Basic Mechanical Engineering

PRACTICAL

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Practical

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NOTE

All dimensions are given in mm. The diameter of the round rod is given as 20 mm. The design of the exercises may be modified according to the size of the material available.

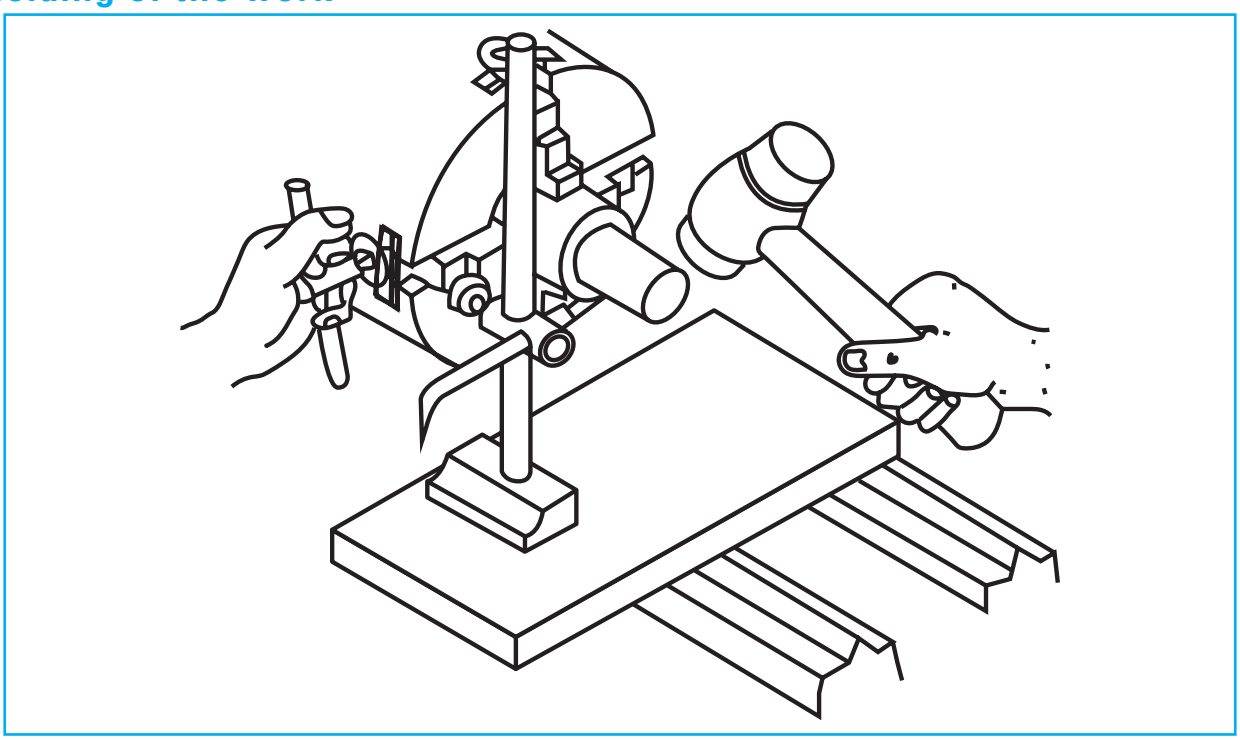
Points to be considered while working on a lathe

Some important points are to be considered before setting on to work on a lathe. They are

1. The suitable method of holding different types of work according to their shape.
2. Selection of proper cutting speed according to the size, weight, material of the work and the type of the operation.
3. Selection of proper cutting tool.
4. Mounting of the selected tool on the tool post.

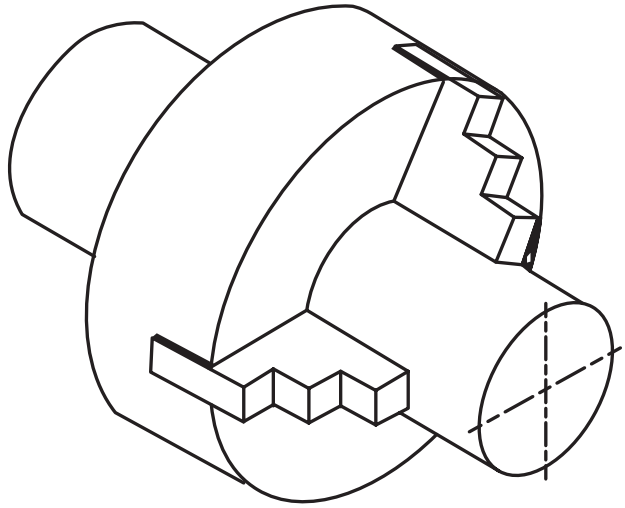
The following illustrations are given to provide a good idea of holding a work, cutting speed, types of tools and setting of the tool.

Holding of the work

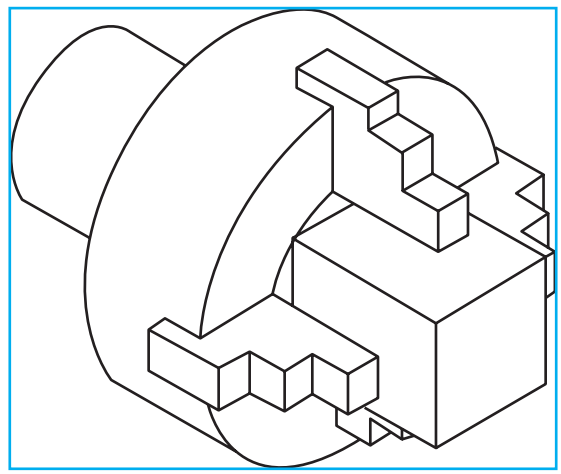


Holding of the work

The method of setting the work in a four jaw chuck with the help of a surface gauge



A cylindrical work is held in a three jaw chuck



A rod of square section is held in four jaw chuck

Cutting speed

Speed can be defined as the distance an object moves in a particular time. In a lathe, the cutting speed is the distance travelled by a point on the outer surface of the work in one minute. It is expressed in meters per minute.

$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

Where,

'd' – is the diameter of the work in mm.

'n' – is the r.p.m. of the work.

π = 22/7 (or) 3.14

Table showing cutting speed for various materials

Work Material	Cutting tool material		
	High speed steel	Tungsten steel	Stellite
Mild steel	30 m/min	80 m/min	58 m/min
High carbon steel	26 m/min	65 m/min	50 m/min
Cast steel	15 m/min	80 m/min	42 m/min
Cast iron	22 m/min	80 m/min	50 m/min
Aluminium	90 m/min	400 m/min	330 m/min
Brass	61 m/min	200 m/min	33 m/min

Tools used in a lathe

A. According to the construction. The lathe tools are classified into three types

1. Solid tool
2. Brazed tipped tool
3. Tool bit and tool holders

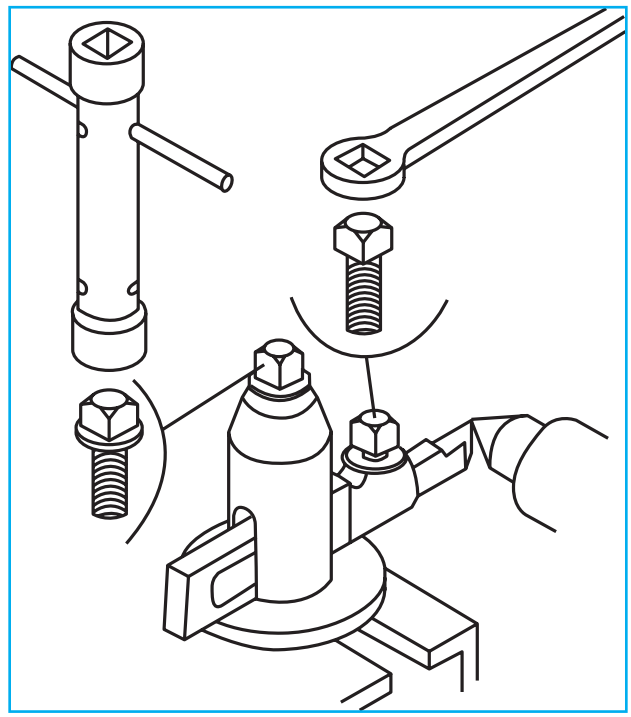
B. According to the operation to be performed, the cutting tools are classified as

1. Turning tool
2. Thread cutting tool
3. Facing tool
4. Forming tool
5. Parting tool
6. Grooving tool
7. Boring tool
8. Internel thread cutting tool
9. Knurling tool

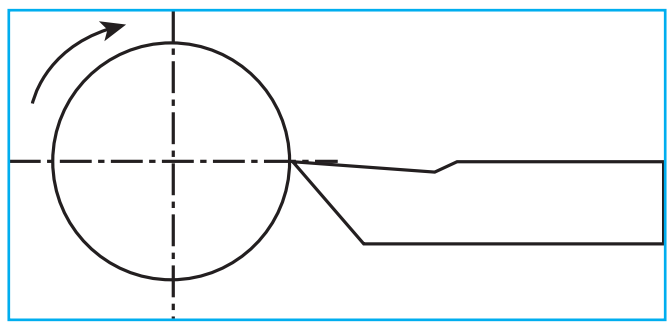
C. According to the direction of feed movement, the following tools are used

1. Right hand tool
2. Left hand tool
3. Round nose tool

Method of mounting the cutting tool on the tool post

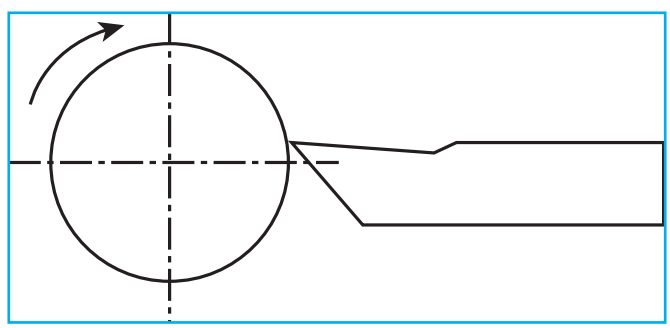


Correct method



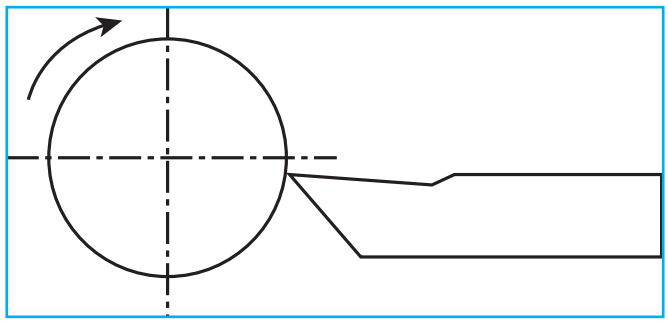
The cutting edge of the cutting tool is positioned exactly aligned to the axis of the lathe spindle.

Incorrect method-1



If the cutting edge of the cutting tool is positioned above the axis of the lathe spindle, the front clearance surface of the tool drags on the work. The cutting edge loses its cutting capacity due to wear.

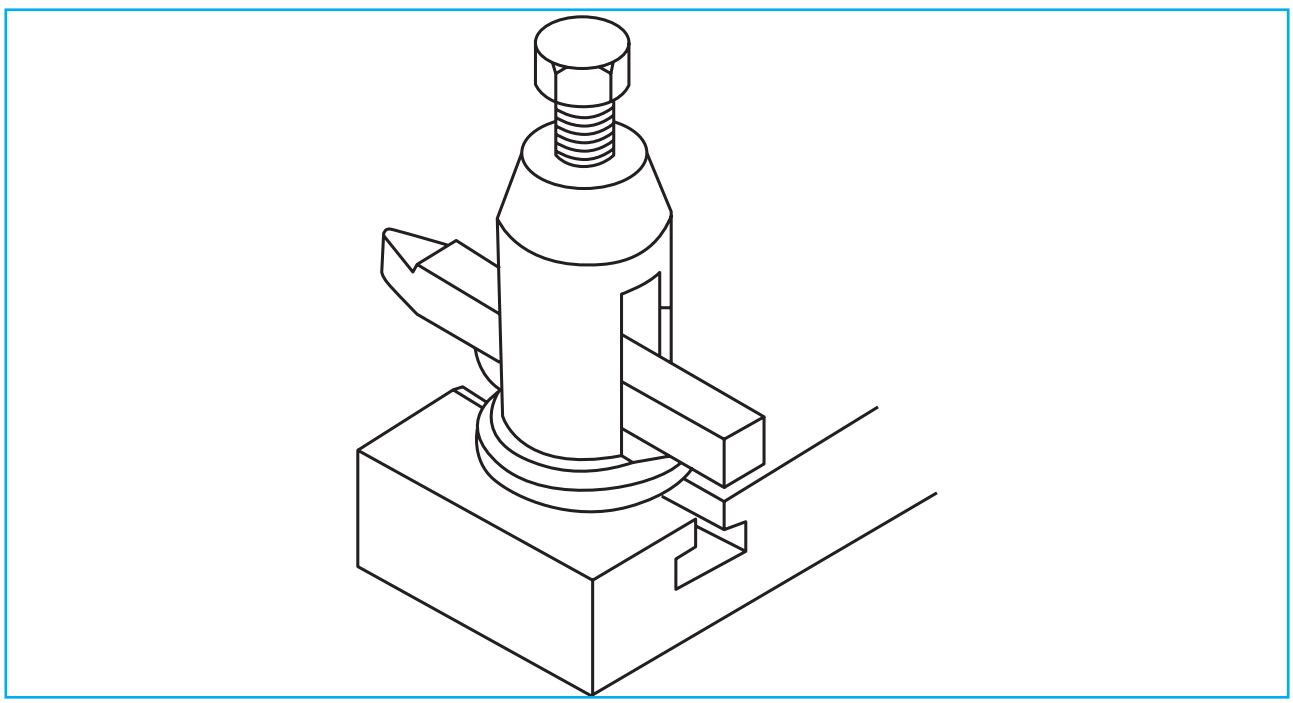
Incorrect method-2



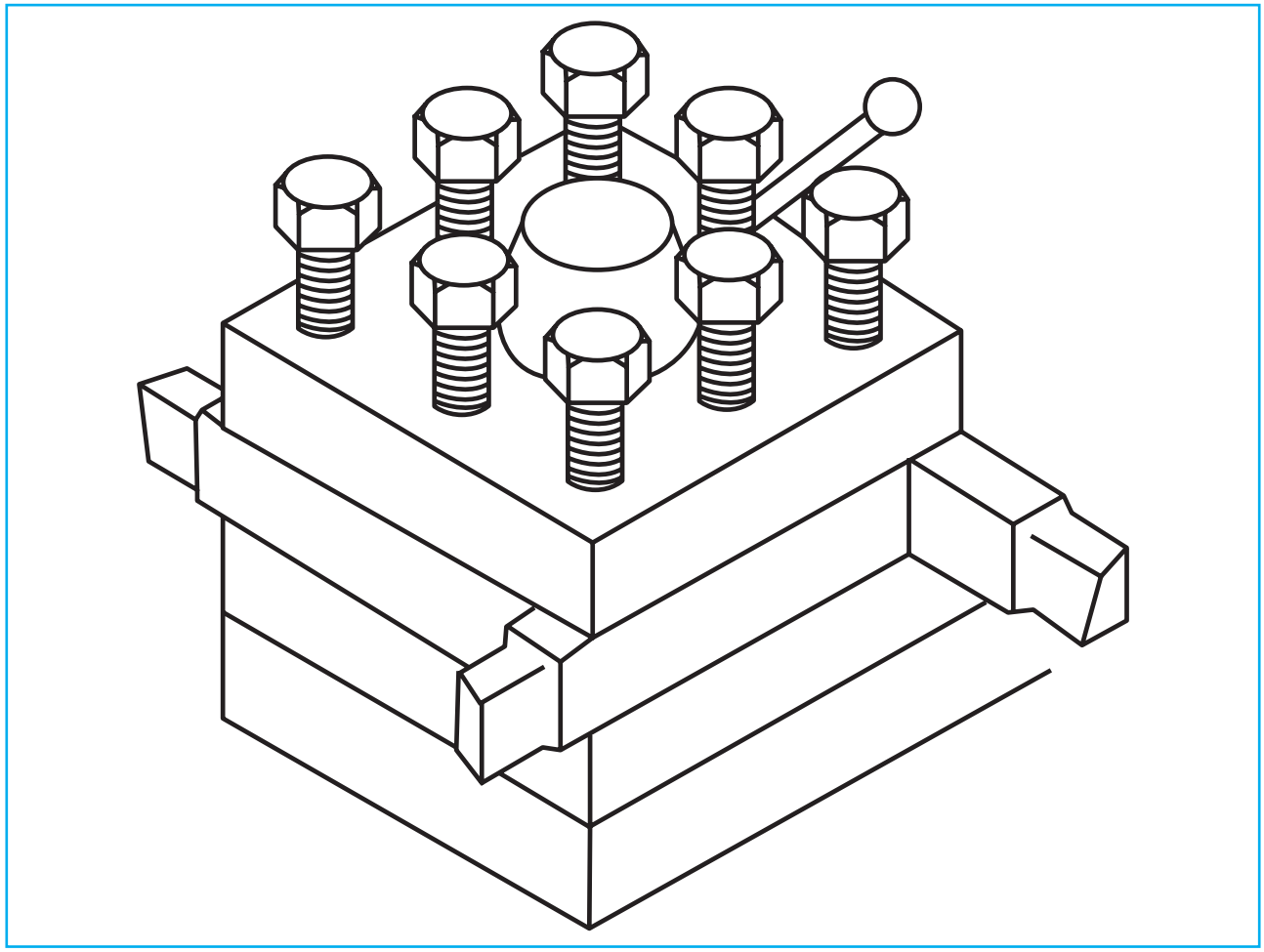
If the cutting edge of the cutting tool is positioned above the axis of the lathe spindle, the cutting edge loses its keenness. When the tool is provided with depth of cut, the work rides over the tool. The cutting edge may be broken and the work surface is damaged.

Types of toolposts

Single screw toolpost



Four way toolpost



Facing

Aim

- To machine a flat surface on the face of the given round rod (Facing)

Required instruments

1. Facing tool
2. Chucky key
3. Tool holder
4. Steel rule
5. Vernier Caliper
6. Surface gauge

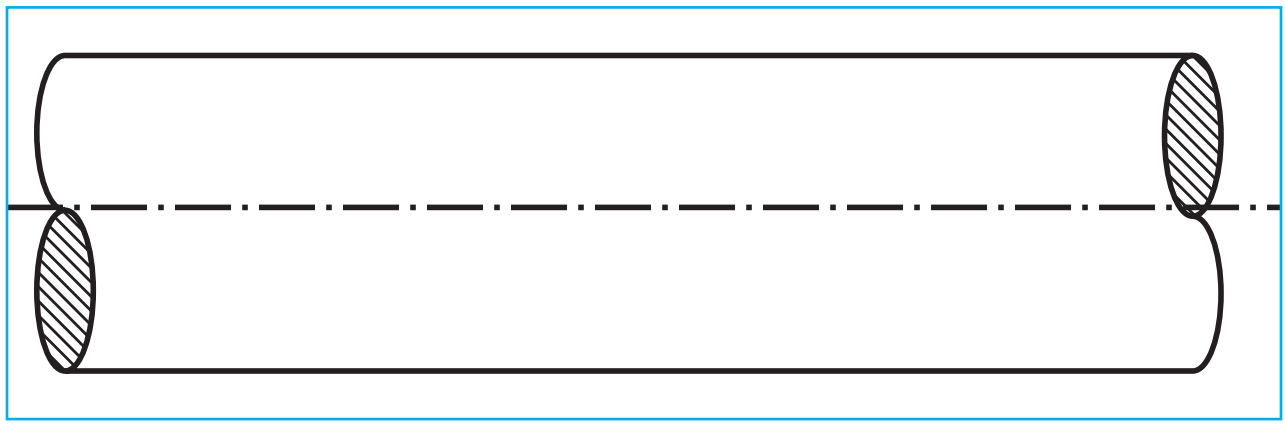
Tool setting

A facing tool is mounted on the toolpost and its cutting edge is set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

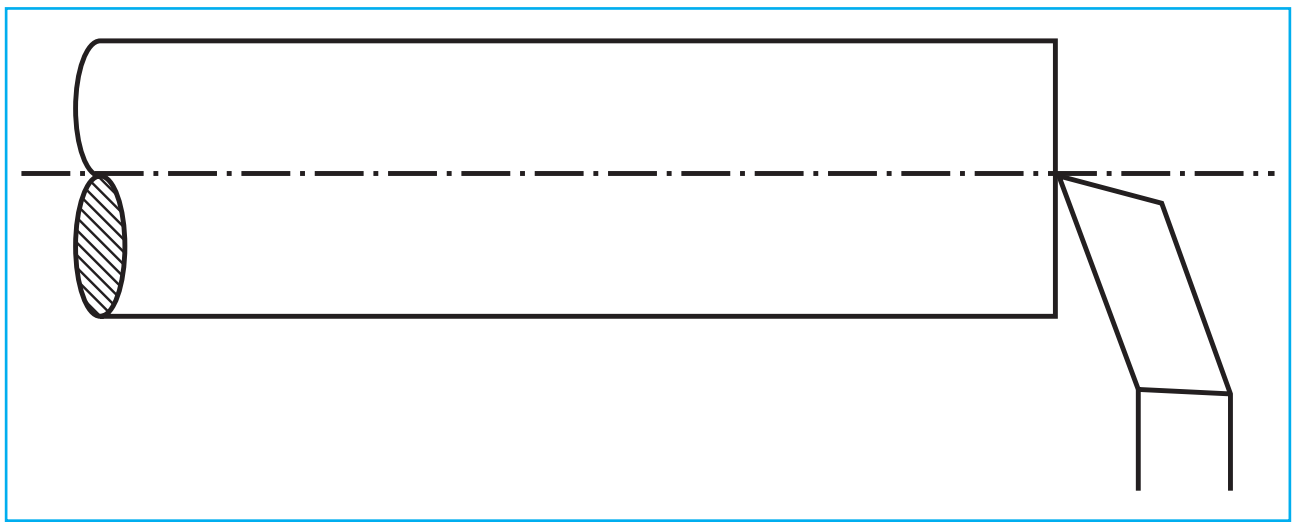
Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Exercise – 1



Operation – 1



Selection of cutting speed

Cutting speed = $\frac{\pi DN}{1000}$ m/min.

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

Procedure

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 02

Facing & Plain Turning

Aim

- To machine a flat surface on the face of the given round rod (Facing) and to perform plain turning operation to produce a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

Tool setting

A facing tool and a plain turning are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

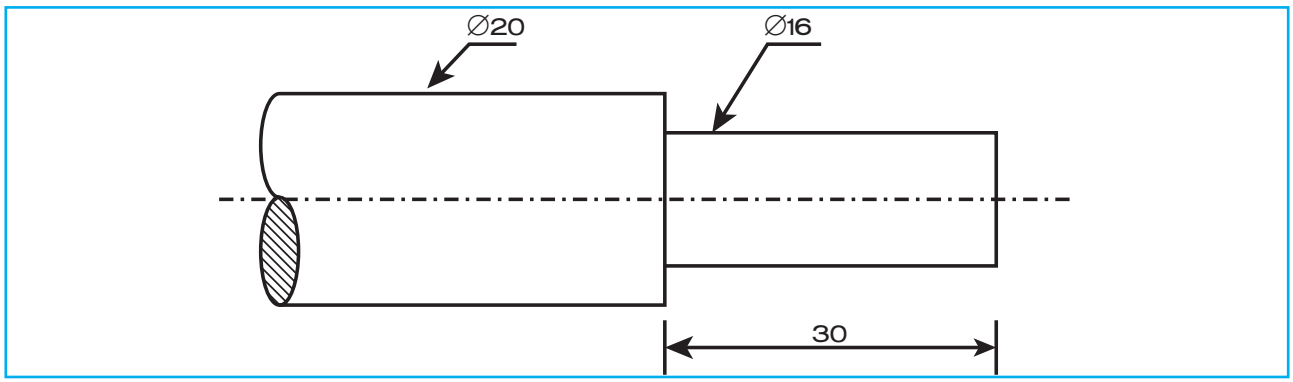
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

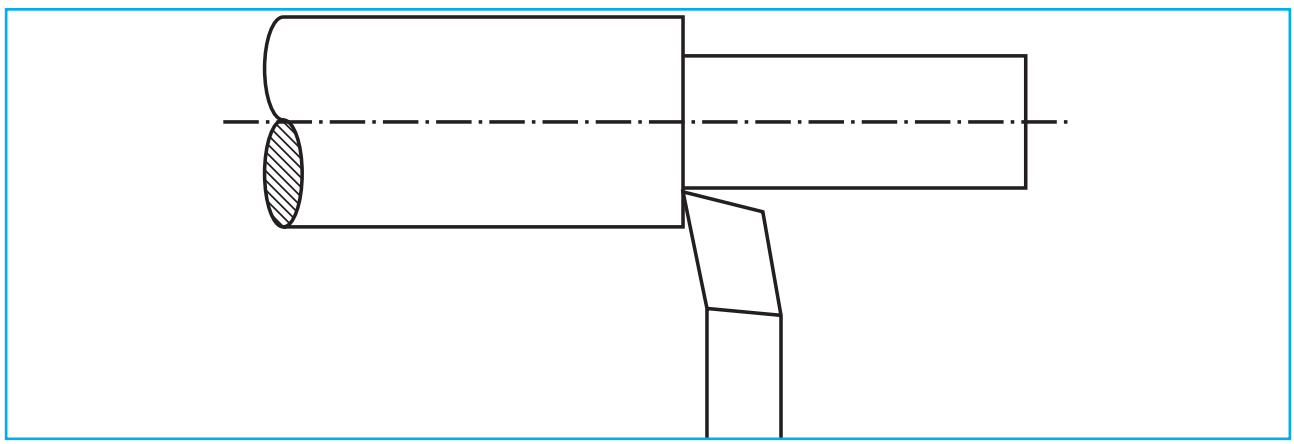
Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

Exercise – 2



Operation – 1



Marking

Marking is done on the work at the required point to indicate the length to be plain turned.

Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.
2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.
3. During the process, the diameter of the work is checked with the help of outside caliper.
4. Finishing tool is used to obtain accurate dimensions of length and diameter.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 03

Step turning

Aim

- To perform step turning operation to produce a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

Tool setting

A facing and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

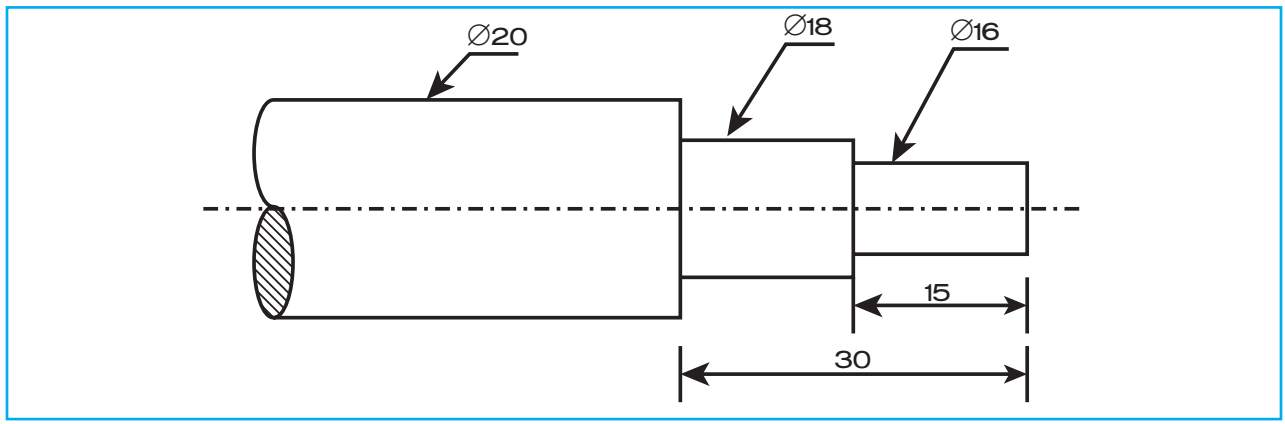
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

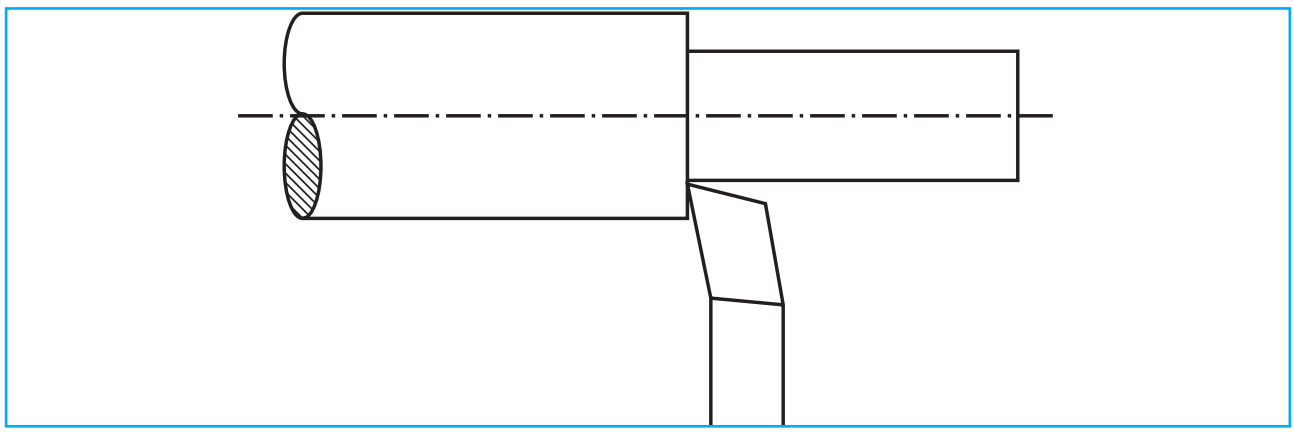
Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

Exercise – 3



Operation – 1



Marking

Marking is done on the work at the required point to indicate the length of the steps to be turned.

Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.
2. The above process is repeated until the required diameter is obtained. The length should be equal to the sum of the lengths of larger and smaller diameter.
3. When the larger step of given diameter is obtained, the tool is again fed parallel to the lathe axis to the given length of smaller step. Depth of cut is gradually given by the cross-slide to get the smaller step of required length and diameter.
4. Finishing tool is used to obtain accurate dimensions of length and diameter.
5. During the process, the dimensions of the work are checked with the help of outside caliper and inside calipers.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 04

Step Turning and Chamfering

Aim

- To perform step turning and chamfering operations to produce a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. Chamfering tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

Tool setting

A facing tool, a plain turning tool and a chamfering tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

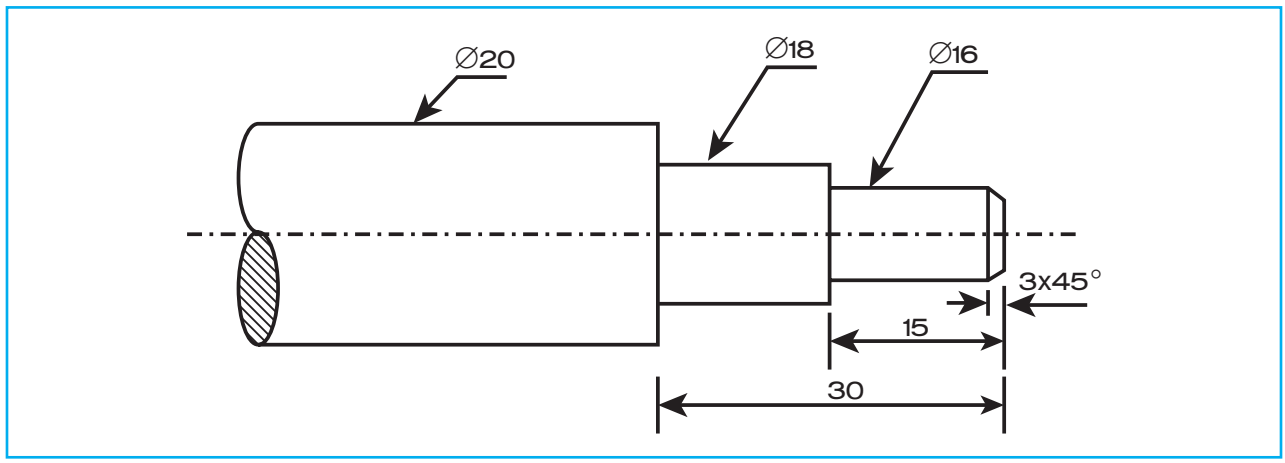
1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

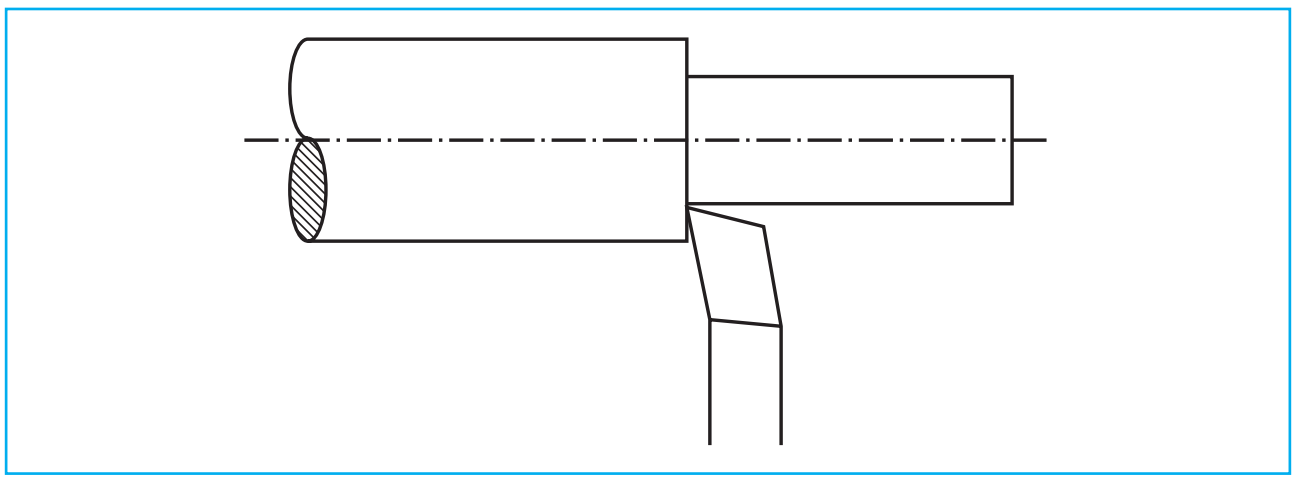
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

Exercise – 4

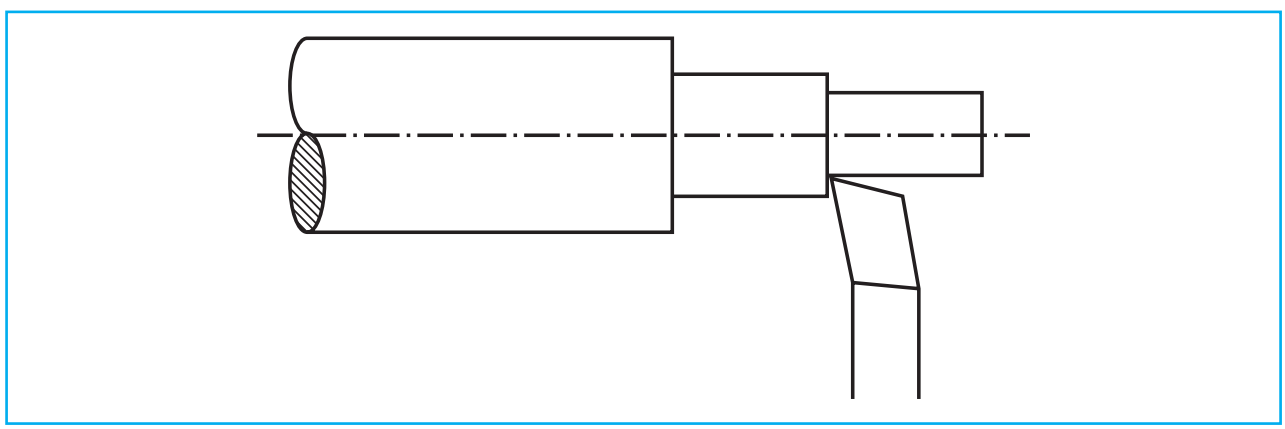


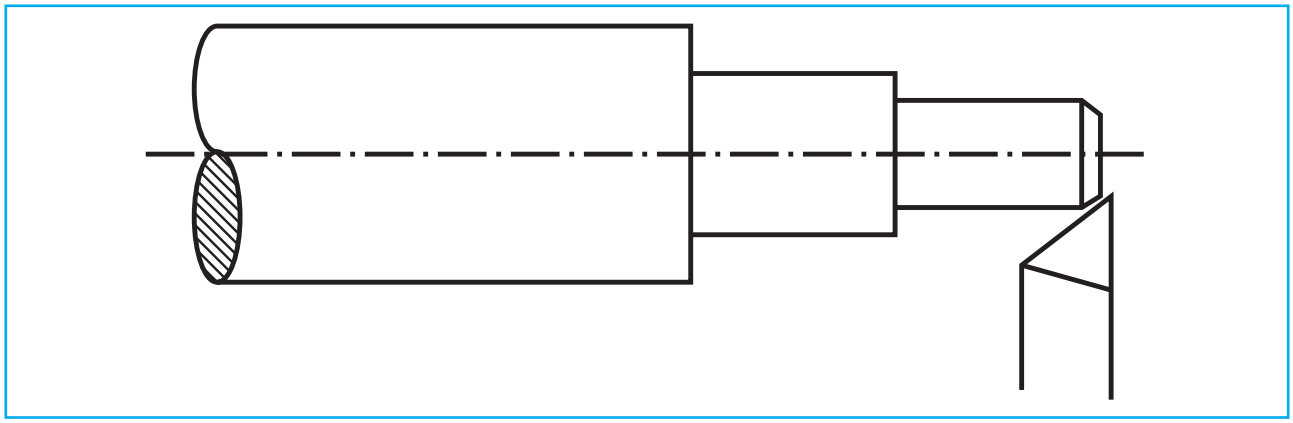
Operation – 1



Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface of the face of the work is generated.





Marking

Marking is done on the work at the required point to indicate the length of the steps to be turned.

Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.
2. The above process is repeated until the given larger diameter is obtained. The length should be equal to the sum of the lengths of larger and smaller diameter. When the larger step of given diameter is obtained, the tool is again fed parallel to the lathe axis to the given length of smaller step. Depth of cut is gradually given by the cross-slide to get the smaller step of required length and diameter.
3. During this process, the dimensions of the work are checked with the help of outside caliper and inside calipers.
4. Finishing tool is used to obtain accurate dimensions of length and diameter.
5. The chamfering tool (form tool) is set at the work at the required angle. Feed is given to the tool by the cross-slide to perform chamfering.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 05

Taper Turning

Aim

- To perform taper turning to produce a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

Tool setting

A facing tool and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

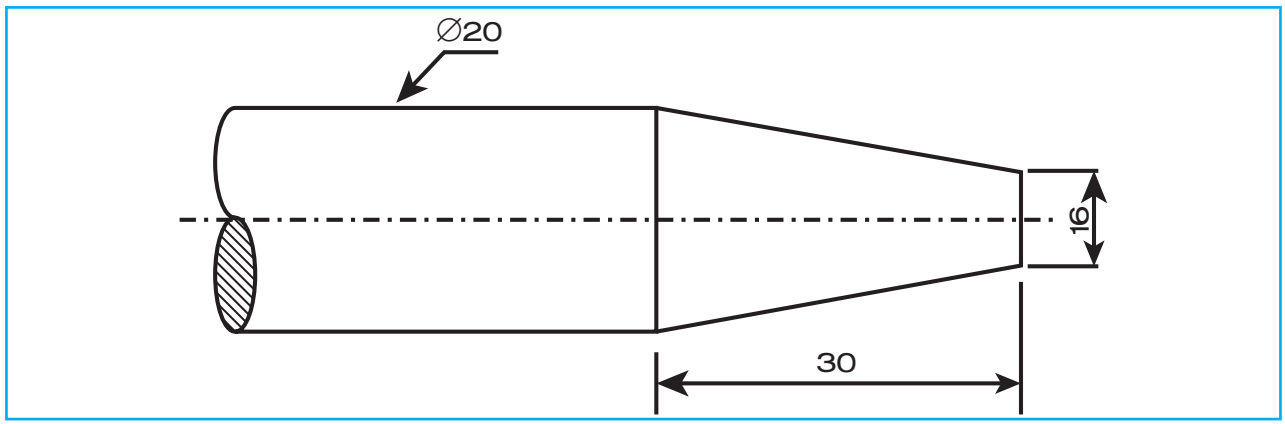
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

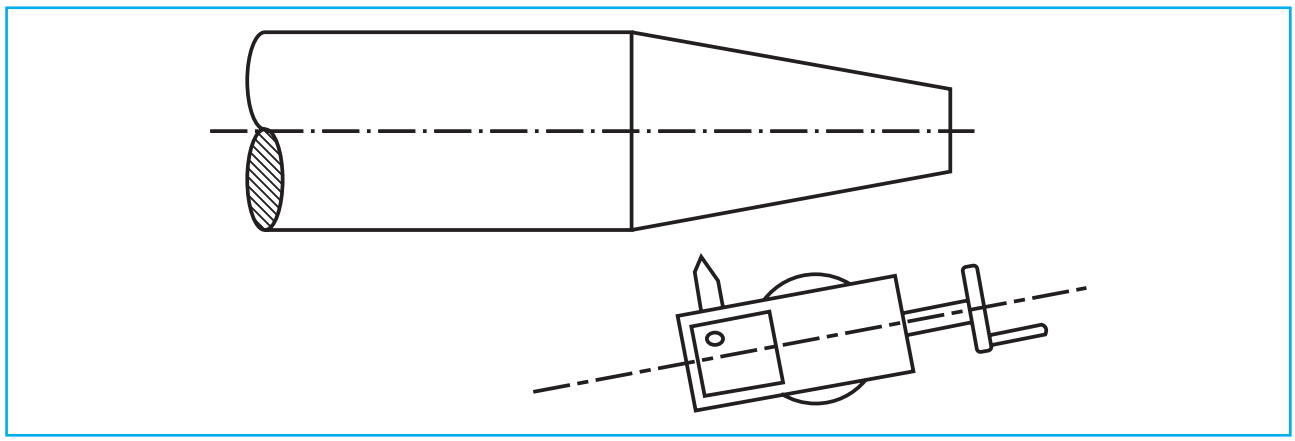
Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

Exercise – 5



Operation – 1



Marking

Marking is done on the work at the required point to indicate the length of the steps to be turned.

Procedure

1. The angle (θ) through which the compound slide is to be swiveled is calculated by the formula

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

   where
   'D' is the larger diameter
   'd' is the smaller diameter and
   'l' is the length of the taper

2. The compound slide is swiveled to the angle calculated as above.
3. The depth of cut is set by adjusting the cross-slide.
4. The plain turning tool mounted on the toolpost is given feed by the compound slide at the required angle to the lathe axis.
5. The above process is repeated until the taper required length is obtained. This is done by adjusting the cross-slide for depth of cut and compound slide for feed.
6. While doing so, feed is provided from smaller diameter to larger diameter.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 06

Knurling

Aim

- To perform knurling operation on a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. Knurling tool holder
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

Tool setting

A facing and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

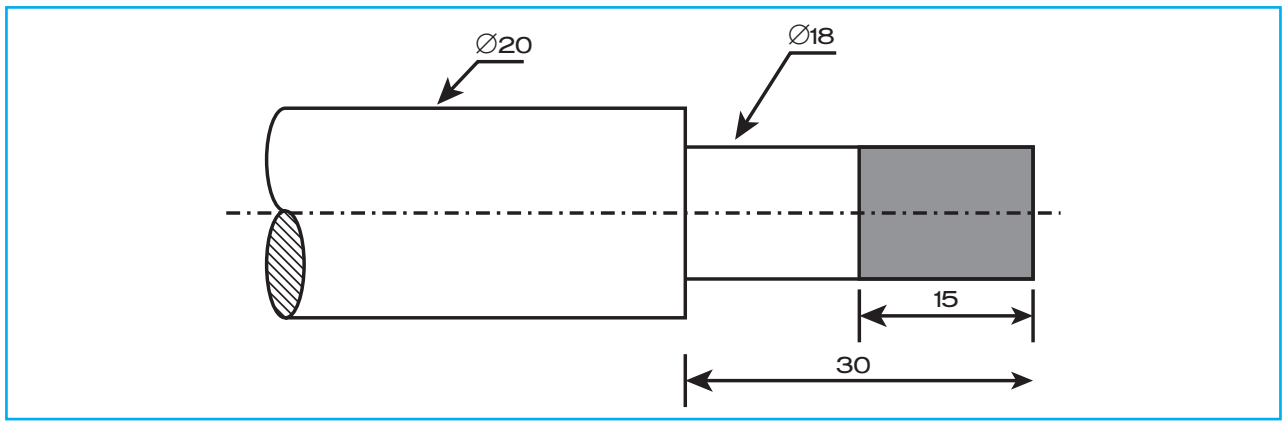
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

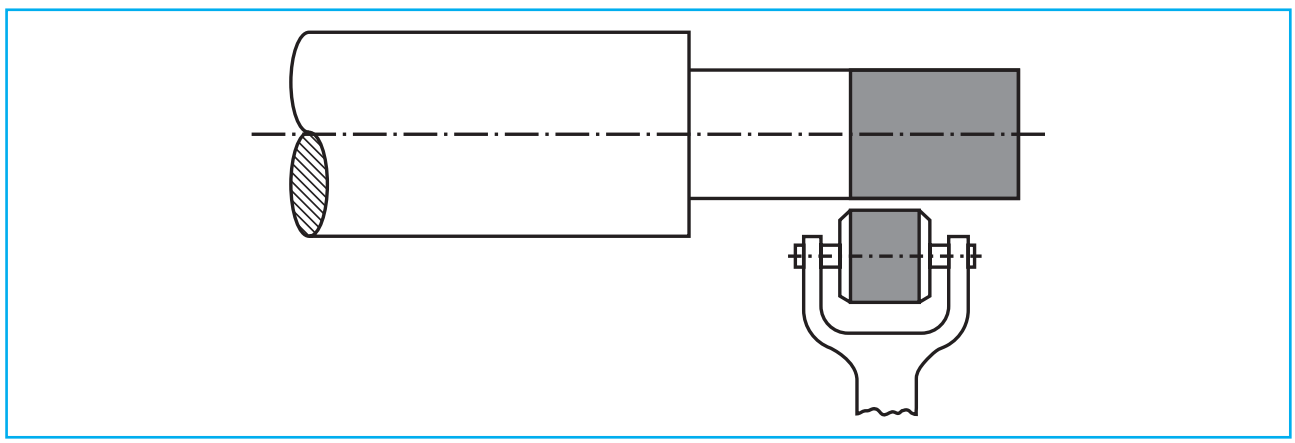
Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

Exercise – 6



Operation – 1



Marking

Marking is done on the work at the required points to indicate the length of the portion to be knurled.

Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.
2. The above process is repeated until the required diameter is obtained. This is done by the gradually moving the cross-slide after each cut.
3. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.
4. Finishing tool is used to obtain accurate dimensions of length and diameter.
5. A knurling tool holder has one or two knurling rolls fitted to it. It is fitted on the toolpost and pressed against the work rotating at a slower speed. The feed is given by the carriage parallel to the lathe axis.
6. The knurling tool holder is relieved from the work after the operation is performed for the required length.

Result

The finished piece of work is sent for inspection after the machining is over.

EXERCISE 07

Grooving

Aim

- To machine a groove of given width and depth on a cylindrical part of given dimensions.

Required instruments

1. Facing tool
2. Plain turning tool
3. Parting tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

Tool setting

A facing tool, a plain turning tool and a parting tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0^0 mark.

Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

Selection of cutting speed

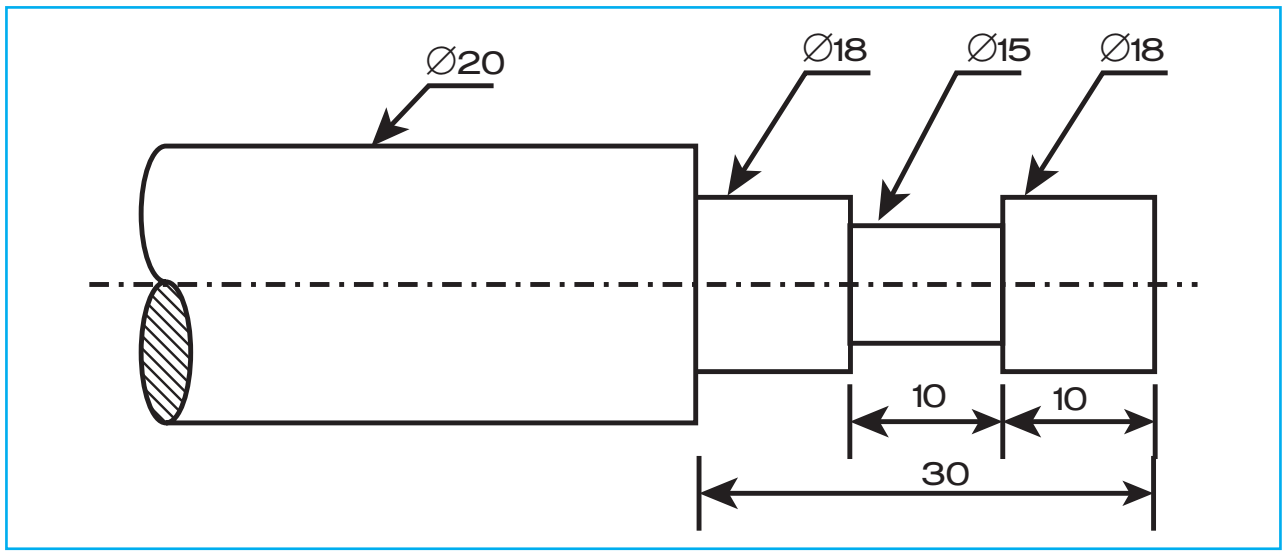
$$\text{Cutting speed} = \frac{\pi DN}{1000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

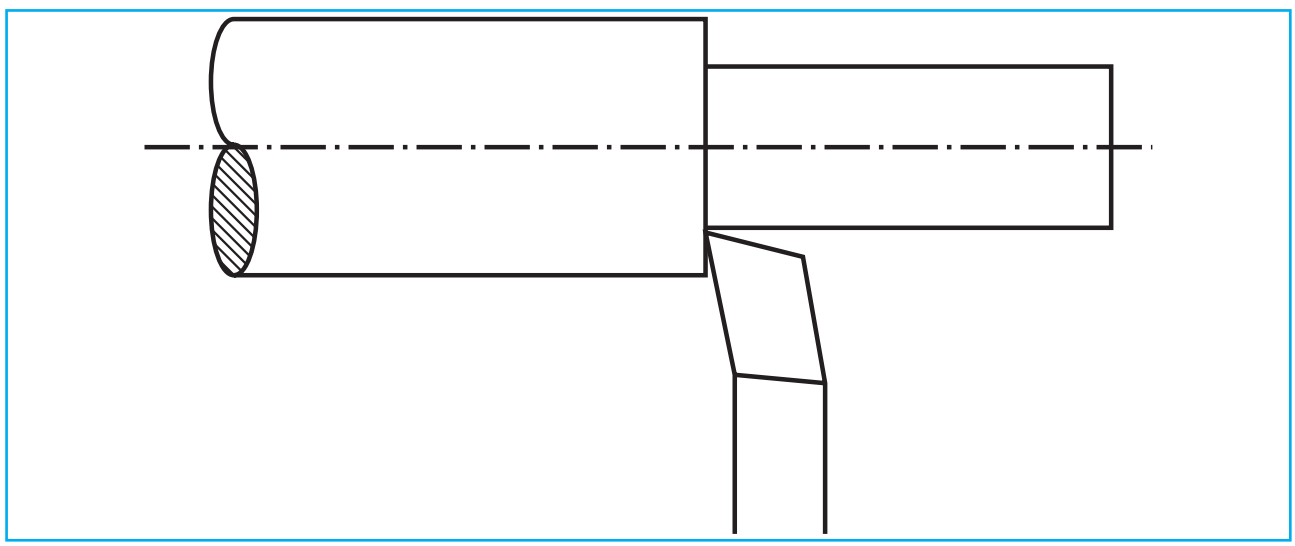
Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

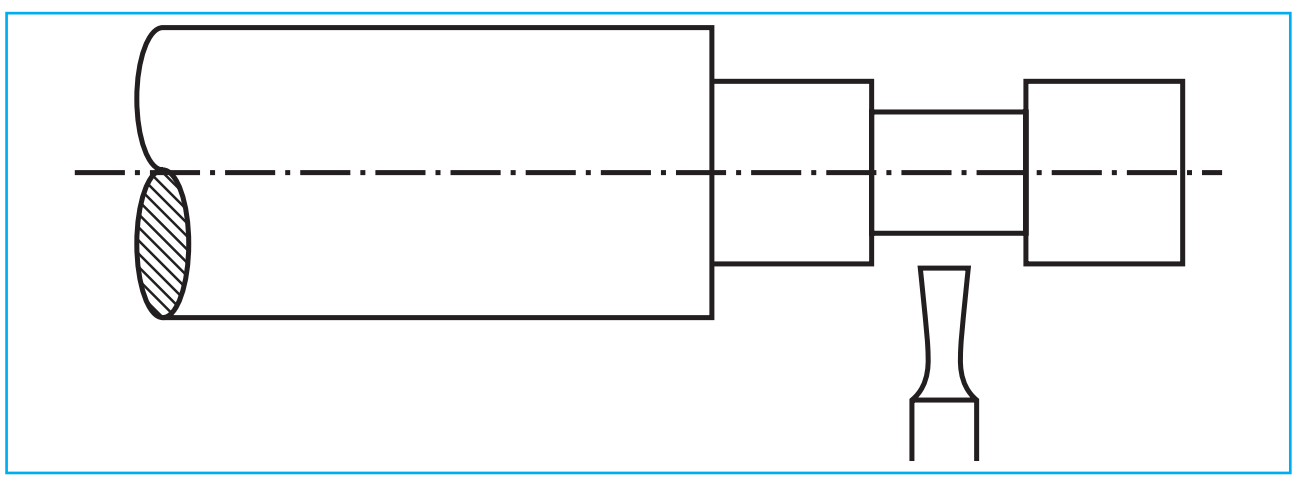
Exercise – 7



Operation – 1



Operation – 2



Marking

Marking is done on the work at the required points to indicate the location of the groove after plain turning is performed to the required diameter.

Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.
2. The above process is repeated until the required diameter is obtained. This is done by the gradually moving the cross-slide after each cut.
3. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.
4. Finishing tool is used to obtain accurate dimensions of length and diameter.
5. The parting tool is brought to the marked location of the groove. The depth of cut is set by the cross-slide and the feed is provided by moving the carriage slowly between the marked points.
6. The above process is repeated until the required depth and the length of the groove is obtained.

Result

The finished piece of work is sent for inspection after the machining is over.

C. Ravi,

3, Babu Nagar, Jolarpettai, Vellore District – 635 851.

Educational Qualification

- Passed SSLC, March 1987 in Government Boys Hr. Secondary School, Jolarpet.
- Passed +2 – HSC – Vocational – General Machinist section (Now called as 'Basic Mechanical Engineering) in April,, 1989 at Government boys Hr Sec School, Natrampalli, Vellore District – 635 852.
- Passed B.Sc., (Maths) at Majharull Ulum college, Ambur in vellore Dt.

Professional Experience

- Worked as Technical Assistant at J.T.C. Network Company, Singapore in 1994-1997.
- Worked as Technical Assistant at private construction company, Singapore in 1997-2003.
- In between 2003-2010, I became owner of brick industry and then worked as supervisor in R.K. International Private Ltd, Chennai.
- Worked as supervisor in Matrix Skill Development Company Jolerpet which selects man power for abroad in 2010-2016.
- I am running company known as "CRS agarbathies", private Limited, Jolarpettai producing agarbathies with above 300 machineries and above 500 workers.
- I proud of my school so I built an auditorium of the value Rs. 4.5 lakhs for the use of students of Government Boys Hr. Sec. School, Natrampalli, Vellore District.

For the improvement of my life, my elementary education and Higher Secondary General Machinist Vocational course are very useful. Encouragement and advices of my vocational teacher Thiru. C. Ravivarman is always memorable in my life.

Declaration:

I hereby declare that all above are true to the best of my knowledge and I am doing my profession with interest and dedication.

Yours faithfully

C. Ravi
Jolarpet

A. Senthil Kumar,
Sri Sakthi engineering, A-15,
Sidco Industrial Estate, Phase – 3,
Guindy, Chennai – 600 032.

Educational Qualification:

- Passed HSC (+2) Vocational Course General Machinist (Now called as "Basic Mechanical Engineering) section with 72% mark in March 1991 in Government Boys Higher Secondary School, Arni, Thiruvannamalai District.
- Passed in Diploma in Mechanical engineering with 76% mark in 1994 at Meenakshi Ammal Polytechnic, Uttiramerur, chengalpet District.

Professional experience:

- My professional career starts with CNC machine trainer at two small industries in 1994-2007.
- I went to Japan country and worked as Design Engineer for one year in 2007.
- In between 2008-2013, I worked as Design Engineer in an American Company.
- From 2013, I am running small scale industry called as "Sree Sakthi engineering" in Guindy. I offer job opportunities for students those passed in HSC – Basic Mechanical Engineering.
- I always remember my Vocational teachers Thiru. N. Palanivelu and Thiru. C. Velmurugan for their part in my life. They taught me discipline, tiredless work and dedication. These are the factors used for improvement of my life.

Declaration:

I hereby declare that all above are true to the best of my knowledge and I always remember "work is workship".

Yours faithfully

A. Senthilkumar

Chennai-32

M. Surya

No. 12 g1 Krishna Castle,
Color Homes TTK Nagar, West Tambaram,
Kanchipuram, Chennai – 600 045.

Educational qualification

- Completed my Higher Secondary Education in General Machinist Vocational Group in the year 2011 securing 70% marks in Boys Higher Secondary School, Vandavasi, Thiruvannamalai Dt.,
- Passed Bachelor of Technology in civil engineering branch in the year 2015 with securing 65% marks, Bharat Institute of Technology, Deemed University, Chennai.

Professional experience

- Started Man Power Agency at 2015 coordinate with Prestige company. Associated with AGS Constructions, Medavakkam worked as Manager during CASA Grande Project in 2016-17. A sole Proprietor of GS Constructions and Landscape, Chennai started in April 2018.

Skill Matrix

- Strength and Durability Properties Of Concrete By Using Florescent Light Tube Powder Replacing As Cement
- This project is strength and durability of concrete by using fluorescent light scrap comparing it with the conventional mix.

Area of Interests

- Site Engineer
- Designing field

Declaration

I here by declare that all the details provided above are true to the best of my knowledge and belief, and I bear the responsibility for the correctness of the above mentioned particulars.

Yours Truly,

M. Surya
Chennai-45