keep a workpiece stable and immobile.*

*A. True*

*B. False*

*4. Rests are used to support a long workpiece.*

*A. True*

*B. False*

# Check Your Understanding

**5. Arbors are called as..... ?**

- A. Spindle**
- B. Mandrel**
- C. Chuck**
- D. None of these**

**6. .... are useful in holding the workpiece in a lathe between centers. ?**

- A. Chuck key**
- B. Lead screw**
- C. Centers**
- D. Star Keys**



# *Check Your Understanding*

*7. Which is a work holding device ?*

- A. Chuck*
- B. Lathe dogs*
- C. Face Plate*
- D. All of These*

*8. Which type of chuck is used in lathe ?*

- A. Three jaw chuck*
- B. Four jaw chuck*
- C. Magnetic jaw chuck*
- D. All of These*

# ***Answer Key***

- 1. B. Carriers**
- 2. A. Face Plate**
- 3. A. True**
- 4. A. True**
- 5. B. Mandrel**
- 6. C. Centers**
- 7. D. All of These**
- 8. D. All of These**

# ***Lathe Machine***

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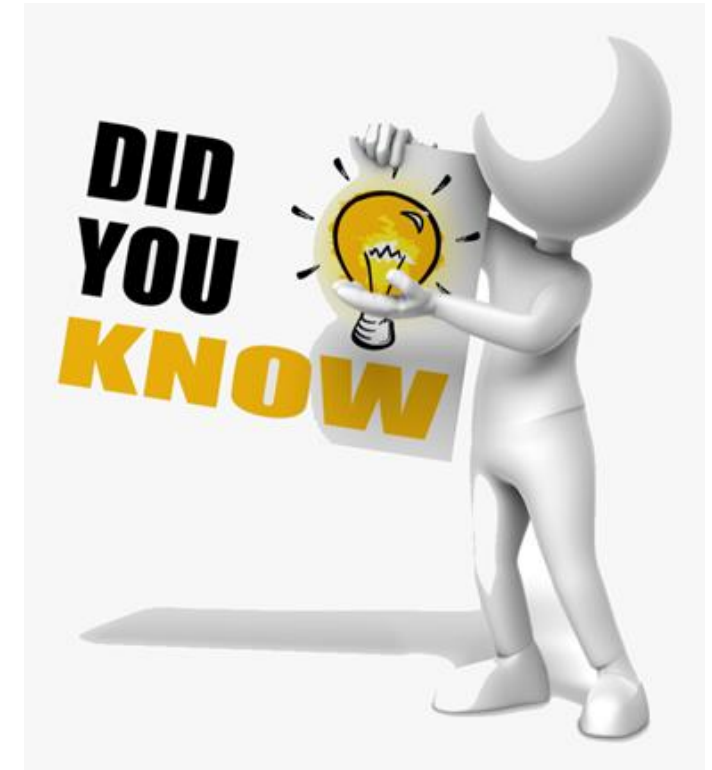
## ***Cutting Tools and Materials***

***Upon completion of the course the student shall be able to:***

- ***Know the use of cutting tools .***
- ***Understand the cutting tool materials.***

# *Did you Know?*

- *Cutting tools are used to cut the workpiece during machining process. There are so many types of cutting tools used in lathe machine for different operations. They are available in different shapes and made from various materials.*



# Introduction to Cutting Tools

- *For general purpose , the tool used in lathe machine is a single point cutting tool.*
- *But for special operations multipoint tools may use.*
- *Cutting tools are available in different sizes for respective functions of lathe.*
- *The available tools such as forming tool , shaping tool, boring tool etc.*
- *Generally the tools are made up of strong materials.*



# Type of Cutting Tools

*There are various types of cutting tools that are used for Lathe;*

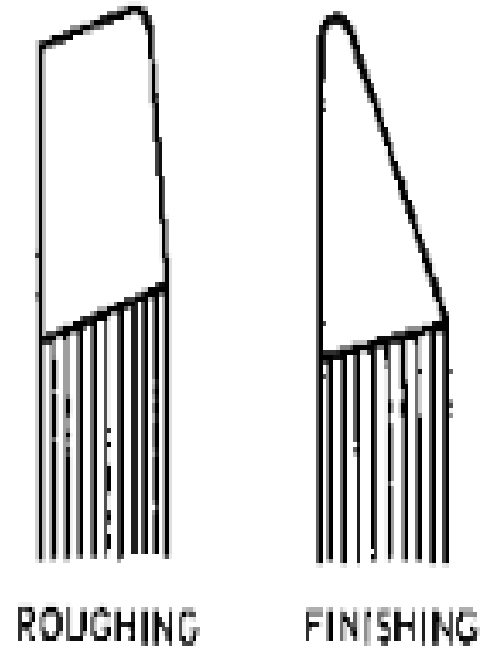
*1. Turning Tool : There are mainly two types of turning tool.*

- *Rough Turning Tool :*

*The main function of a rough turning tool is to remove the maximum amount of material in minimum time that the tool.*

- *Finish Turning Tool :*

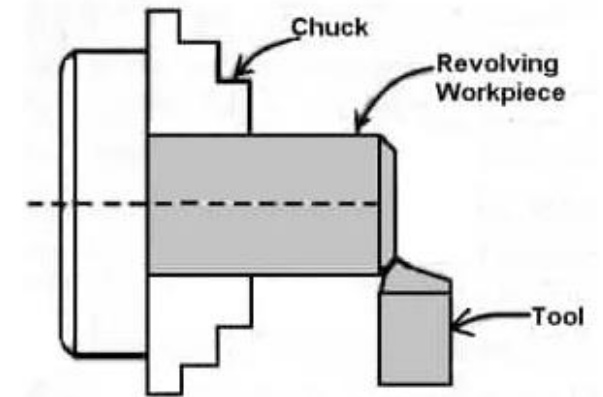
*Turning tool is used to remove the very small amount of material. A tool angle is so ground that it can produce a very*



# Type of Cutting Tools

## 2. Chamfering Tool :

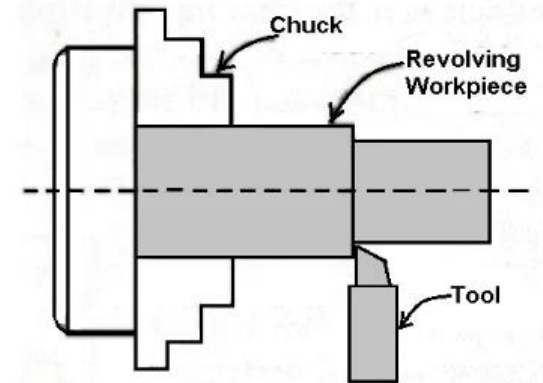
- *Straight turning tools are also used as a chamfering tool by setting at an angle of the chamfer.*
- *Where a large number of chamfer works are to be performed a special chamfering tool is used.*



Chamfering

## 3. Shoulder Turning Tool :

- *A square shoulder is turned by a knife-edge turning tool. A beveled shoulder may be turned by a straight turning tool having a side cutting edge angle and zero nose radius*



Shoulder Turning



# Type of Cutting Tools

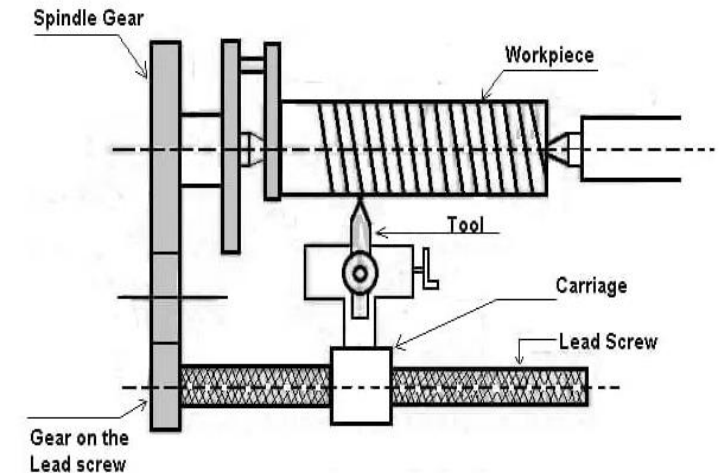
## 4. Thread Cutting Tool :

### 4.1 External Thread Cutting Tool :

- *Metric, B.S.W and American “V” threads are formed by a single point thread cutting tool. Its cutting edges sharpened to the shape and size of the thread to be cut.*

### 4.2 Internal Thread Cutting Tool :

- *The cutting edge of the tool is exactly similar to an external thread cutting tool but the front clearance angle is sufficiently increased as*

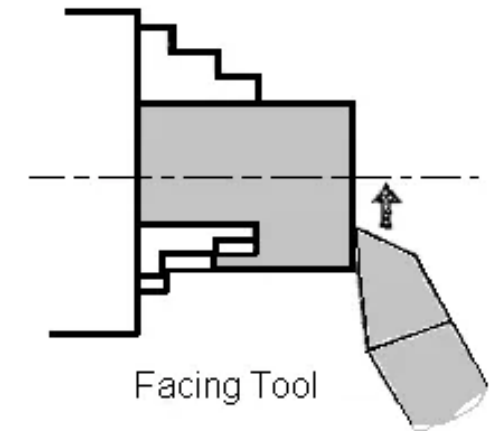


Thread Cutting

# Type of Cutting Tools

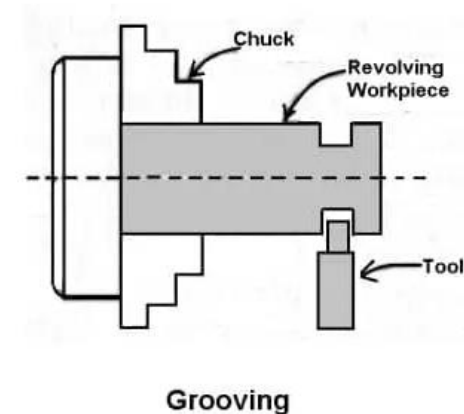
## 5. Facing Tool :

- A facing tool removes metal by its side cutting edges. So no top rake is necessary in facing tool.
- The figure shows H.S.S. facing tool intended for finishing operation.



## 6. Grooving Tool :

- Grooving tool is similar to a parting-off tool.
- The cutting edges are made square, rounded or “V” shape according to the shape of the groove to be cut.



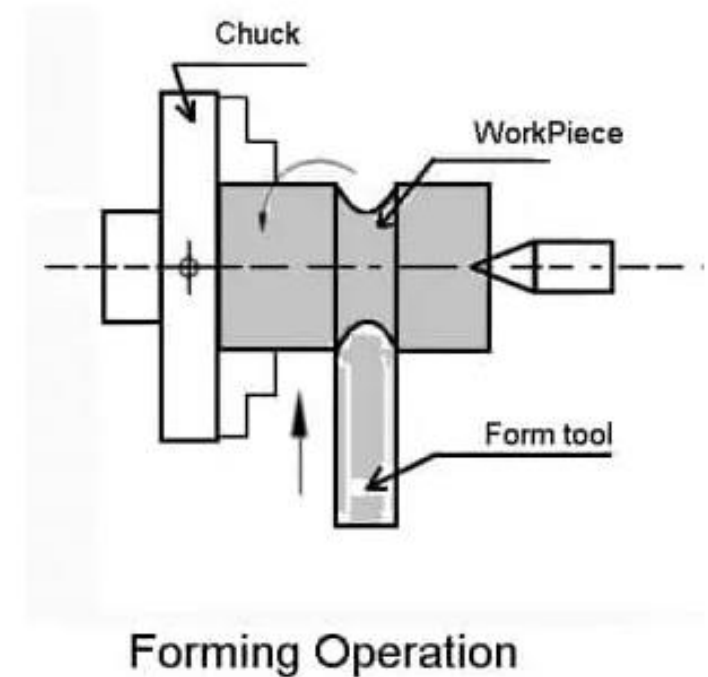
# Type of Cutting Tools

## 7. Forming Tool :

*Turning curved profiles are affected by using :*

- *Ordinary lathe tools*
- *Flat forming tools*
- *Circular forming tools*

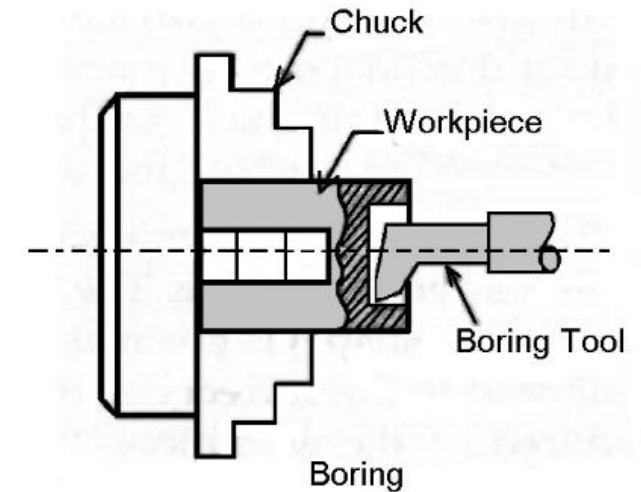
*An ordinary lathe turning tool may fulfill the purpose where a copying attachment is used to reproduce the forms .*



# Type of Cutting Tools

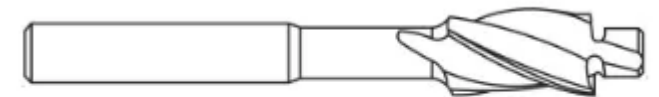
## 8. Boring Tool :

- *A boring tool is similar to a left-hand external turning tool.*
- *The tool may be a bit type inserted in a boring bar or holder having a tool shank.*



## 9. Counterboring Tool :

- *The counterboring operation can be performed by a common boring tool.*
- *A counterbore having multiple cutting edges is commonly preferred.*

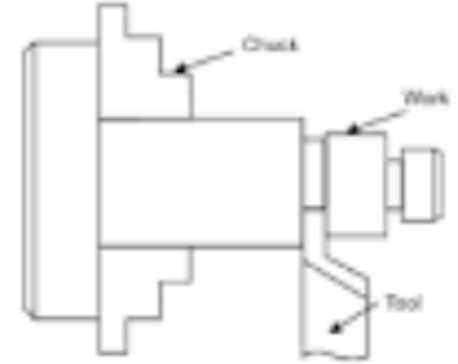


COUNTERBORING TOOL

# Type of Cutting Tools

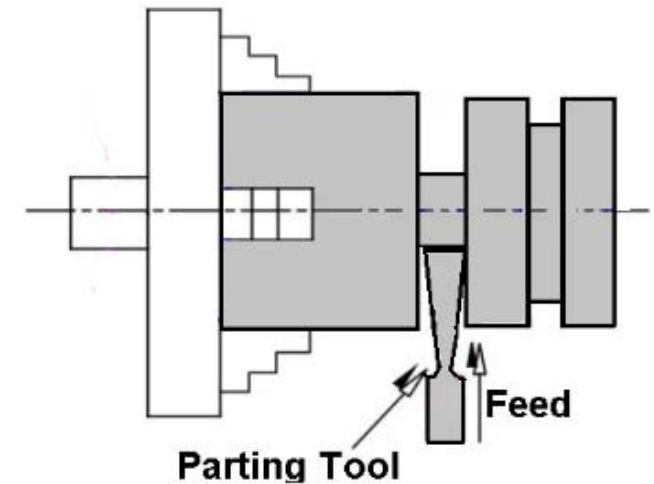
## 10. Undercutting Tool :

*Undercutting or grooving tool has a point and form of the cutting edge exactly similar to the form of the groove.*



## 11. Parting Off Tool :

*A parting off tool is normally forged and used as bits for cemented carbide tipped cutting tools. Parting off tool is made as narrow as possible to remove the minimum material.*



# Materials of Cutting Tools

## *Carbon tool steel :*

- *These plain carbon steel cutting tool have the composition of 0.6-1.5% carbon and very small amount of Mn, Si.*
- *Other metal like Cr, V are added to change the hardness of cutting tool.*

## *High-speed steel (HSS) :*

- *This is a high carbon steel with a significant amount of alloying element, such as tungsten, molybdenum, chromium, etc.*
- *It gives a higher metal removal rate. It loses its hardness at a*



# *Materials of Cutting Tools*

## *Cemented carbide tool and cermet :*

- The cemented carbide cutting tool is produced by powder metallurgy technique.*
- It consists of tungsten, tantalum and titanium carbide with cobalt as a binder element.*

## *Ceramics :*

- Most common ceramic materials are aluminum oxide and silicon nitride. Powder of ceramic material Compacted in insert shape, then sintered at high temperature. Ceramic tools are chemically inert and shows resistance to corrosion.*

# Materials of Cutting Tools

## ***Diamond :***

- ***It is the hardest material and it is also expensive. It possesses very high thermal conductivity and melting point. Diamond offers best abrasion resistance, low friction coefficient and low thermal expansion.***

## ***Cubic boron nitride (CBN) :***

- ***It is the second hardest material after diamond material. They are generally used in hand machines. They offer high resistance to abrasion and use as an abrasive for grinding wheels.***



# Specifications of Lathe Machine

***A Cutting tool can be specified as per:***

- ***Type of tool***
- ***Cutting angles***
- ***Shape of the tool***
- ***Material of the tool***

EG	MWLNK2020K08
M	Plate types
W	The first Number of the Suitable cutting insert Specification
L	Cutting angles of the cutting insert install into the cutting Tools
N	The Second Number of the Suitable cutting insert Specification
R	RIGHT HAND TOOL
2020	The handle size of lathe tool 20x20mm
K	The total length of tools
08	The Six tNumber of the Suitable cutting insert Specifications . Means the length of cutting insert .

# *Applications of Cutting Tools*

*Cuttings are used for following operations :*

- *Turning*
- *Facing*
- *Boring*
- *Countersinking*
- *Threading*

*From the above Topic we learnt about :*

- *The uses of Cutting tools*
- *Applications of Cutting tools*
- *Materials of cutting tool*

# *Check Your Understanding*

**1. For general purpose the type of tool used in lathe?**

- A. Hacksaw-blade**
- B. Single point cutting tool**
- C. Milling cutter**
- D. None**

**2. Lead screw is made up of?**

- A. Carbon Steel**
- B. Plastic**
- C. Both A and B**
- D. Cast iron**

# Check Your Understanding

*3. The plain carbon steel cutting tool have the composition of 0.6-1.5% carbon and very small amount of Mn , Si.*

*A. True*

*B. False*

*4. The cemented carbide cutting tool is produced by powder metallurgy technique.*

*A. True*

*B. False*

# Check Your Understanding

**5. A facing tool removes metal by its  
..... cutting edges?**

- A. Front**
- B. Side**
- C. Both A and B**
- D. None of these**

**6. Grooving tool is similar  
to a ..... tool?**

- A. Forming tool**
- B. Straight tool**
- C. Parting-off tool**
- D. None**

# *Check Your Understanding*

***7. Type of cutting tool used in lathe?***

- A. Facing tool***
- B. Grooving tool***
- C. Both A and B***
- D. None of them***

***8. Which is a type of cutting tool material used in lathe operations?***

- A. Ceramics***
- B. Diamond***
- C. Carbon tool steel***
- D. All of These***

# ***Answer Key***

- 1. B. Single point cutting tool**
- 2. A. Carbon Steel**
- 3. A. True**
- 4. A. True**
- 5. B. Side**
- 6. C. Parting-off tool**
- 7. C. Both A and B**
- 8. D. All of These**



# ***Lathe Machine***

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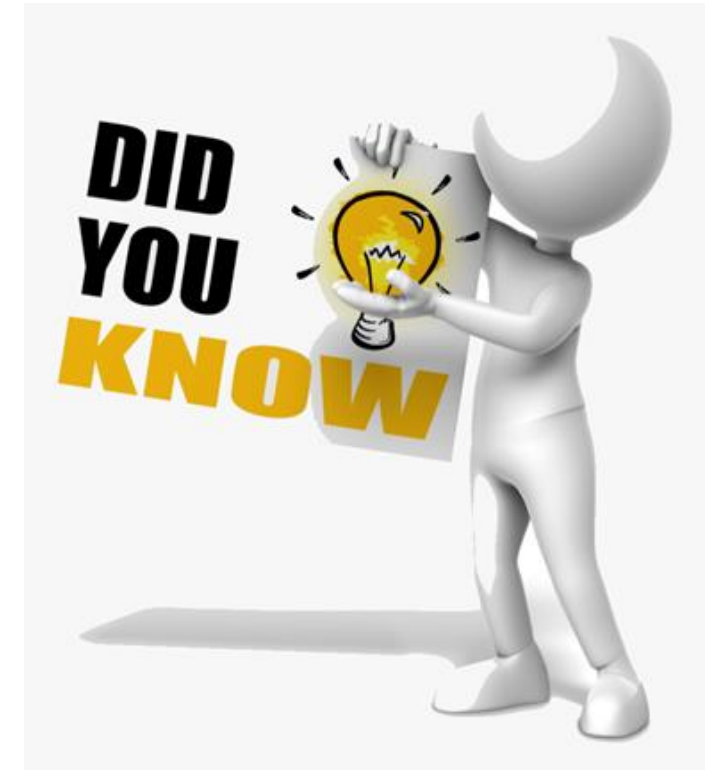
## ***Bench Lathes And Centre Lathes***

***Upon completion of the course the student shall be able to:***

- ***Know the use of Bench lathe Machine .***
- ***Understand the applications of Centre lathe machine.***

# *Did you Know?*

- *A lathe can be of two types ; bench lathe and centre lathe . Bench lathe fixed on a work bench while centre lathe fixed to ground . Both have different applications and advantages related to their work.*



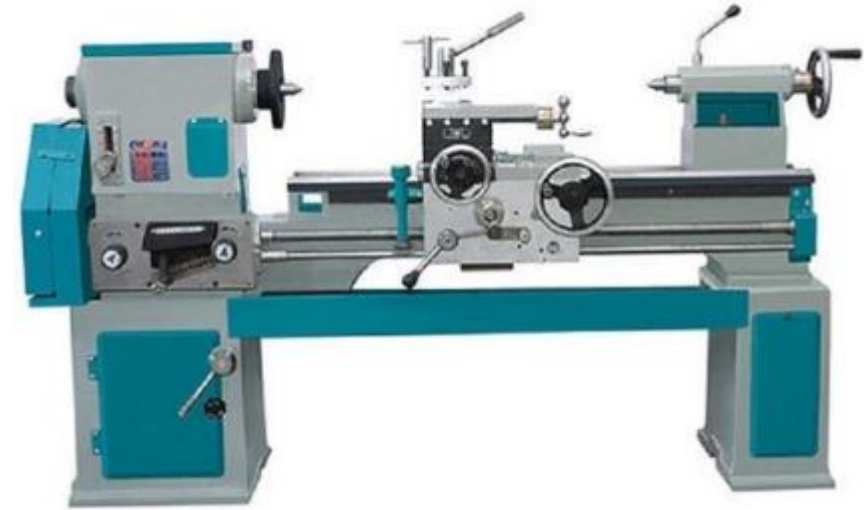
# ***Introduction to Bench Lathe***

- ***A bench lathe is a material reduction machine built into a worktable. A lathe takes a solid block of a material and reduces it to create a symmetrical item.***
- ***Using a bench lathe, you can cut, knurl or sand material down to create a new object.***
- ***The lathe is designed to hold the block at two points and spin it while allow the user to reduce the material to the new shape.***



# Introduction to Centre Lathe

- *The Centre Lathe is used to manufacture cylindrical shapes of materials like steels and plastics.*
- *These may be lathes operated directly by people or CNC machines with working program.*
- *This type of lathe is controlled by a person turning the handles on the top slide and cross slide in order to make a product / part.*
- *The speed of rotation of the chuck is usually set by using the gear levers.*



# *Applications of Bench Lathe*

- *Bench lathe Used for metal working.*
- *Carpentry works also done by Bench lathe machines*
- *These machines can also perform for pottery works.*

# *Applications of Centre Lathe*

- *Used for glass turning operation*
- *Automobile industries use centre lathe machines for making crankshaft*
- *Thermal spraying is also conducted by centre lathe machines.*

***From the above Topic we learnt about :***

- ***Applications of Bench lathe machine***
- ***Uses of Centre lathe machine***



# Check Your Understanding

1. *In lathe machine, the tool has how many types of motion?*
  - A. *One type of motion*
  - B. *Two types of motions*
  - C. *Three types of motion*
  - D. *No motion*
2. *Which is used for the long length job on lathe machine?*
  - A. *Carriage*
  - B. *Steady rest*
  - C. *Follower rest*
  - D. *Tailstock*

# *Check Your Understanding*

*3. A bench lathe is a material reduction machine built into a worktable.*

*A. True*

*B. False*

*4. The speed of rotation of the chuck is usually set by using the gear levers.*

*A. True*

*B. False*

# Check Your Understanding

5. In lathe machine, in order to produce cylindrical surface, the cutting tool must '-----'?      6. Lathe machine produces '-----'?

A. Move perpendicular to the axis of rotation

B. Move parallel to the axis of rotation

C. Move along the circumference of the surface

D. None of these

A. Spherical surface

B. Cylindrical surface

C. Flat surface

D. Both B and C

# Check Your Understanding

*7.....is a accessory of the lathe machine?*

- A. Tailstock*
- B. Headstock*
- C. Carriage*
- D. All of these*

*8. In a lathe machine, the tool moves..... to the axis of the material being cut?*

- A. Perpendicular*
- B. Parallel*
- C. Inclined*
- D. All of These*

# ***Answer Key***

- 1. B. Two types of motions**
- 2. D. Tailstock**
- 3. A. True**
- 4. A. True**
- 5. B. Move parallel to the axis of rotation**
- 6. D. Both B and C**
- 7. D. All of these**
- 8. D. All of These**

# ***Lathe Machine***

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***Cutting speed , Feed , Depth of cut***

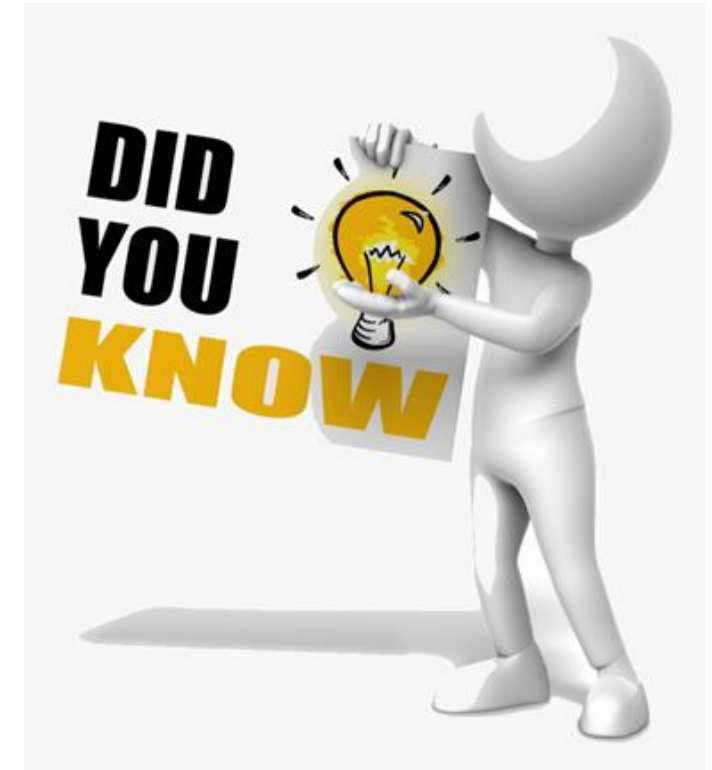
# Objective

***Upon completion of the course the student shall be able to:***

- ***Know the definition of cutting speed ,feed , depth of cut.***
- ***Understand the calculations related to Lathe operations.***

# *Did you Know?*

- *cutting speed , feed and depth of cut are the important parameters for machining operations performed in lathe. These variables decide the correctness of the*

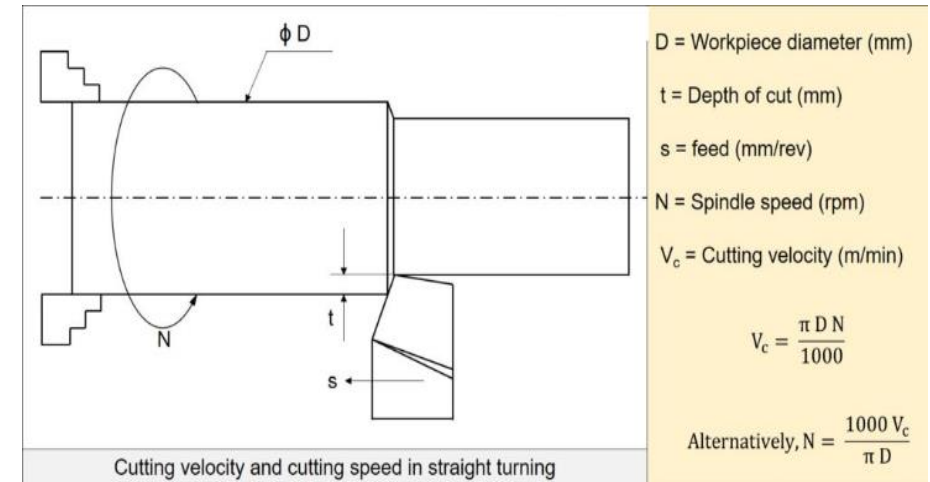




# Cutting Speed

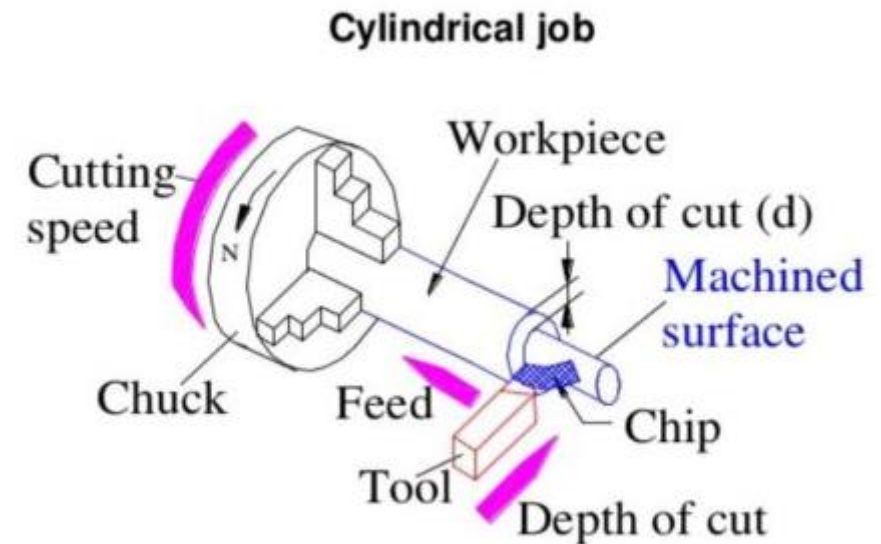
- The cutting speed ( $v_c$ ) of a tool is the speed at which the metal is removed by the tool from workpiece.
- In lathe, it is the peripheral speed of the workpiece. It is expressed in meters per minute.

$$V_c = \frac{\pi D N}{1000}$$



# Feed

- *The feeds of the cutting tool in lathe work are the distance the tool advances for each revolution of the workpiece . Feed is expressed in millimeters per revolution.*
- *In the British system, it is expressed in inches per revolution.*
- *Increased feed reduces the cutting time. But increased feed greatly reduces tool life.*



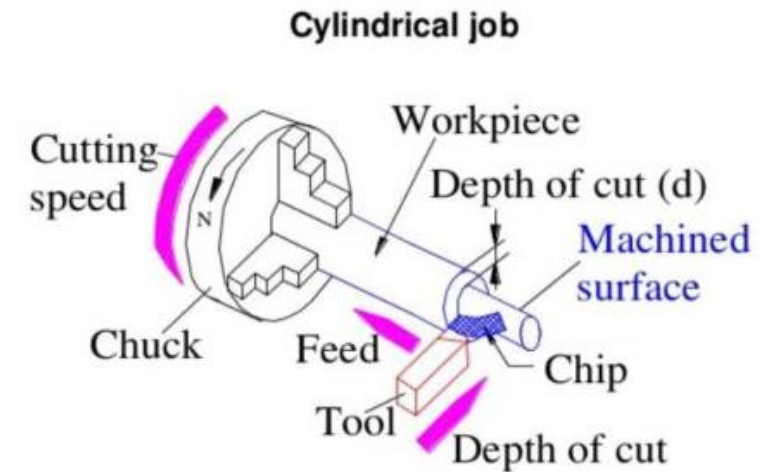
# Depth of cut

*The depth of cut (d) is the perpendicular distance measured from the machined surface to the uncut surface of the work.*

*d<sub>1</sub> – diameter of the workpiece surface before machining.*

*d<sub>2</sub> – diameter of the machined surface.*

$$\text{Depth Of Cut} = \frac{d_1 - d_2}{2}$$



*From the above Topic we learnt about :*

- *The calculations of Cutting speed*
- *Role of Depth of cut*
- *Application of Feed*

# Check Your Understanding

1. The feed may be expressed as?

- A. mm/revolution
- B. mm\*revolution
- C. mm
- D. None

2. Which is equal to half of the difference in diameter of the workpiece used?

- A. Feed
- B. Depth of cut
- C. Machining time
- D. None

## *Check Your Understanding*

*3. In lathe, it is the peripheral speed of the workpiece. It is expressed in meters per minute.*

*A.True*

*B.False*

*4. Increased feed reduces the cutting time.*

*A. True*

*B. False*

# Check Your Understanding

**5. Depth of cut is generally expressed in .....?**

- A. mm**
- B. Meter/minute**
- C. Meter\*minute**
- D. None**

**6. Distance of the tool advances for each revolution of the workpiece is .....?**

- A. Depth of cut**
- B. Feed**
- C. Cutting speed**
- D. None**

# Check Your Understanding

***7. Which of the following are the cutting parameters used in Lathe?***

- A. Cutting speed***
- B. Feed***
- C. Depth of cut***
- D. All of these***

***8. Meter/minute is the unit of which of the following parameters ?***

- A. Cutting speed***
- B. Peripheral speed***
- C. Both A and B***
- D. None of the above***



# ***Answer Key***

- |                            |                           |
|----------------------------|---------------------------|
| <b>1. A. mm/revolution</b> | <b>5. A. mm</b>           |
| <b>2. B. Depth of cut</b>  | <b>6. B. Feed</b>         |
| <b>3. A. True</b>          | <b>7. D. All of these</b> |
| <b>4. A. True</b>          | <b>8. C. Both A and B</b> |

# ***Lathe Machine***

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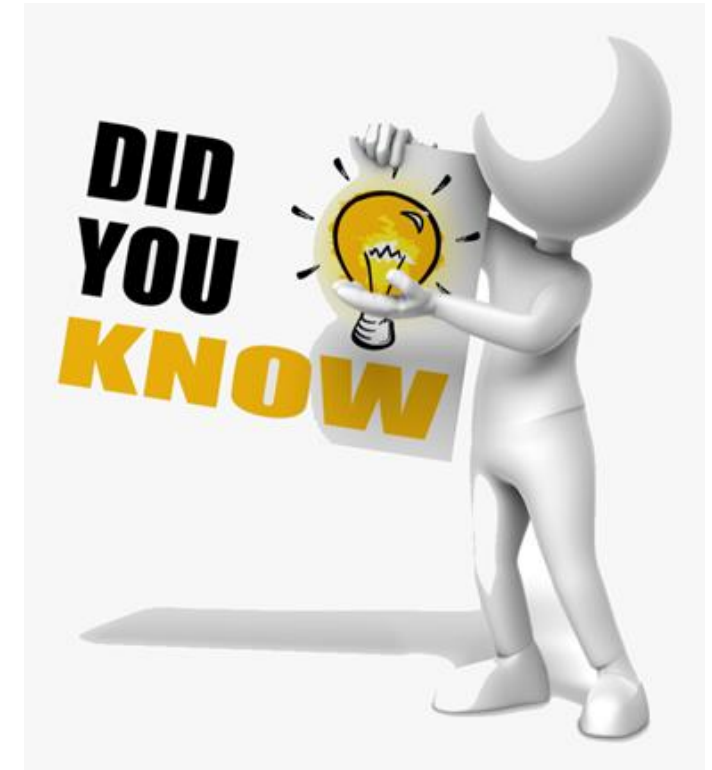
## ***Facing***

***Upon completion of the course the student shall be able to:***

- ***Understand the Facing operation .***
- ***Know the usage of single point cutting tool.***

# *Did you Know?*

- *Facing is a common machining process that involves the use of a lathe machine to remove material from the end and/or shoulder of a workpiece .*



# Introduction to Facing

- *When facing on lathe, the machinist uses a facing tool to cut a flat surface perpendicular to the work's rotational axis. The facing tool is then fed perpendicularly across the axis.*
- *Facing will take the workpiece down to its finished length very accurately: depending on how much material needs to be taken out , a machinist can choose to take roughing or finishing cuts.*



# *Needs and Applications of Facing*

- *Facing will take the work piece down to its finished length very accurately.*
- *For reference purpose generally facing is preferred.*

*From the above Topic we learnt about :*

- *The Facing operation*
- *Usage of single point cutting tool*

# *Check Your Understanding*

***1. Which of the following isn't a work holding device in Lathe?***

- ***Chuck***
- ***Lathe Dog***
- ***Face plate***
- ***None***

***2. Facing is done for?***

- A. Reduce the length of work***
- B. Better gripping***
- C. Designing***
- D. None***



# *Check Your Understanding*

*3. The facing tool is fed perpendicularly across the axis.*

*A. True*

*B. False*

*4. Facing will take the work piece down to its finished length very accurately.*

*A. True*

*B. False*

# *Check Your Understanding*

*5. .... Guide ways are present in lathe for tailstock movement?*

- A. Splines*
- B. Flat*
- C. square*
- D. Dove tail*

*6. Coolant ; during facing is required for.....?*

- A. Reduce tool wear*
- B. Dressing*
- C. Cutting edge reform*
- D. None*

# *Check Your Understanding*

***7. Parameters of facing are?***

- A. Depth of cut***
- B. Feed***
- C. Both A and B***
- D. None of them***

***8. Which is not a part of Lathe machine?***

- A. Arbor***
- B. Column***
- C. Milling cutter***
- D. All of These***

# ***Answer Key***

- 1. D. None**
- 2. A. Reduce the length of work**
- 3. A. True**
- 4. A. True**
- 5. D. Dove tail**
- 6. A. Reduce tool wear**
- 7. C. Both A and B**
- 8. D. All of These**

# ***Lathe Machine***

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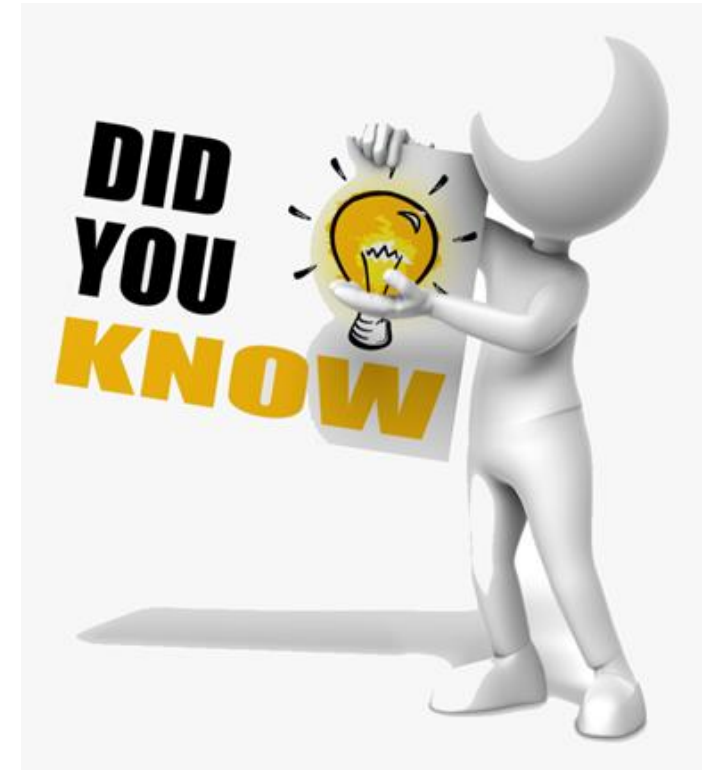
## ***Plain Turning***

***Upon completion of the course the student shall be able to:***

- ***Understand the plain Turning operation .***
- ***Know the usage of single point cutting tool.***

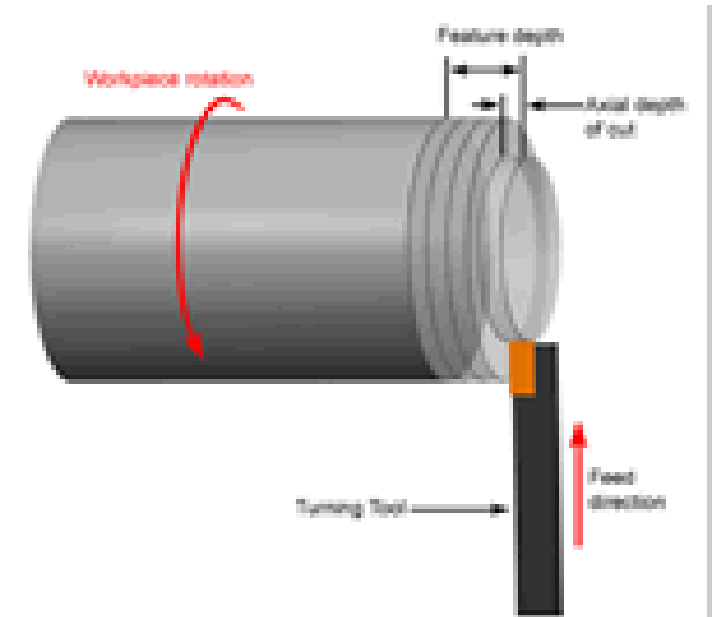
# *Did you Know?*

- *The general process of plain turning involves rotating a part while a single-point cutting tool is moved parallel to the axis of rotation. Turning can be done on the external surface of the part as well as the internal surface.*



# Introduction to Plain Turning

- *Plain Turning is 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 to conduct the operation.*
- *The cutter is typically a single-point cutting tool that is fixed in the machine tool post.*
- *The cutting tool feeds into the rotating workpiece and cuts away material to get the*





# *Needs and Applications of Plain Turning*

- *Plain Turning process is used for producing machine components, shafts, and engine components.*
- *It is used to produce rotational, Axi-symmetric parts such as holes, grooves, threads, tapers etc.*

***From the above Topic we learnt about :***

- ***The plain Turning operation***
- ***Usage of single point cutting tool***

# *Check Your Understanding*

***1. Which tool is used for plain turning?***

- A. Milling cutter***
- B. Drill bit***
- C. Single point cutting tool***
- D. Forming tool***

***2. In plain turning the movement of the tool is in which direction?***

- A. Longitudinal***
- B. Transverse***
- C. Both A and b***
- D. None***

# Check Your Understanding

**3. Reduction in diameter of the workpiece can be achieved by Plain turning.**

**A. True**

**B. False**

**4. Plain Turning process is used for producing machine components, shafts, and engine components. .**

**A. True**

**B. False**

# Check Your Understanding

**5. Generally cutting tool material for turning tool ..... ?**

- A. HSS**
- B. MS**
- C. Sharp Edge plastic**
- D. None of these**

**6. During turning the movement of workpiece is.....?**

- A. Linear**
- B. Rotational**
- C. Parabolic**
- D. Hyperbolic**

# Check Your Understanding

**7. What is the purpose of turning?**

- A. Reduce the material diameter**
- B. Produce axi-symmetric Product**
- C. Both A and B**
- D. None of them**

**8. Which is wrong about Plain turning ?**

- A. Workpiece Stationary**
- B. Tool rotating**
- C. Multi point cutting tool used**
- D. All of These**

# ***Answer Key***

- 1. C. Single point cutting tool**
- 2. A. Longitudinal**
- 3. A. True**
- 4. A. True**
- 5. A. HSS**
- 6. B. Rotational**
- 7. C. Both A and B**
- 8. D. All of These**

# ***Lathe Machine***

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## ***Taper Turning***

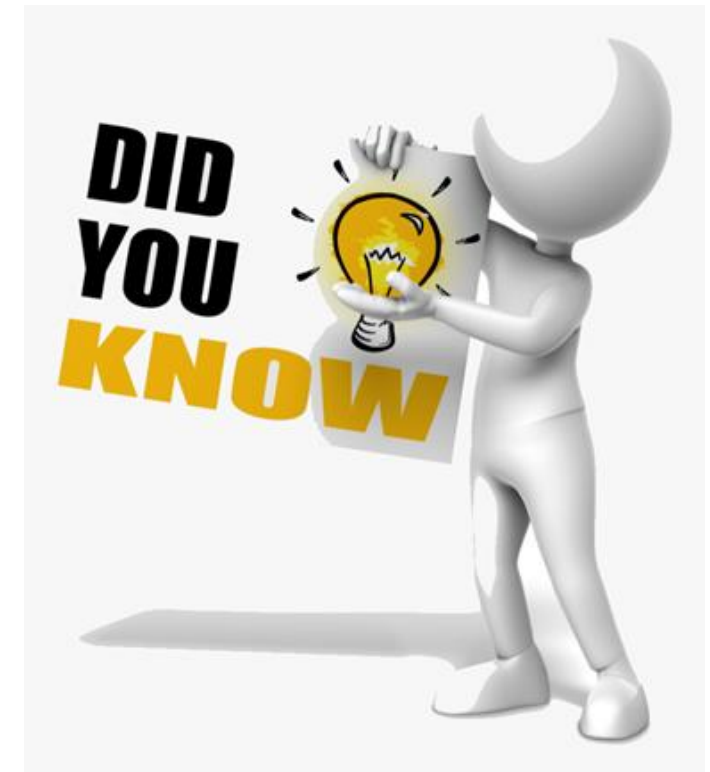


*Upon completion of the course the student shall be able to:*

- *Understand the Taper Turning operation .*
- *Know the usage of single point cutting tool.*

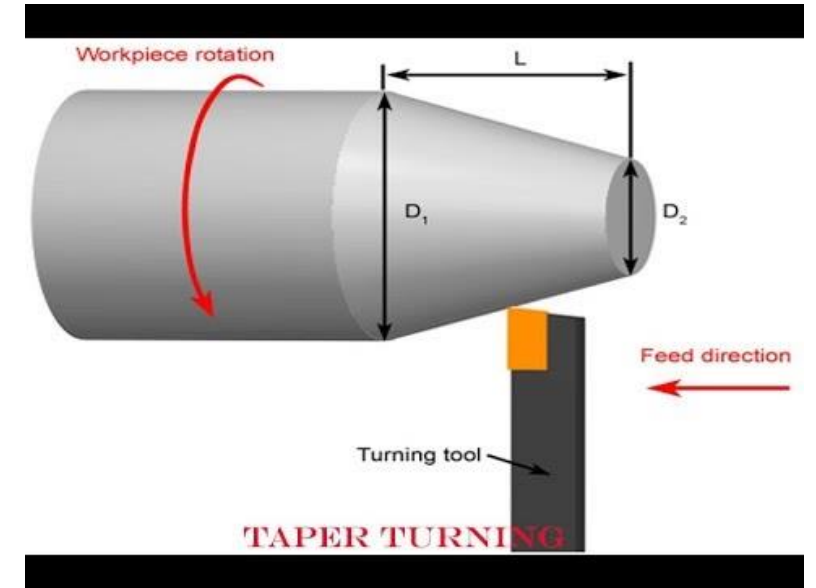
# *Did you Know?*

- *Taper turning is a machining operation, which means that the diameter of cylindrical workpieces gradually decreases from one part to another.*
- *The taper can be external or internal.*



# Introduction to Taper Turning

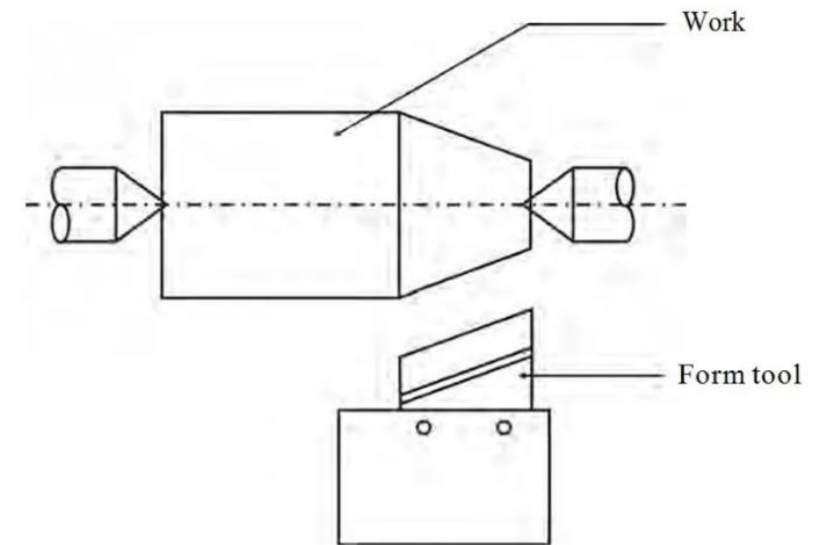
- *Taper turning is a turning process in which the cutting tool moves at an angle to the axis of the workpiece so that the workpiece receives a tapered shape.*
- *In a tapered piece, the diameter of the workpiece varies uniformly from one end to the other end.*
- *The workpiece must be positioned in such a way as to make the taper such that the axis of rotation is at the angle to an axis of the tool.*



# Types of Taper Turning methods

## 1. Form tool method:

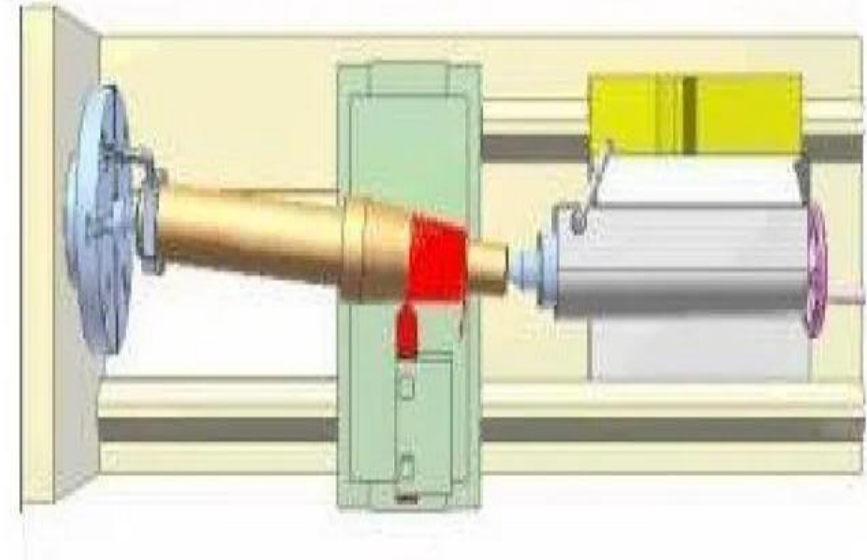
- *Form tool method is one of the simplest methods to produce a short type taper.*
- *In this method, a form tool having straight cutting edge is set onto the work at a half taper angle and is fed straight into the workpiece. The tool used in this method is known as taper turning form tool.*
- *The tool used itself is of taper shape hence producing tapered workpiece as output.*



# Types of Taper Turning methods

## *2. Tailstock set over method:*

- Generally, when the angle of taper is very small this taper turning methods in lathe machine will be conducted.*
- The workpiece be placed in the live center. Now, the tailstock will be moved in a cross-wise, which is perpendicular to the lathe axis by turning the set over method.*
- This process is known as tailstock set over method.*



# Types of Taper Turning methods

## 2. Tailstock set over method (calculation):

*The amount of offset is calculated in the following way,*

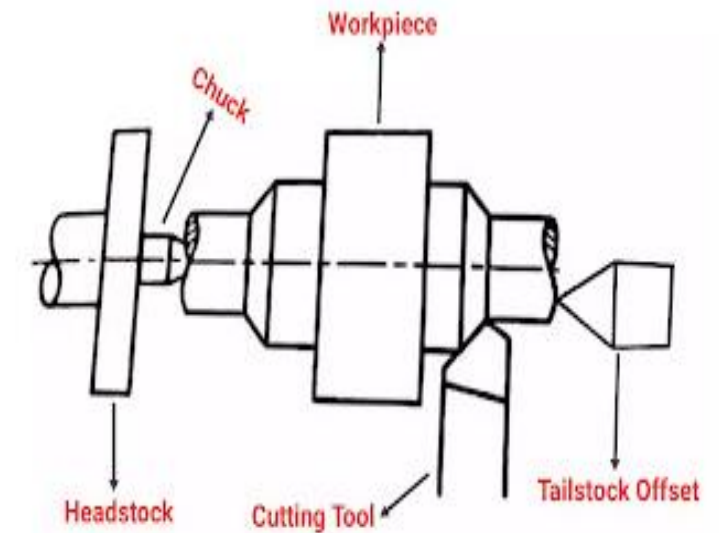
$$\text{Offset} = (\text{Taper} \times L) / 2000$$

*Where,*

*Offset is in mm.*

*Taper = millimeter/meter*

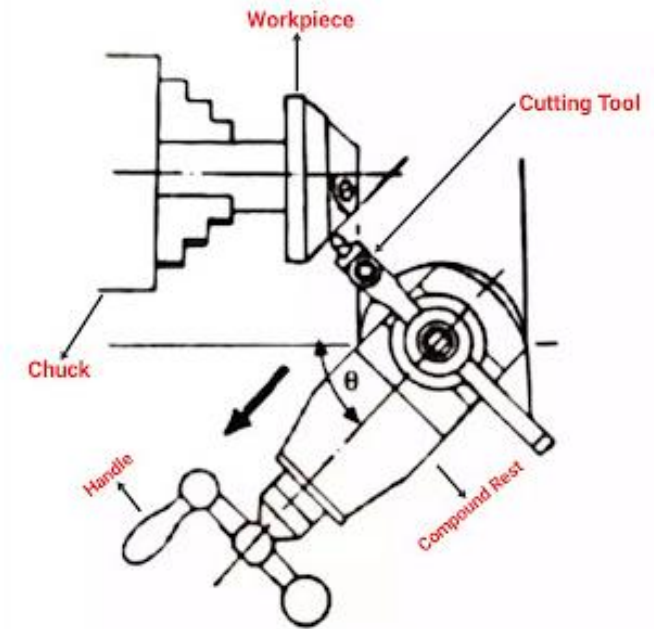
*L = Length of workpiece in mm*



# Types of Taper Turning methods

## 3. Compound Rest Method:

- *This method is typically used to produce short and steep cones.*
- *In this method, the compound rest is swiveled at the required angle and held in position.*
- *The compound rest can be rotated up to 45 degrees. The workpiece is held in the chuck & will be rotated in the lathe axis as same as turning.*



# Types of Taper Turning methods

## 3. Compound Rest Method (calculation):

$$\tan \theta = \frac{D-d}{2L}$$

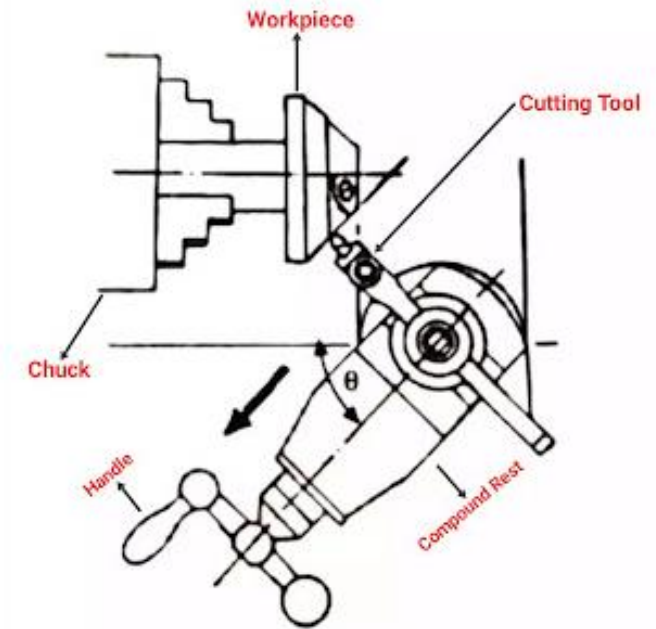
$$\theta = \tan^{-1} \left( \frac{D-d}{2L} \right)$$

Where,

$D$  = Larger diameter of the taper

$d$  = Smaller diameter of the taper

$L$  = Length of the taper





# Types of Taper Turning methods

## *4. Taper turning attachment method:*

- A Taper Turning Attachment may be used for longer tapers if the workpieces are larger in length.*
- In this taper turning method a different attachment of lathe machine, a taper turning attachment is attached to the rear end of the machine bed.*
- It has a guide bar which is usually pivoted at the center. The guide bar has the ability to swing and it can be set in any angle.*



# Types of Taper Turning methods

## 4. Taper turning attachment method (calculation):

The angle is calculated using the formula,

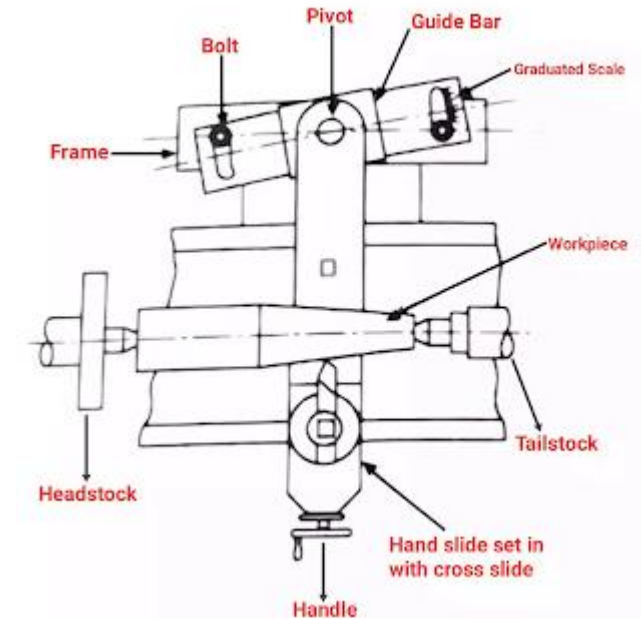
$$\tan (\alpha/2) = (D-d)/2l \text{ or } \tan \theta = (D-d)/2l$$

$\theta$  = Total angle,  $\theta = \alpha/2$

$D$  = Large diameter of workpiece

$d$  = Small diameter of workpiece

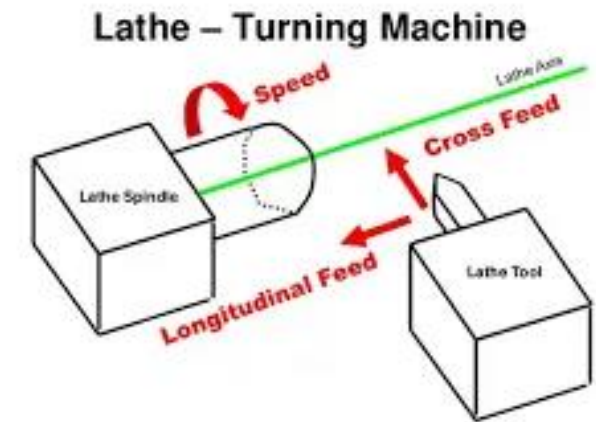
$l$  = Length of workpiece



# Types of Taper Turning methods

## 5. Combining Feeds Method:

- *In this method, longitudinal and cross feeds are performed simultaneously, so that the tool moves along the diagonal path.*
- *The trajectory of the resultant can be adjusted by changing the feed rate by changing the gears given within the apron.*



# ***Needs and Applications :Taper Turning***

- ***Taper Turning process is used for manufacturing tapered parts in workshop.***
- ***We need the process of taper turning during angular parts assembly.***

*From the above Topic we learnt about :*

- *The Taper turning operation*
- *Usage of single point cutting tool*
- *Calculations of Taper turning*

# Check Your Understanding

1. Which method is typically used to produce short and steep cones?
  - A. Tapper turning attachment
  - B. Tailstock set over method
  - C. Compound rest method
  - D. None
2. Longitudinal and cross feeds are performed simultaneously in which method?
  - A. Tailstock set over method
  - B. Taper turning attachment
  - C. Compound rest method
  - D. Combining feeds method

# Check Your Understanding

*3. Form tool method is one of the simplest methods to produce a short type taper.*

*A. True*

*B. False*

*4. Taper Turning process is used for manufacturing tapered parts in workshop.*

*A. True*

*B. False*

# Check Your Understanding

**5. For compound rest method the formula is..... ?**

- A.  $\tan \theta = D-dt/2L$**
- B.  $\tan \theta = D-d/2L$**
- C.  $\tan \theta = D-d/2L+1$**
- D. None of these**

**6. ....type cutting tool is used for taper turning?**

- A. Single point cutting tool**
- B. Allen Key**
- C. Milling cutter**
- D. Angle plate**



# Check Your Understanding

**7. The constituent elements of HSS ?**

- A. Chromium**
- B. Vanadium**
- C. Both A and B**
- D. None of them**

**8. Which of the following is a taper turning method ?**

- A. Taper turning attachment**
- B. Compound rest method**
- C. Combining feeds method**
- D. All of These**

# Answer Key

1. *C. Compound rest method*
2. *D. Combining feeds method*
3. *A. True*
4. *A. True*
5. *B.  $\tan \theta = \frac{D-d}{2L}$*
6. *A. Single point cutting tool*
7. *C. Both A and B*
8. *D. All of These*

# ***Lathe Machine***

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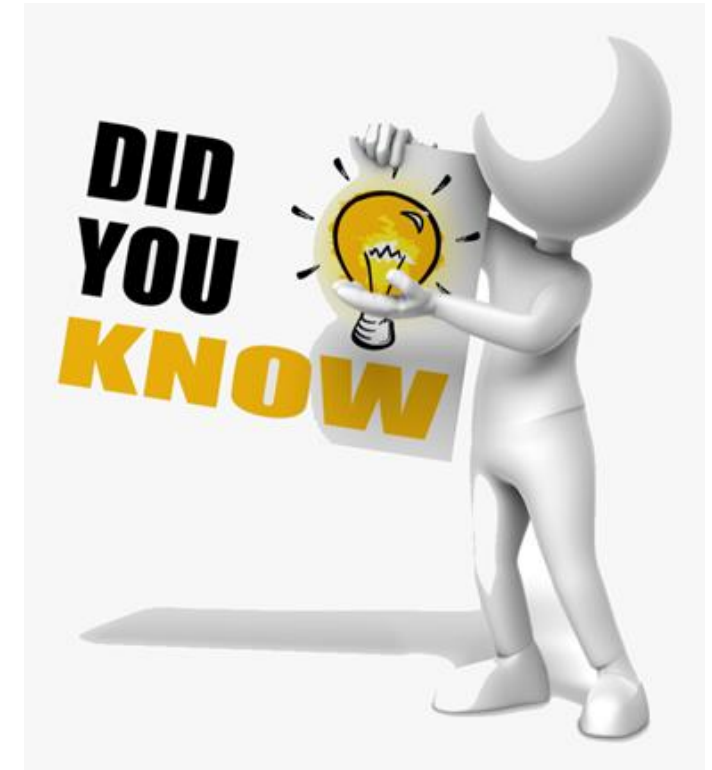
## ***Step Turning***

***Upon completion of the course the student shall be able to:***

- ***Understand the Step Turning operation .***
- ***Know the usage of single point cutting tool.***

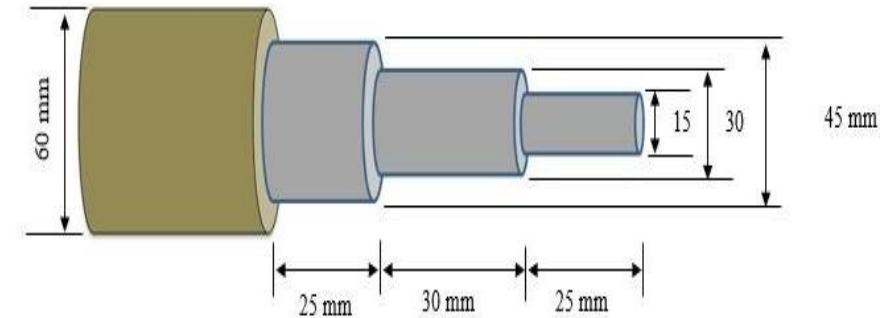
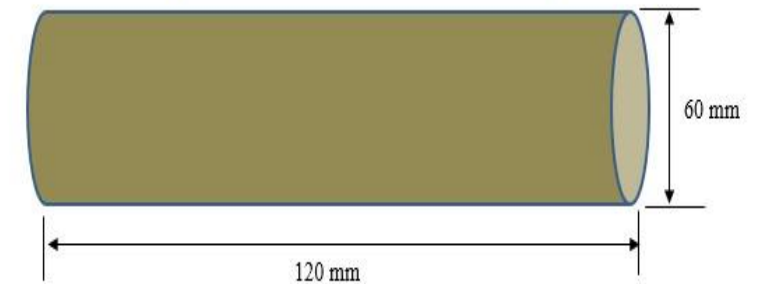
# *Did you Know?*

- *Step turning is an operation similar to creating a stair case on a work piece. Here excess materials from the workpiece is removed non uniformly i.e. in various steps with different dimensions.*



# Introduction to Step Turning

- *Step turning creates two surfaces with an abrupt change in diameters between them.*
- *The final feature resembles a step.*
- *The cutting tool used in this operation is single point cutting tool.*
- *The process of step turning can be achieved by repeating plain turning operation on a particular length.*
- *In this type of operation; Length and diameter of work changes .*



# *Needs and Applications of Step Turning*

- *Step Turning process is used for producing machine components, shafts with steps in their design.*
- *It is used for the products of assembly like male and female part engagement.*

*From the above Topic we learnt about :*

- *The plain Turning operation*
- *Usage of single point cutting tool*



# *Check Your Understanding*

*1. Single point cutting tool used for which operation ?*

- A. Step Turning*
- B. Drilling*
- C. Reaming*
- D. Boring*

*2. Three jaw chuck is used for holding which type of work ?*

- A. Rectangular*
- B. Cylindrical*
- C. Tapered*
- D. None*

# Check Your Understanding

**3. Step turning creates two surfaces with an abrupt change in diameters between them.**

**A. True**

**B. False**

**4. The process of step turning can be achieved by repeating plain turning operation on a particular length.**

**A. True**

**B. False**

# Check Your Understanding

**5. The Spindle speed can be varied by.....?**

- A. Gear lever arrangement**
- B. Belt drive**
- C. Chain drive**
- D. None of these**

**6. .... Holds the work during step turning?**

- A. Tailstock**
- B. Bed**
- C. Tool post**
- D. Headstock**

# Check Your Understanding

***7. In step turning operation which of the following variables change ?***

- A. Diameter of work***
- B. Length of work***
- C. Both A and B***
- D. None of them***

***8. Which is correct about Step turning ?***

- A. Tool is stationary***
- B. Work is rotating***
- C. Single point cutting tool used***
- D. All of These***

# ***Answer Key***

- 1. A. Step Turning**
- 2. B. Cylindrical**
- 3. A. True**
- 4. A. True**
- 5. A. Gear lever arrangement**
- 6. D. Headstock**
- 7. C. Both A and B**
- 8. D. All of These**

# ***Lathe Machine***

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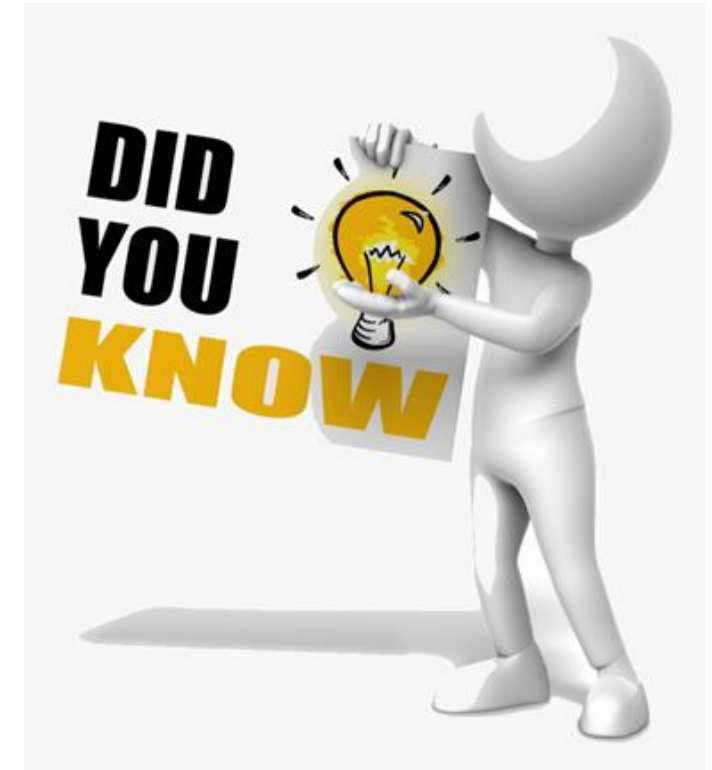
## ***Grooving/Parting***

***Upon completion of the course the student shall be able to:***

- ***Understand the Grooving/Parting operation.***
- ***Know the usage of Grooving and Parting tools.***

# *Did you Know?*

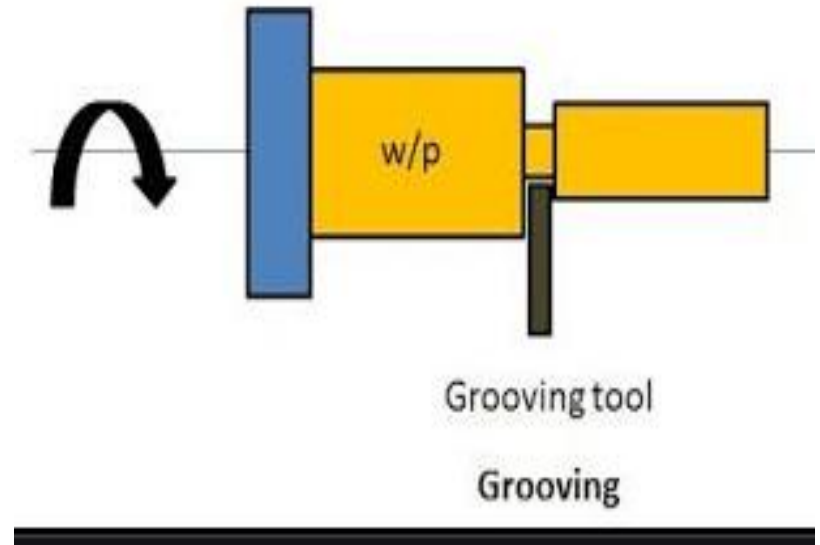
- *The term grooving usually applies to a process of forming narrow cavity of a certain depth on a cylinder, cone, or a face of the part.*
- *Parting uses a blade-like cutting tool plunged directly into the workpiece to cut off the workpiece at a specific length.*





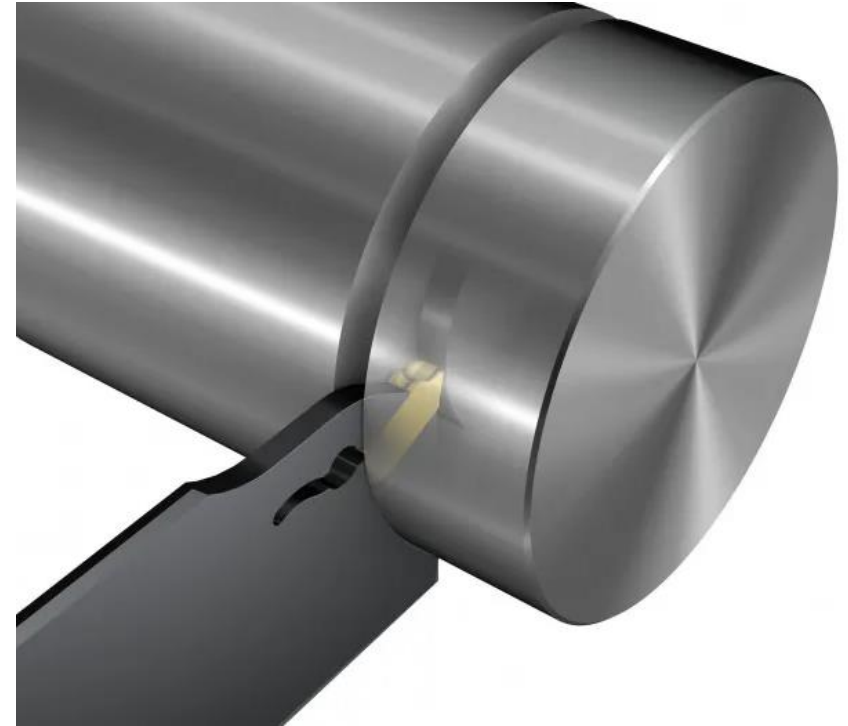
# Introduction to Grooving

- *Cutting tools for grooving are either external or internal type and uses a variety of inserts in different configurations.*
- *The difference between grooving and turning is the direction of cut .*
- *Grooving tool is normally used to cut in a single direction only.*
- *There is another application of a two axis simultaneous motion in grooving, a corner breaking on the grooves.*



# Introduction to Parting

- *Parting is the process whereby a part that has been made, or is wanted for another operation, on the end of a bar is cut off from the rest of the bar*
- *It is normally used to remove the finished end of a workpiece from the bar stock that is clamped in the chuck.*
- *Other uses include things such as cutting the head off a bolt.*



# *Needs and Applications of Grooving*

- *Grooving usually used to cut external or internal grooves, and many other machining operations.*
- *Grooving are often done on workpiece shoulders to ensure the correct fit for mating parts.*

# *Needs and Applications of Parting*

- *Parting process is used for producing machine components by slicing that from long workpiece.*
- *It is used to produce small objects like nuts ,bolts from a long piece.*

***From the above Topic we learnt about :***

- ***The Grooving/Parting operation***
- ***Usage of specific tools in Grooving and Parting***

# *Check Your Understanding*

**1. *Example of parting operation ?***

- A. *Finishing a square plate***
- B. *Grinding a bolt head***
- C. *Cutting the head off a bolt***
- D. *None***

**2. *Grooving tool is normally used to cut in how many directions ?***

- A. *Triple direction***
- B. *Double direction***
- C. *Single direction***
- D. *Multi direction***

# Check Your Understanding

*3. The difference between grooving and turning is the direction of movement .*

*A. True*

*B. False*

*4. Parting is normally used to remove the finished end of a workpiece from the bar stock that is clamped in the chuck.*

*A. True*

*B. False*

# *Check Your Understanding*

*5. ....is used to clamp the tool in lathe?*

- A. Carriage*
- B. Headstock*
- C. Tool post*
- D. None of these*

*6. Parting tool is looks like..... ?*

- A. Cutting teeth*
- B. Sharp plate*
- C. Ruler*
- D. Cutting blade*



# *Check Your Understanding*

*7. Which of the following processes are carried out in lathe machine?*

- A. Grooving*
- B. Parting*
- C. Knurling*
- D. All of These*

*8. Which is correct about Lathe machine ?*

- A. Mother of all machines*
- B. Conventional machine*
- C. Used to machine cylindrical parts*
- D. All of These*

# ***Answer Key***

- 1. C. Cutting the head off a bolt**
- 2. C. Single direction**
- 3. B. False**
- 4. A. True**
- 5. C. Tool post**
- 6. D. Cutting blade**
- 7. D. All of These**
- 8. D. All of These**

# ***Lathe Machine***

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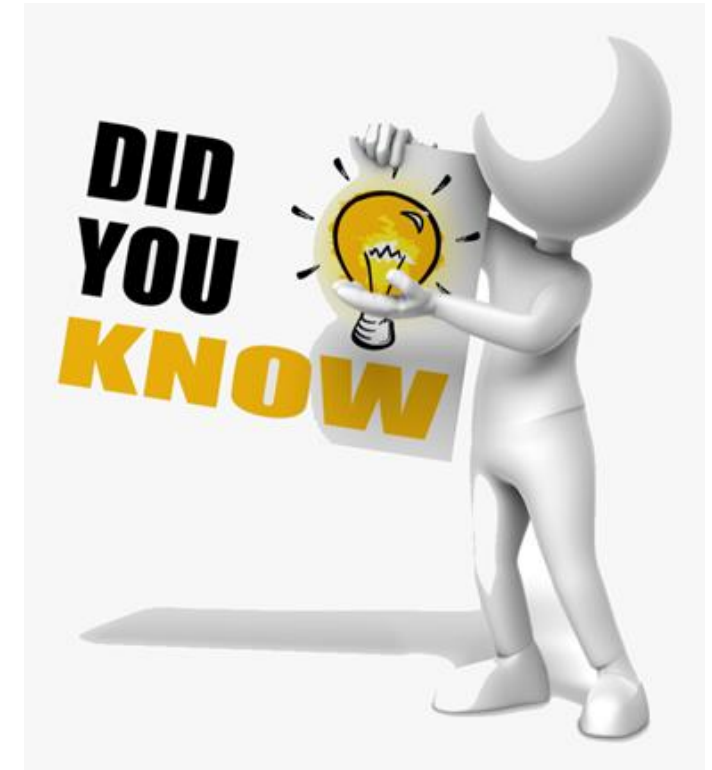
## ***Knurling***

***Upon completion of the course the student shall be able to:***

- ***Understand the Knurling operation .***
- ***Know the usage of knurling tool.***

# *Did you Know?*

- *Knurling is a process of impressing a diamond shaped or straight line pattern into the surface of a workpiece by using specially shaped hardened metal wheels to improve its appearance and to provide a better gripping surface.*



# Introduction to Knurling

- *The knurling tool must be set in the tool post with the axis of the knurling head at centre height and the face of the knurls parallel with the workpiece surface.*
- *A slow speed is needed with a medium feed. Commonly, the speed is set to 60 to 80 RPM, while the feed is best from 0.04 mm to 0.08 mm revolution of the spindle.*
- *Check that the rollers move freely and are in good cutting condition; then oil the knurling tool cutting*



# Knurling Tools

- *Two common types of knurling tools are the Knuckle joint and Revolving head type of knurling tools.*
- *The knuckle joint type is equipped with a single pair of rollers that revolve with the workpiece as it is being knurled.*
- *The revolving head type of tool is fitted with three pairs of rollers so that the pitch can be changed to a different knurl without changing the setup.*



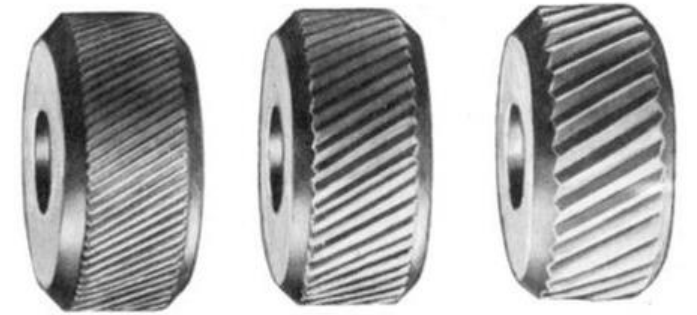
Revolving head knurling tool



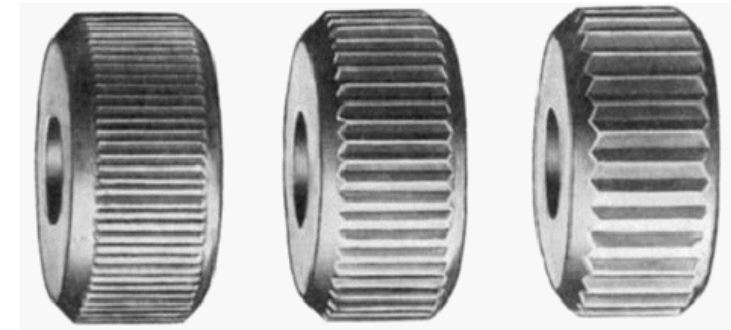
Knuckle joint knurling tool

# Knurling Patterns

- *There are two knurl patterns, diamond and straight type.*
- *There are three pitches of rollers that are coarse, medium, and fine.*
- *The diamond is the most common pattern and the medium pitch is used most.*
- *The coarse pitch is used for large diameter work while the fine pitch is used for small diameter work.*



Diamond pattern - Fine, Medium and Course



Straight pattern - Fine, Medium and Course



# *Needs and Applications of knurling*

- *Knurling used for tools for better griping.*
- *Appearance of workpiece can be improved by Knurling operation.*

***From the above Topic we learnt about :***

- ***The Knurling operation***
- ***Usage of Knurling tools***

# Check Your Understanding

1. *How many types of patterns are used in knurling?*
  - A. 3
  - B. 2
  - C. 5
  - D. 10
2. *Which type of knurling tool consists three pair of rollers ?*
  - A. *Revolving head type*
  - B. *Knuckle joint type*
  - C. *Straight type*
  - D. *None of These*

# Check Your Understanding

*3. There are two knurl patterns, diamond and straight type.*

*A. True*

*B. False*

*4. There are three pitches of rollers that are coarse, medium, and fine.*

*A. True*

*B. False*

# Check Your Understanding

**5. ....is a lathe operation?**

- A. Hitting**
- B. Knurling**
- C. Filing**
- D. None of these**

**6. The face of the knurls  
..... with the workpiece  
surface ?**

- A. Inclined**
- B. Perpendicular**
- C. Parallel**
- D. None**

# Check Your Understanding

**7. Which of the following is a type of knurling pattern?**

- A. Diamond**
- B. Straight**
- C. Both A and B**
- D. None of them**

**8. Which of the following statement is correct about knurling ?**

- A. There are two types of knurling tool**
- B. Knurling is used to make pattern on work**
- C. Knurling tool is used**
- D. All of These**

# ***Answer Key***

- 1. B. 2**
- 2. A. Revolving head type**
- 3. A. True**
- 4. A. True**
- 5. B. Knurling**
- 6. C. Parallel**
- 7. C. Both A and B**
- 8. D. All of These**

# ***Lathe Machine***

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## ***Threading***

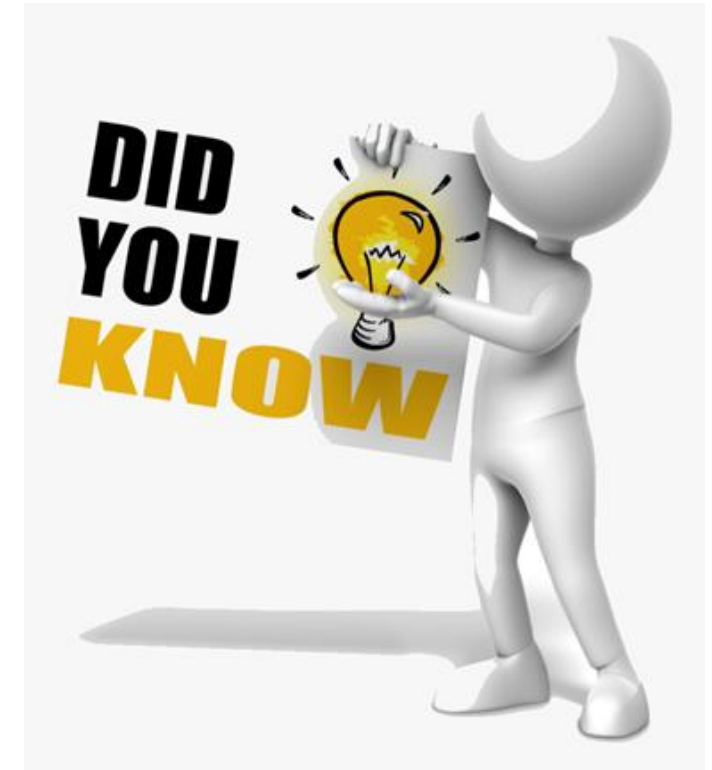


*Upon completion of the course the student shall be able to:*

- *Understand the Threading operation .*
- *Know the usage of tools during Threading.*

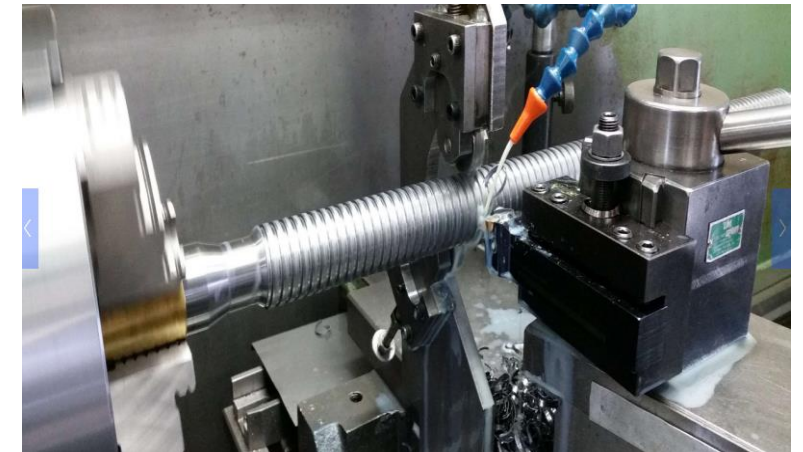
# *Did you Know?*

*• Thread cutting on the lathe is a process that produces a helical ridge of uniform section on the workpiece. This is performed by taking successive cuts with a threading tool and the same shape as the thread form required.*



# Introduction to Threading

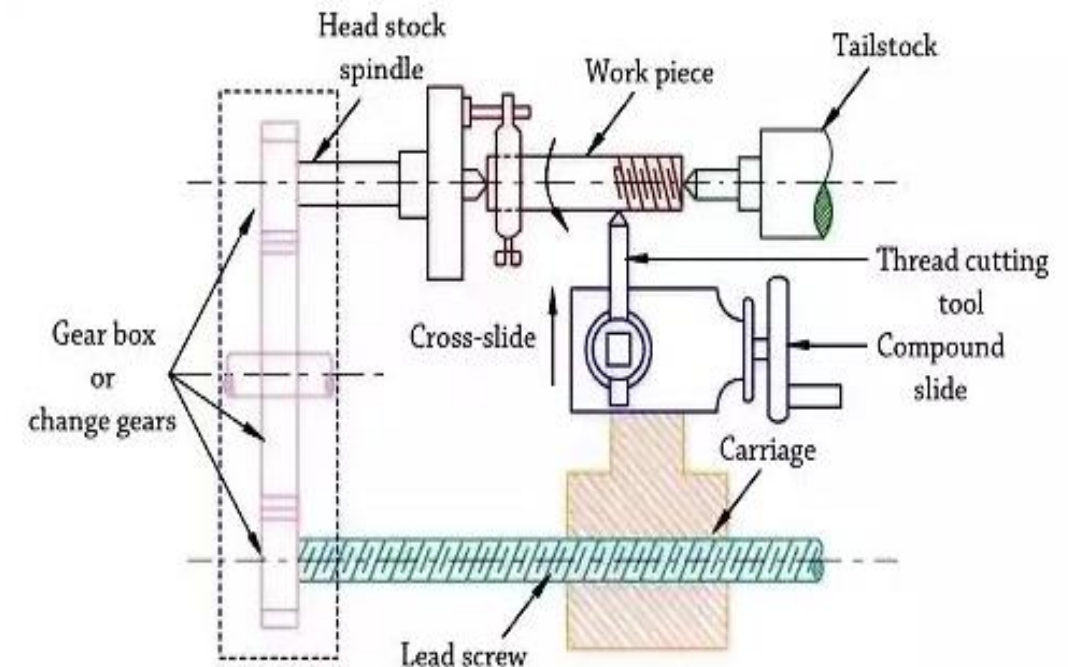
- *Thread cutting operation is done on lathe using a thread cutting tool.*
- *The workpiece is held in a chuck and the tool is held in tool post.*
- *For producing threads of pitch ' $p$ ' mm, the tool must travel a distance equal to ' $p$ '(mm) as the workpiece makes one complete rotation.*
- *The definite relative rotary and linear motion between the workpiece and tool is*



# Threading

- *The following relationship is used to determine the gears/wheels required to generate threads of definite pitch.*

$$\text{Gearing Ratio} = \frac{\text{Pitch of screw to be cut}}{\text{Pitch of lead screw}}$$



# *Needs and Applications of Threading*

- *Threading operation is carried out on lathe for making threads on a long bar.*
- *Any kind of nut and bolt engagement can be achieved by threading process.*

*From the above Topic we learnt about :*

- *The Threading operation*
- *Usage of Threading tool*

# *Check Your Understanding*

1. *Which tool is used for threading in lathe machine?*
2. *Which is used to hold the workpiece during threading?*

- A. Cutter*
- B. Threading tool*
- C. Milling cutter*
- D. Drill bit*

- A. Tailstock*
- B. Headstock*
- C. Tool post*
- D. None of These*

# Check Your Understanding

***3. Thread cutting operation is done on lathe using a thread cutting tool.***

***A. True***

***B. False***

***4. The definite relative rotary and linear motion between the workpiece and tool is achieved by locking or engaging the carriage with the lead screw.***

***A. True***

***B. False***



# Check Your Understanding

**5. .... Is an operation can be done by lathe ?**

- A. Marking**
- B. Milling**
- C. Filing**
- D. Threading**

**6. Threading tool is a .....?**

- A. Single point cutting tool**
- B. Multi point cutting tool**
- C. Two point cutting tool**
- D. None**

# Check Your Understanding

***7. Gearing ratio depends on which of the following parameters?***

- A. Pitch of screw to be cut***
- B. Pitch of lead screw***
- C. Both A and B***
- D. None of them***

***8. Which is wrong about threading operation performed on lathe?***

- A. Multi point cutter used***
- B. Chuck is removed***
- C. No effect on Lead screw***
- D. All of These***

# ***Answer Key***

- 1. B. Threading tool**
- 2. B. Headstock**
- 3. A. True**
- 4. A. True**
- 5. D. Threading**
- 6. A. Single point cutting tool**
- 7. C. Both A and B**
- 8. D. All of These**