Classification of lathe, lathe specification

Objectives: At the end of this lesson you shall be able to
- **state the different types of lathes and their uses**
- **state the method of specifying a centre lathe.**

Types of lathe

1 Speed lathe
   a) Wood working
   b) Centering
   c) Polishing
   d) Spinning
2 Engine lathe (or) centre lathe
   a) Belt drive
   b) Individual motor drive
   c) Gear head lathe
3 Bench lathe
4 Tool room lathe
5 Capstan and turret lathe
6 Special purpose
   a) Wheel lathe
   b) Gap bed lathe
   c) T-lathe
   d) Duplicating lathe
7 Automatic lathe
8 CNC machine

Speed lathe

- The speed lathe has been so named because of very high speed head stock spindle.
- It consists of head stock, tailstock and tool post mounted on adjustable slide.
- Tool is fed into the work by hand control.
- It has no gear box lead screw and carriage.
- Different speeds are obtained by cone pulley (1200-3600rpm)
- Wood working, spinning, polishing, centering operations can be performed.

Engine lathe (or) centre lathe

- The term engine is because of that early lathes were driven by steam engine.
- It consists of basic parts like bed, head-stock and tail stock but head-stock is more robust and has additional drive mechanism for multiple speeds.
- Engine lathe can feed cutting tool both in cross and longitudinal directions with the help of carriage, feed rod, and leadscrew.
- Belt drive lathe gets power from an over head line shaft equipped with speed cone and one or more back gears.
- Individual motor driven lathe gets power from individual motor.
- A geared head lathe gets its power from constant speed motor and all speed changes are obtained by shifting various gears located in the headstock.

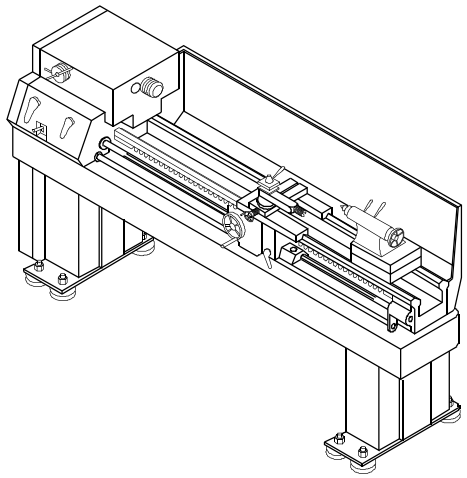
Bench lathe

- It is mounted on bench and has the same features like engine lathe.

Tool room lathe (Fig 1)

- It has the same features like engine lathe and has very low to high speed up to 2500rpm.

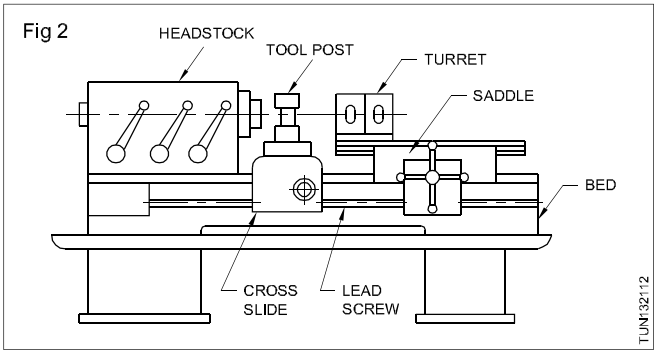
Fig 1

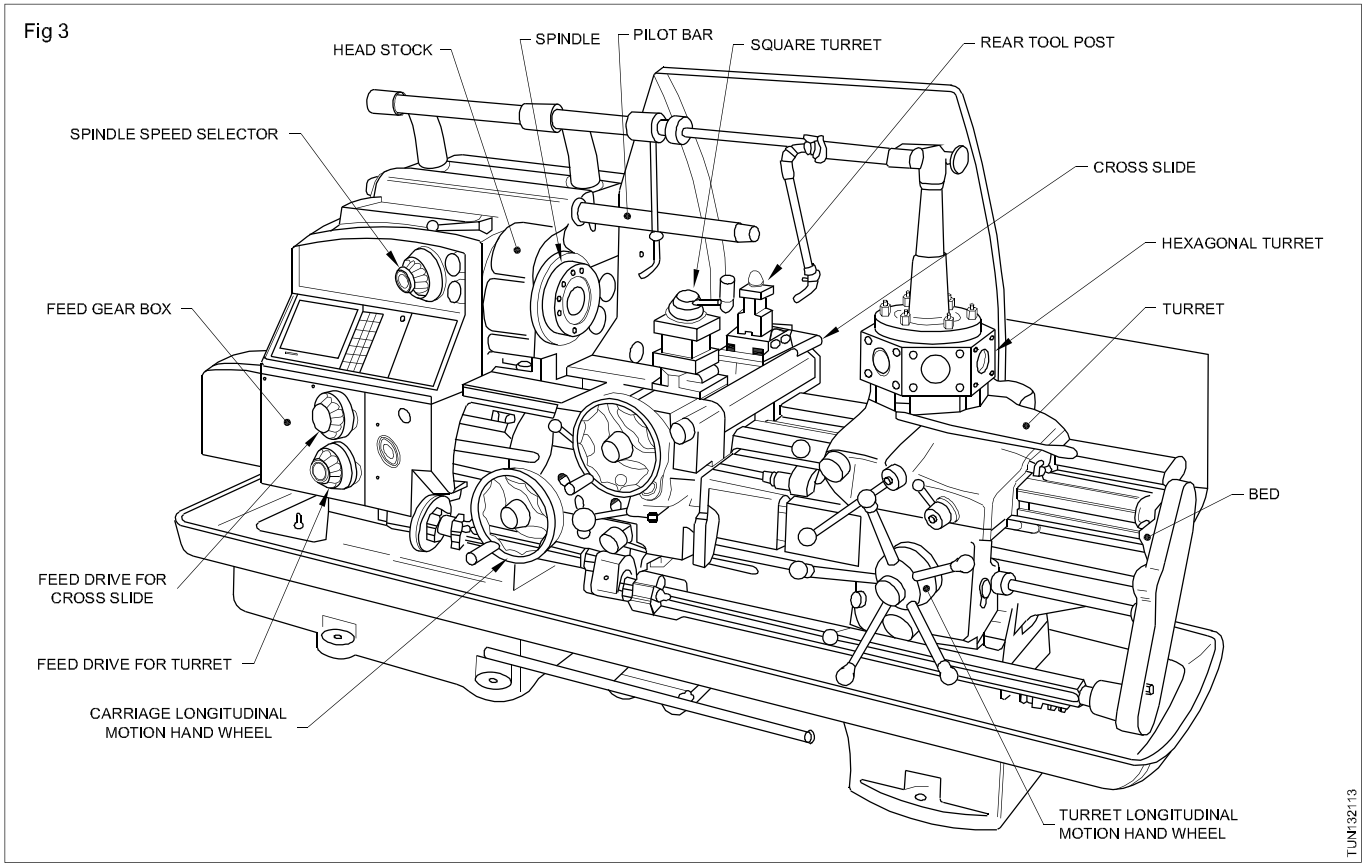


- It has taper turning attachment, draw in collet attachment, thread chasing dial, relieving attachment, steady and follower rest, pump for coolant.
- Used for precision work on tools, dies, gauges.

Capstan and turret lathe (Fig 2 & 3)

Fig 2





- These are developed from engine lathe, used for production work.
- Tailstock of an engine lathe is replaced by hexagonal turret where number of tools can be mounted.
- Number of identical parts can be produced in minimum time.

Special purpose lathe

- These are used for special purposes.
- Wheel lathe is used for finishing the journal and turning the thread on locomotive wheels.
- The gap bed lathe can accommodate the jobs having extra diameter.
- T-lathe is intended for machining the rotors for jet engines, axis of bed is right angles to the axis of head stock spindle.
- Duplicating lathe is used for duplicating the shape of given tamplate using mechanical or hydraulic system.

Special purpose lathe

- These are high speed, heavy duty, mass production lathes with complete automatic control.
- Once the tools are set and machine is started it performs automatically all the operations to finish at a time.
- Change of tools, speeds and feeds can be done automatically, operator can run 5 to 6 machines at a time.

CNC machine (CNC Fig)

- Complex shapes machined easily.
- High production rate.
- Accuracy and repeatability is achieved.
- Less operation skill and involvement.
- Reduced space.

Centre lathe specification

Objective: At the end of this lesson you shall be able to
- **specify the size of a lathe.**

The size of a lathe is generally specified by the following means:

a) Swing or maximum diameter that can be rotated over the bed ways.

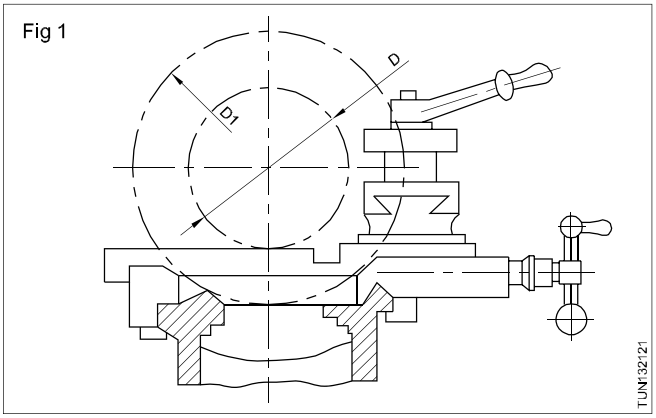
b) Maximum length of the job that can be held between head stock and tailstock centres.

c) Bed length, which may include head stock length also,

d) Maximum diameter of the bar that can pass through spindle or collect chuck of capstan lathe.

Fig 1 illustrates the elements involved in specifications of a lathe. the following data also contributes to specify a common lathe machine.

Fig 1



- Maximum swing over bed.
- Maximum swing over carriage.
- Height of centers over bed.
- Maximum distance between centers.
- Length of bed.
- Width of bed.
- Morse taper of center
- Diameter of hole through spindle.
- Face plate diameter.
- Capacity of tool post.
- Number of spindle speeds
- Lead screw diameter and number of threads per inch or pitch in mm.
- Capacity of electrical motor.
- Pitch range of metric and inch threads etc.

Lathe function, construction of different parts of lathe

Objectives: At the end of this lesson you shall be able to
- **state the functions of a lathe bed**
- **list the different types of bed - ways**
- **state the reasons for manufacturing a lathe bed out of cast iron.**

Functions of a lathe bed

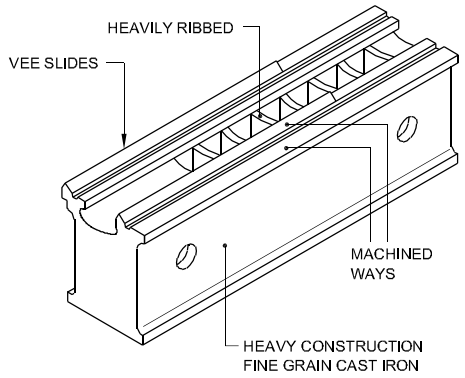
The two functions of a lathe bed are :

- to locate the fixed units in accurate relationship to each other
- to provide slideways upon which the operating units can be moved.

Constructional features of *a* lathe bed (Fig 1)

In the majority of cases, the bed generally, a single iron casting. In larger machines, the bed may be in two or more sections, accurately assembled together. Web bracings are often employed to increase the rigidity. For absorbing shock and vibration, the bed should be of considerable weight. Bed castings are usually rough machined and then allowed to 'age' naturally before finish machining to remove distortions.

Fig 1



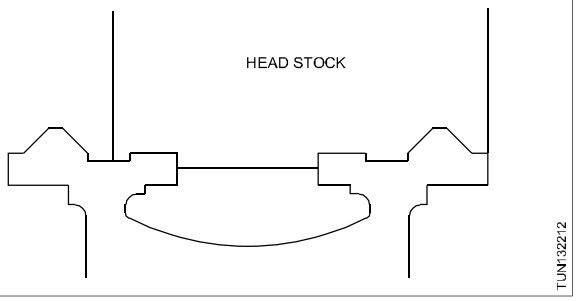
A swarf or a combined swarf and a coolant tray are provided on the lathes. This may be an integral part with the lathe bed. This increases the rigidity of the bed.

The bed generally rests on cast iron or welded sheet metal legs of box section. This provides the necessary working height for the lathe. Very often the electrical switch gear unit and the coolant pump assembly are housed in the box section legs at the headstock end.

Bed-ways (Fig 2)

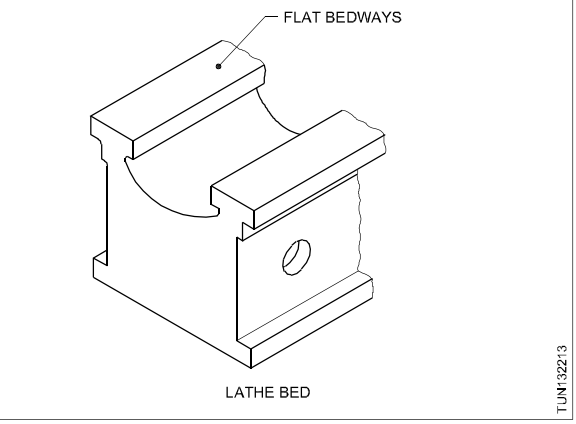
The surfaces of the bed in contact with the sliding units of the lathe are known as bed-ways or guideways or guide shoars. The beds are classified according to the shape ot of the ways. They are:

Fig 2



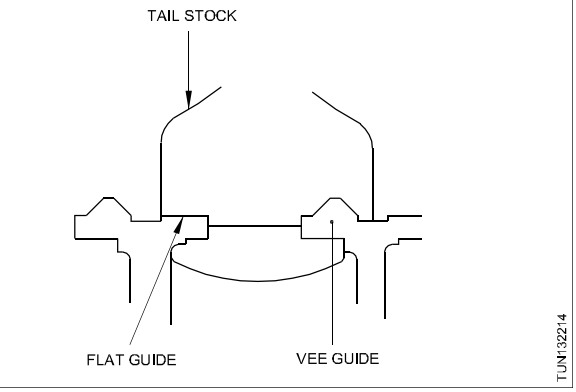
Flat bed-ways (Fig 3)

Fig 3



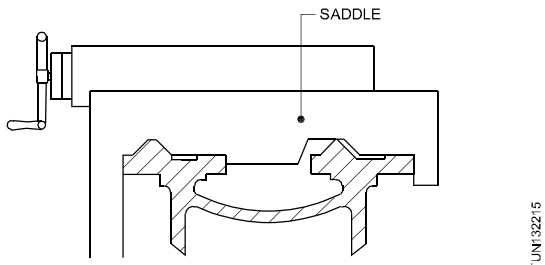
'V' bed (Fig 4)

Fig 4



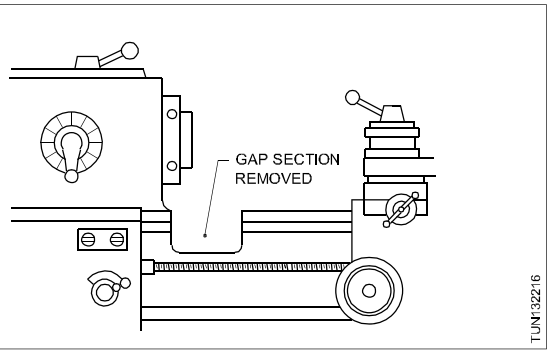
Combination bed (Fig 5)

Fig 5



Gap bed (Fig 6)

Fig 6



Normally the bed is positioned at several centimeters from the headstock, and the bed is reduced at this point. This enables for the swing of larger diameters of work.

A few lathes have at this point a detachable section of the bed which can be fitted when desired to enable the saddle to operate close to the headstock without over hanging the gap. (Fig 6)

In the case of flat bed shears, the machined bases of saddle and tailstock rest and they are guided by their machined edges. The inverted V ways support and guide the sliding units.

The bed-ways are fine-finished by grinding. Some lathes have their bed-ways hand- scraped. Some have their bed-ways hardened and ground. The wear resisting qualities of bearing surfaces are improved by employing chilled iron castings.

The beds are mostly made of close-grained grey cast iron.

The advantages are :

- easily available and costs comparatively less
- under load, cast iron will not bend but break
- in its molten state its fluidity is more so that it can occupy intricate parts of the mould
- carbon is in free state which has self-lubricating property
- grey cast iron is easily machinable
- can withstand more compressive load
- resists vibration.

Different parts of lathe, tailstock, carriage, saddle and compound rest

Objectives: At the end of this lesson you shall be able to
- **name the parts of a tailstock**
- **state the purposes of a tailstock**
- **state the functioning of a tailstock.**

Tailstock

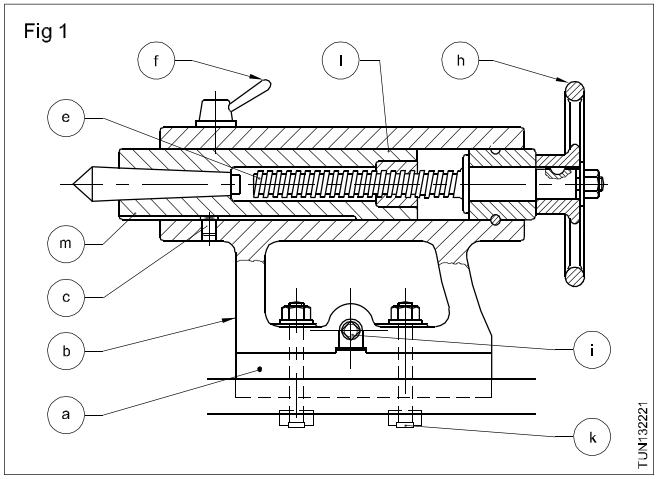
It is *a* sliding unit on the bed-ways of the lathe bed. It is situated on the right hand side of the lathe. It is made in two parts, namely the 'base' and the 'body'. The base bottom is machined accurately and has 'V'grooves corresponding to the bed-ways. It can be slided over the bed and clamped in any position on the bed by means of the clamping unit. The body of the tailstock is assembled to the base and has a corresponding longitudinal movement as to that of the base, along the bed. It has a limited transverse movement as well, with respect to the base. Graduations are marked on the rear end of the base and a zero line is marked on the body.

When both zero lines coincide the axis of the tailstock is in line with the axis of the headstock.

The body and base are made of cast iron. The parts of a tailstock are: (Fig 1)

- base (a)
- body (b)
- spindle (barrel) (c)
- spindle-locking lever (f)
- operating screw rod (e)
- operating nut (I)
- tailstock hand wheel (h)
- key(m)
- clamping unit (k)
- set over screw (i).

Fig 1



Functioning of tailstock

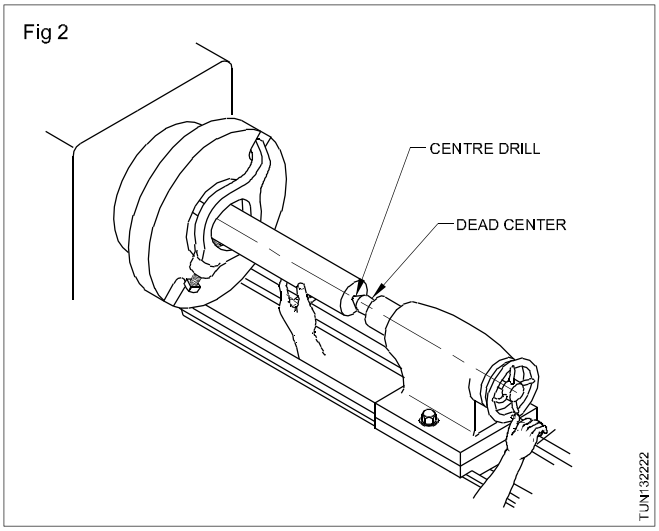
By rotating the hand wheel the screw rod is operated. This causes the barrel, which carries the nut, to move forward and backward according to the direction of rotation. The key, which fits in the keyway milled at the bottom of the barrel, prevents the barrel from rotation. The thread in the screw rod is mostly of left hand square thread to have forward movement for anticlockwise rotation of the hand wheel. The barrel may be locked in any required position. The hollow end of the barrel at the front is provided with a Morse taper to accommodate the cutting tools with the taper shank. Graduations may be marked on the barrel to indicate the movement of the barrel. The screw rod is made of alloy steel and the operating nut is made of bronze. With the help of the adjusting screws, the body can be moved over the base laterally and the amount of movement may be read approximately referring to the graduations marked.

Purpose of the tailstock

To accommodate the dead centre to support a lengthy work for carrying out lathe operations.

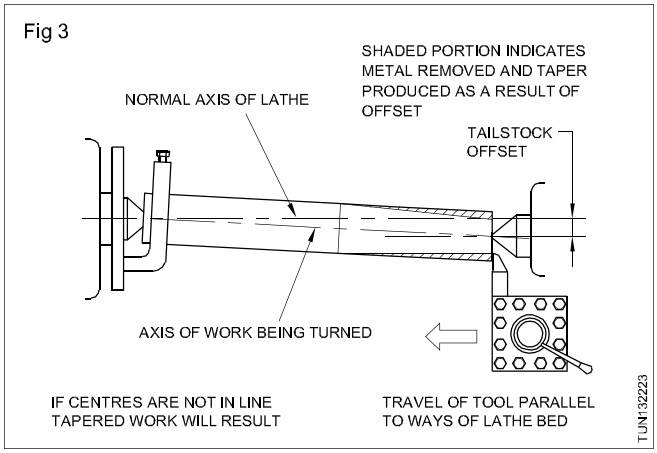
To hold cutting tools like drills, reamers, drill chucks which are provided with taper shank. (Fig 2)

Fig 2



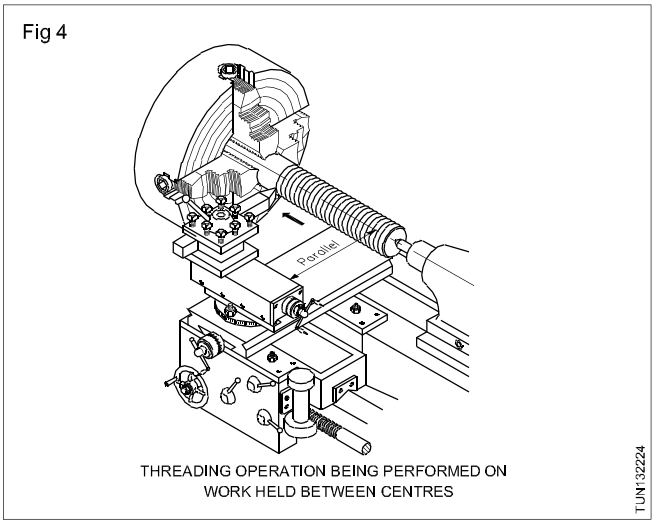
To turn the external taper by offsetting the body of the tailstock with respect to the base. (Fig 3)

Fig 3



To perform external operations on the shaft held between centres. (Fig 4)

Fig 4



The carriage

Objectives : At the end of this lesson you shall be able to
- **state the purpose of a carriage**
- **list out the parts of a carriage**
- **state the functioning of the carriage.**

Purpose of a carriage

The carriage is the part of the lathe which slides over the bed-ways between the headstock and the tail stock. (Fig 1)

It provides various movements for the cutting tool manually as well as by power feed.

The carriage can be locked on the bed at any desired position by tightening the carriage lock-screw.

The tool is provided with the following three movements by the carriage.

Longitudinal feed - with the help of the carriage move-ment (parallel to the axis of work). (Fig 2)

Cross-feed - with the help of the cross-slide movement (perpendicular to the axis of the work). (Fig 3)

Angular feed - with the help of the compound slide movement positioned at an angle to the axis of the work. (Fig 4)

Fig 1

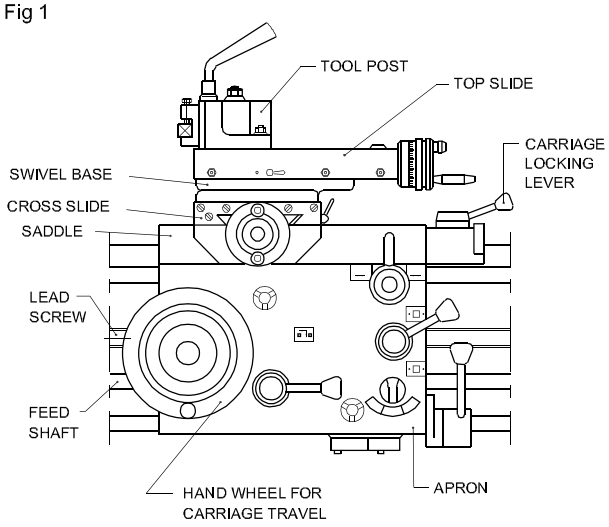


Fig 2

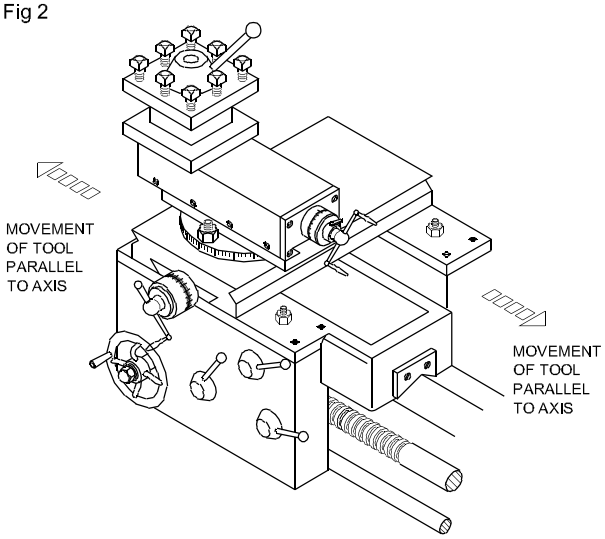


Fig 3

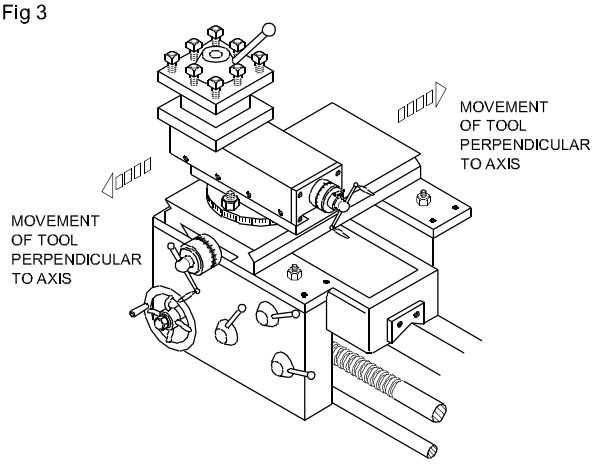
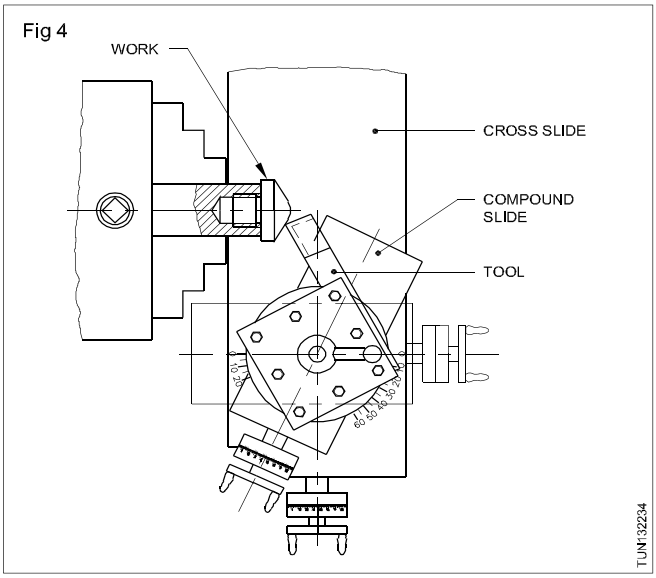


Fig 4



The carriage consists of the following parts. (Fig 5)

Saddle

Cross-slide

Compound rest swivel and top slide.

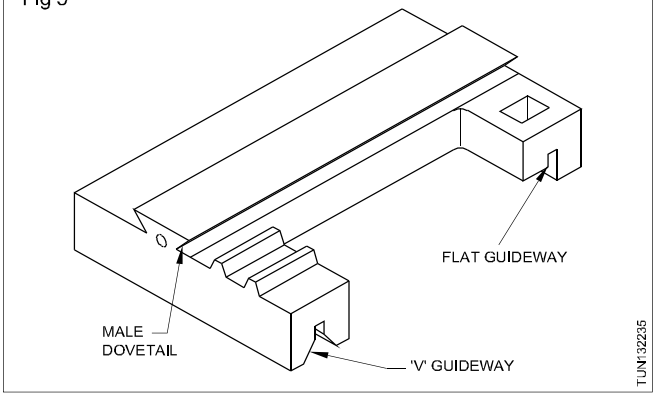
Tool post

Apron

The saddle (Fig 5)

It is 'H' shaped casting and has 'V' guide grooves and flat grooves machined at the bottom face corresponding to the lathe bed-ways for mounting the saddle on the lathe bed and for sliding over the bed by the operation of the hand wheel.

Fig 5



The cross-slide (Fig 6 & 7)

The bottom of the cross-slide has got a dovetail groove machined, which corresponds to the external dovetail machined on the saddle. The cross-slide is assembled to the saddle with the help of a tapered jib. The adjustment of the jib facilitates the required fit for the movement of the cross-slide on the saddle. The cross-slide functions perpendicular to the lathe axis either by hand feed or by automatic feed.

A left hand square or acme thread screw-rod fitted with a hand wheel helps in the manual movement of the cross-slide. The automatic feeding is achieved through gearing. A graduated collar mounted on the screw-rod along with the hand wheel helps to set the fine, movements of the cross slide.

Fig 6

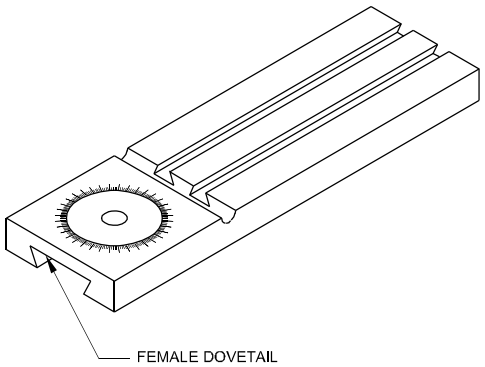
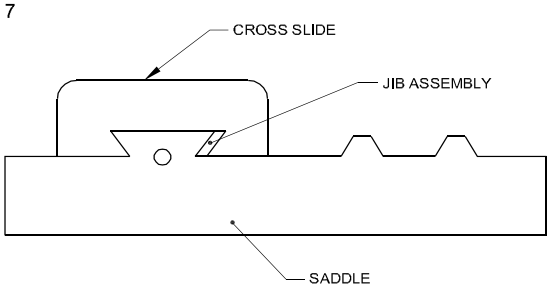


Fig 7



The compound rest (Fig 8)

It is of two parts.

- The swivel base
- The top slide

The swivel base is assembled to the top of the cross-slide and may be clamped at any required position between 0° to 360° by tightening the T' bolts. The head of the bolts moves in the T slot groove on the top of the cross-slide. The swivel base is provided with a dovetail on its top surface and the top slide has *a* corresponding dovetail groove. The assembly of the top slide to the swivel base is done by a tapered jib which can be adjusted to control the top slide movement. The sliding of the top slide on the swivel base is accomplished by the help of a screw-rod fitted with a hand wheel and a graduated collar. Only manual operation is possible for the top slide. The top slide assists in feeding the tool to the work.

Fig 8