

# AUTOMATIC LATHES

- These are machine tools in which components are machined automatically.
- The working cycle is fully automatic that is repeated to produce duplicate parts with out participation of operator.
- All movements of cutting tools, their sequence of operations, applications, feeding of raw material, parting off, un loading of finished parts all are done on machine.
- All working & idle operations are performed in definite sequence by control system adopted in automatic which is set up to suit a given work.
- Only operation reqd to be performed manually is loading of bar stock/ individual casting/ forged blanks.
- These machines are used when production requirements are too high for turret lathes to produce economically.

## Advantages

- Greater production over a given period.
- More economy in floor space.
- More consistently accurate work than turrets.
- More constant flow of production.
- Scrap loss is reduced by reducing operator error.
- During machine operation operator is free to operate another machine/ can inspect completed parts.

## SEMI AUTOMATICS

- These are turning machines used for chucking work.
- In this type of lathes although all movements of w/p (or) tools are automatically controlled, but w/p has to be loaded into & removed from chuck at beginning & end of each cycle of operation.
- Machine cycle is automated, but direct participation of operator is reqd to start subsequent cycle, i.e., to machine each w/p.
- Operator work is to load w/p or blank into machine, start the ma/c, checks the work, & removes the completed part by hand.

**AUTOMATICS & SEMI AUTOMATICS** are designed to perform following operations:

- Centering, cylindrical turning, tapered, formed surfaces, drilling, boring, reaming, facing, knurling, thread cutting, facing, milling, grinding, cut off.
- With help of special attachments additional operations like slotting can be done on this m/c.

Selection of lathe : same job can be machined on engine, capstan, turret, automatic lathes . Main considerations are:

- Quantity of production reqd.
- Number of machining operations to be done on job, number of tools reqd to employed.
- Over all dimensions of that portion of job which is to be machined.

# CLASSIFICATION OF AUTOMATIC LATHES

- Depending up on type of work machined these machines are classified as:

## 1. Magazine loaded Automatics:

- Machines used for producing components from separate blanks.
- Also called as automatic checking machines.

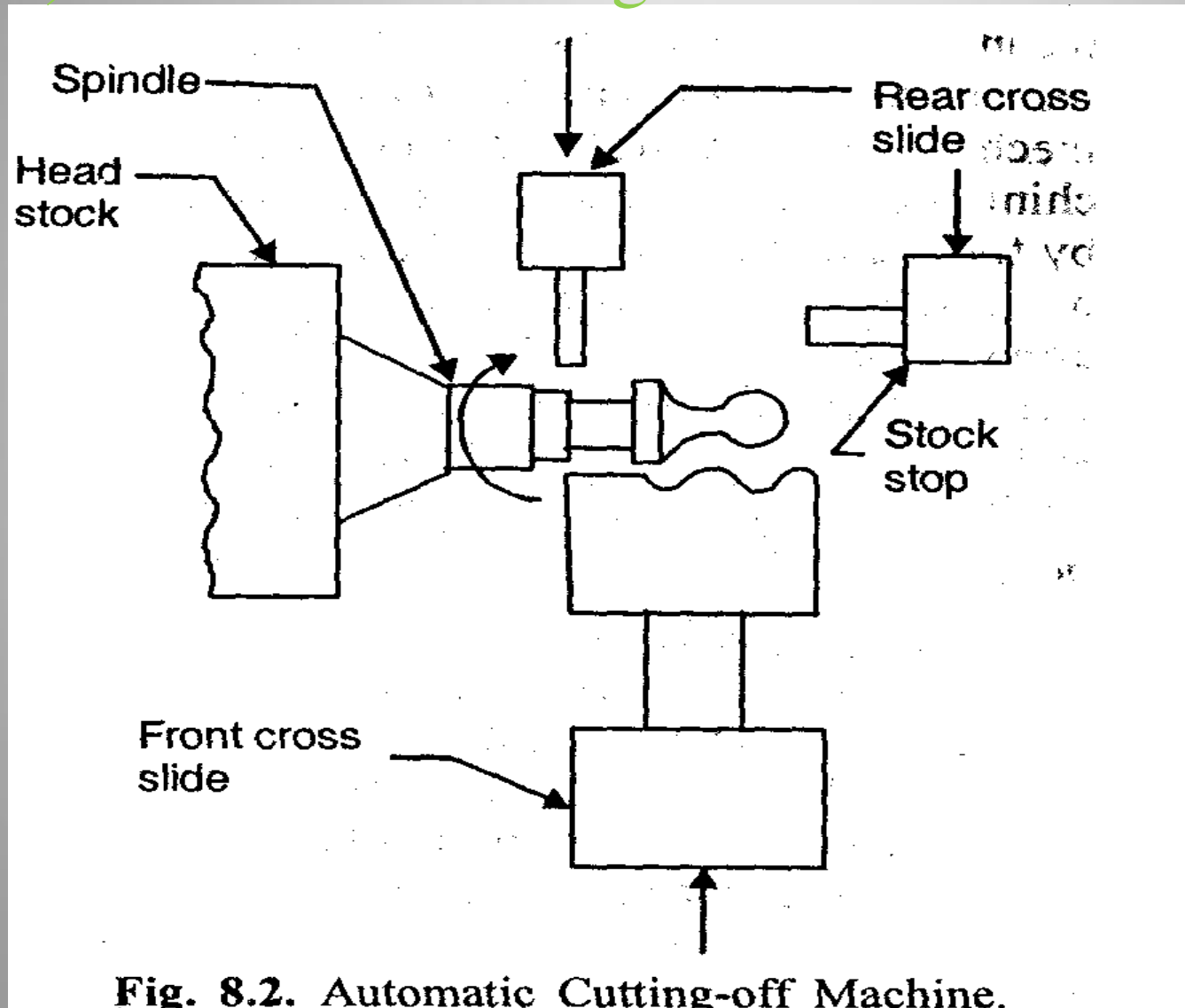
## 2. Automatic Bar Machines:

- designed for machining components from bar/ pipe stock.
- M/c's are used for manufacture of high quality fasteners (screws, nuts), bushings, shafts, rings, rollers, handles which are usually made of bar / pipe stock.

- Depending upon number of work spindles, automatic lathes are classified as:
  1. Single Spindle Automatics.
  2. Multi Spindle Automatics.
  
- Depending upon purpose & arrangement of spindle also automatics are classified as:
  1. Purpose → General & single purpose m/c.
  2. Arrangement of spindle → Horizontal & vertical

# I) Type of Single Spindle Automatics:

## a) Automatic Cutting Off Machine:



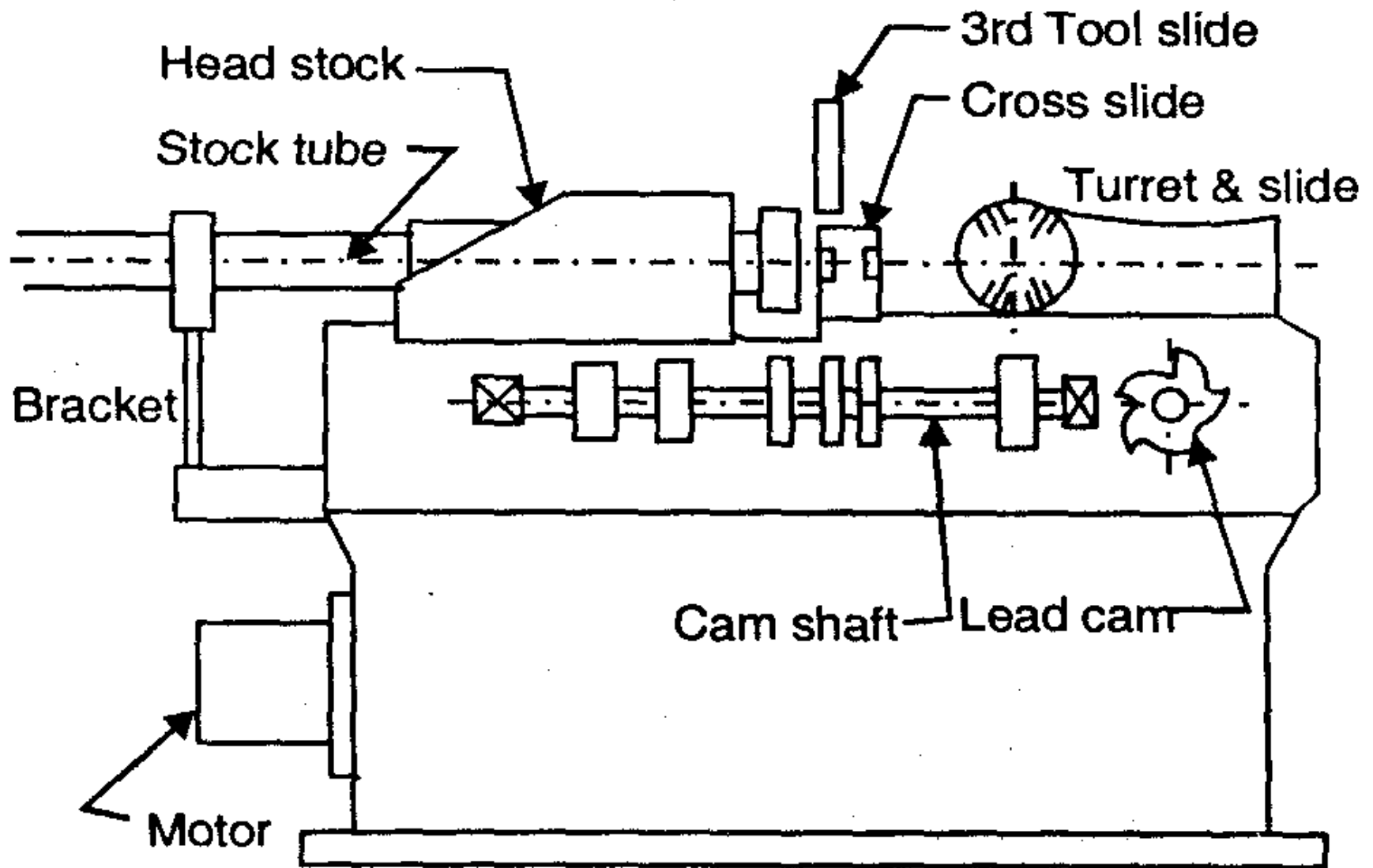
- These machines produce short w/p's of simple form by means of cross sliding tools. Machines are simple in design.
- Head stock with spindle is mounted on bed.
- 2 cross slides are located on bed at front end of spindle.
- CAMS on cam shaft actuate movements of cross slide through system of levers.

### Operation:

- The reqd length of work(stock) is fed out with a cam mechanism, up to stock stop which is automatically advanced in line with spindle axis at each end of cycle.
- Stock is held in collet chuck of rotating spindle.
- Machining is done by tools that are held in slides operating only in cross wise direction.
- Typical simple parts (3 to 20 mm dia) machined on such a machine is shown in fig.



## b) Single spindle Automatic Screw m/c:



**Fig. 8.4.** Automatic Screw Machine

- Used for producing small screws(12.7 to 60 mm dia) generally, but also in production of all sorts of small turned parts.
- These are completely automatic bar type turret lathes, designed for machining complex internal & external surfaces on parts made of bar stock/separate blanks.
- Up to 10 different cutting tools can be employed at one time in tooling of this kind of screw machine.
- 2 cross slides(front & rear) are employed for cross feeding tools.
- Vertical tool slides for parting off operation may also be provided .
- Head stock is stationary & houses the spindle.
- Bar stock is held in collet chuck & advanced after each piece is finished & cut off.
- All movements of machine units are actuated by cams mounted on cam shaft.

- Bar stock is pushed through stock tube in a bracket & its leading end is clamped in rotating spindle by means of collet chuck.
- By stock feeding mechanism bar is fed out for next part.
- Machining of central hole is done by tools that are mounted on turret slide.
- Parting off/ Cutting off, form tools are mounted on cross slide.
- At end of each cut turret slide is withdrawn automatically & indexed to bring next tool to position.

## c) Swiss type automatic screw/Sliding head screw:

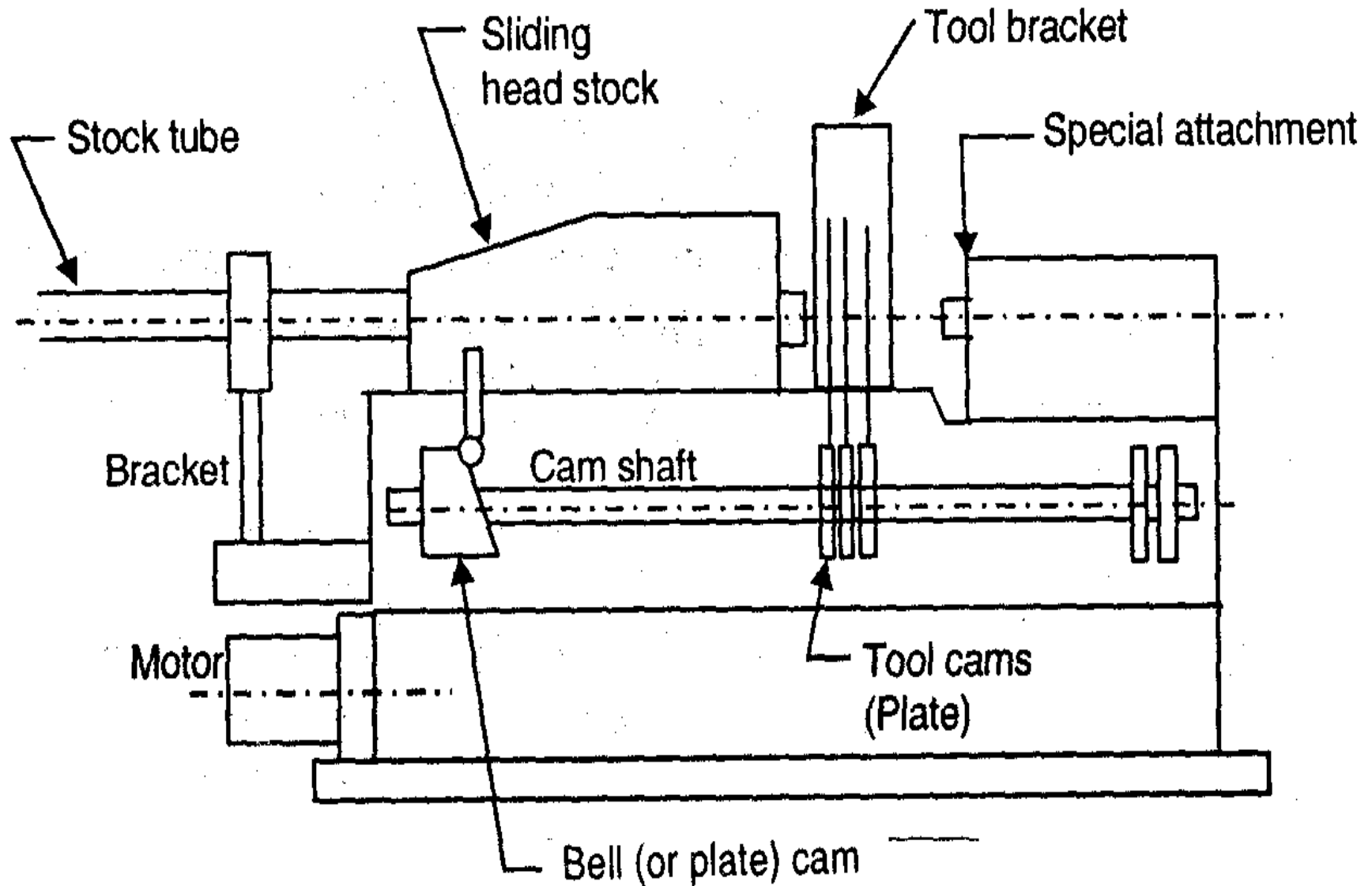
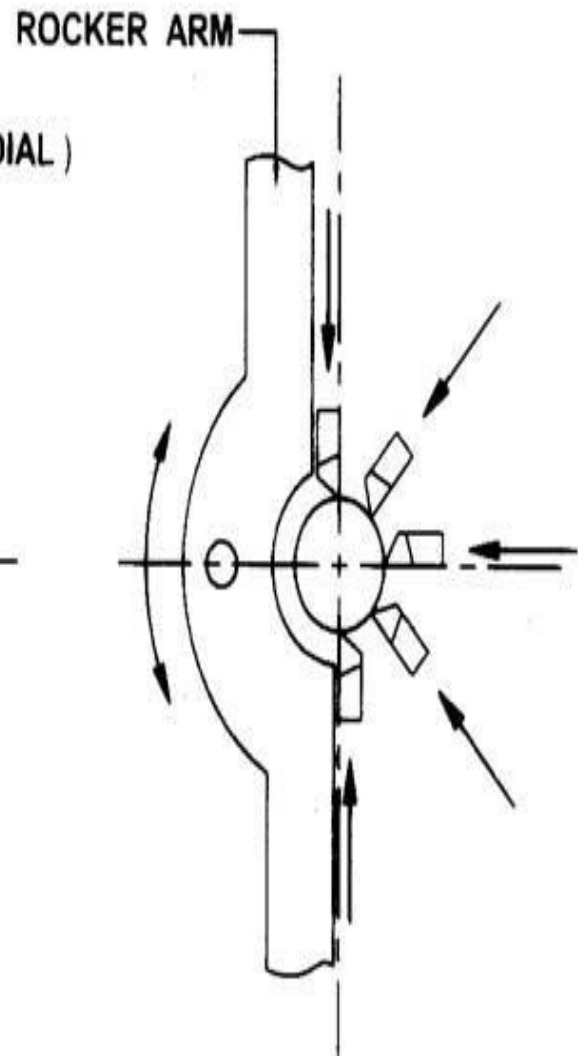
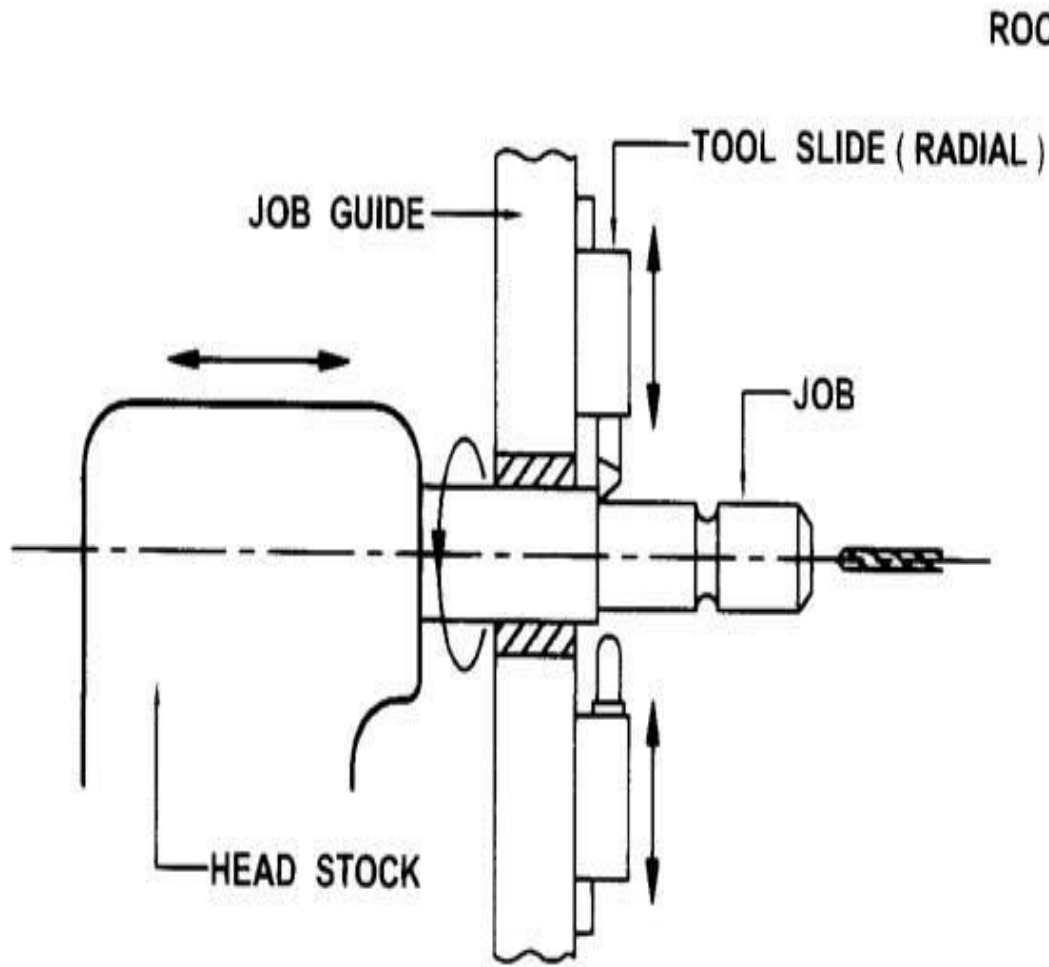


Fig. 8.7. Swiss Type Automatic



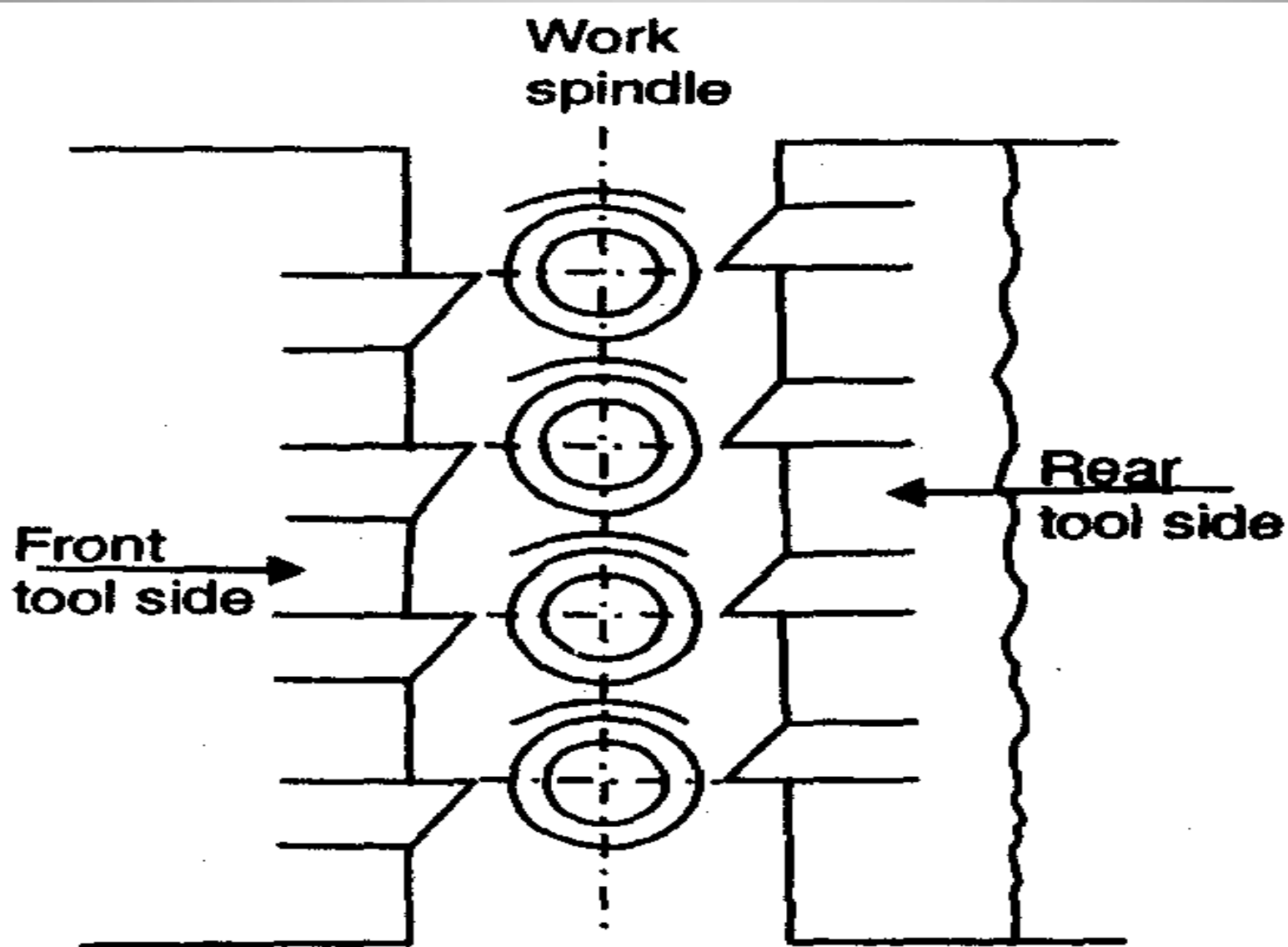
CUTTING TOOL POSITIONS AND MOTIONS

- As name implies in this m/c head stock is movable & tools are fixed.
- These machines are used for machining long accurate parts of small diameter.(2 to 25mm).
- Bar stock is held in rotating collet in head stock & all longitudinal feeds are obtained by cam which moves entire head stock as unit.
- Rotating bar stock is fed through hard bushing in centre of tool head.
- Tool head consists of 5 single point tools is placed radially around bushing.
- Mostly diameter turning is done by 2 horizontal slides, other 3 slides used for operations such as knurling, chamfering, cutoff.
- Tools are controlled & positioned by cams that bring tool in as needed to turn, face, form, cutoff w/p from bar as it emerges from bushing. Close tolerances 0.005 to 0.00125 mm are obtained.

## II) Multi Spindle Automatics:

- These are fastest type of production machines and are made in a variety of models with 2,4,5,6,8 spindles.
- In contrast with single spindle m/c where one turret face at a time is working on one spindle, in multi spindle m/c all turret faces works on all spindles at same time.
- Production capacity is higher, machining accuracy is lower compared to single spindle.
- Because of longer set up time, increased tooling cost this machines are less economical than other on short runs, more economical for longer runs.

# a) Parallel Action Automatics/ Multiple Flow m/c:



**Fig. 8.10. Parallel-action multi-spindle**



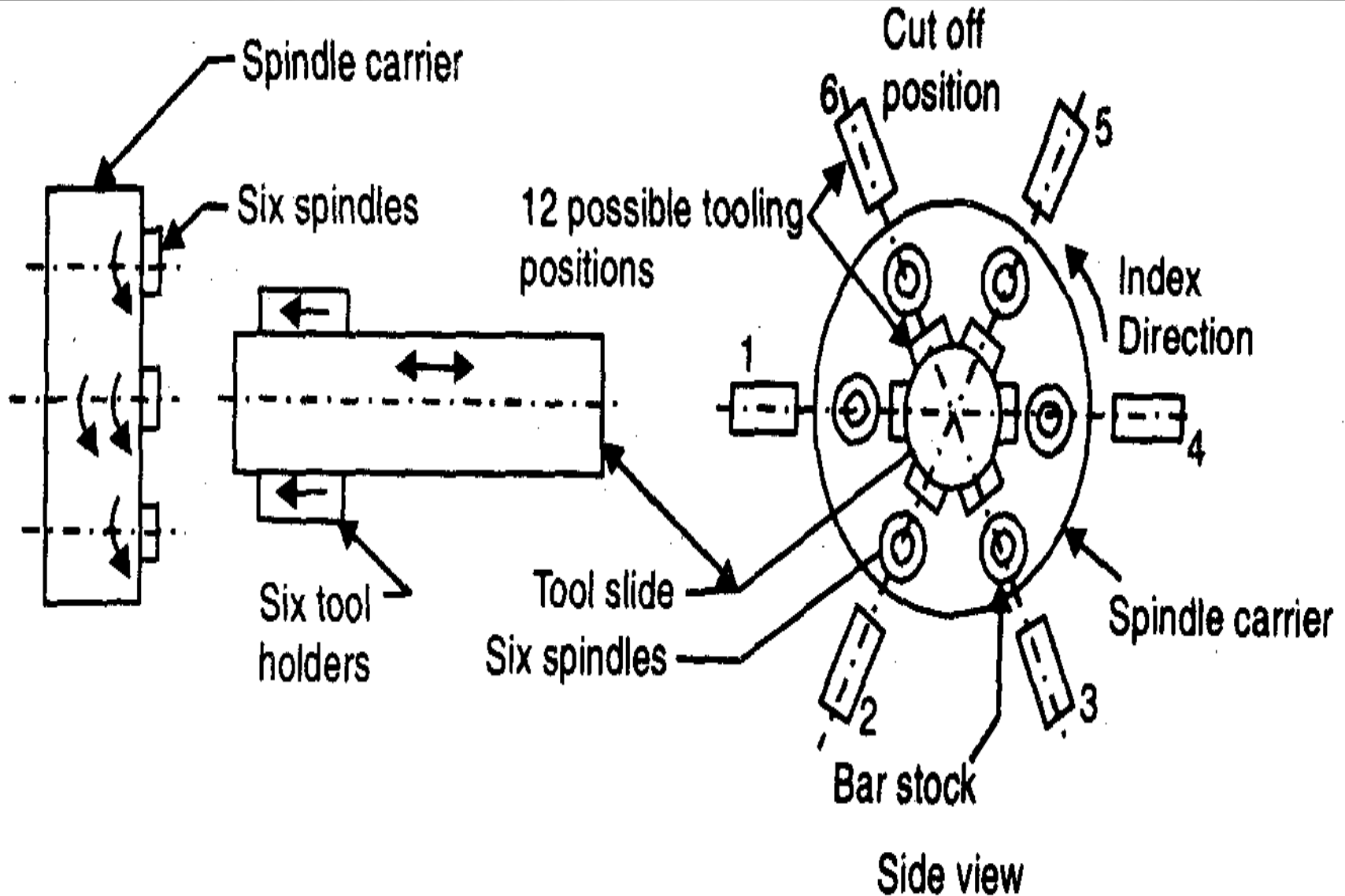
- In this type of machine same operation is performed on each spindle, w/p is finished in each spindle in one working cycle.

- It means that

**No. of components being machined == No. of spindles in machine.**

- Rate of production is high & machine can be used to machine simple parts only since all the machining processes are done at one position.
- These machines are usually automatic cutting off bar type machines, used to perform same work as single spindle automatic cut off machines.
- Machine consists of frame with head stock at right end.
- Horizontal work spindles that are arranged one above the another are housed in this head stock.
- Cross slides are located at right & left hand sides of spindles & carry cross feeding tools. All working & auxiliary motions of machine unit are obtained from CAM mounted on cam shaft.

## b) Six Spindle Progressive Action Multi Spindle:



**Fig. 8.11. Six Spindle Progressive Action Automatic.**

- In this design of machine, the w/p is machined in states & progressively in station after station.
- Head stock is mounted on left end of base of machine.
- It carries spindle carrier which rotates about a horizontal axis through centre of machine.
- Working spindles are mounted on this spindle carriers.
- Spindles carry collets & bars from which w/p's are machined.
- Bar stock is fed through each spindle from rear side.
- On face of spindle carrier support are mounted cross slides which carry tools for operations such as cutoff, turning, facing, forming, chamfering.

- No. of slides === No. of spindles.
- Main tool slide (end tool slide) extends from middle of this support.
- Fed of each tool, both cross slide & end tool slides is controlled by its own individual cams.
- In this diagram spindle carrier indexes on its own axis by  $60^\circ$  at each cutting tool retraction.
- As spindle carrier indexes, it carries work from one station to another station where different tools operate on work.
- Stock moves round the circle in counter clock wise direction & returns to station no. 6 for cutting off.



# **Capstan Lathe & Turret Lathe**

# Introduction

❖ Capstan and turret lathes are production lathes used for production of large number of identical parts in minimum time.

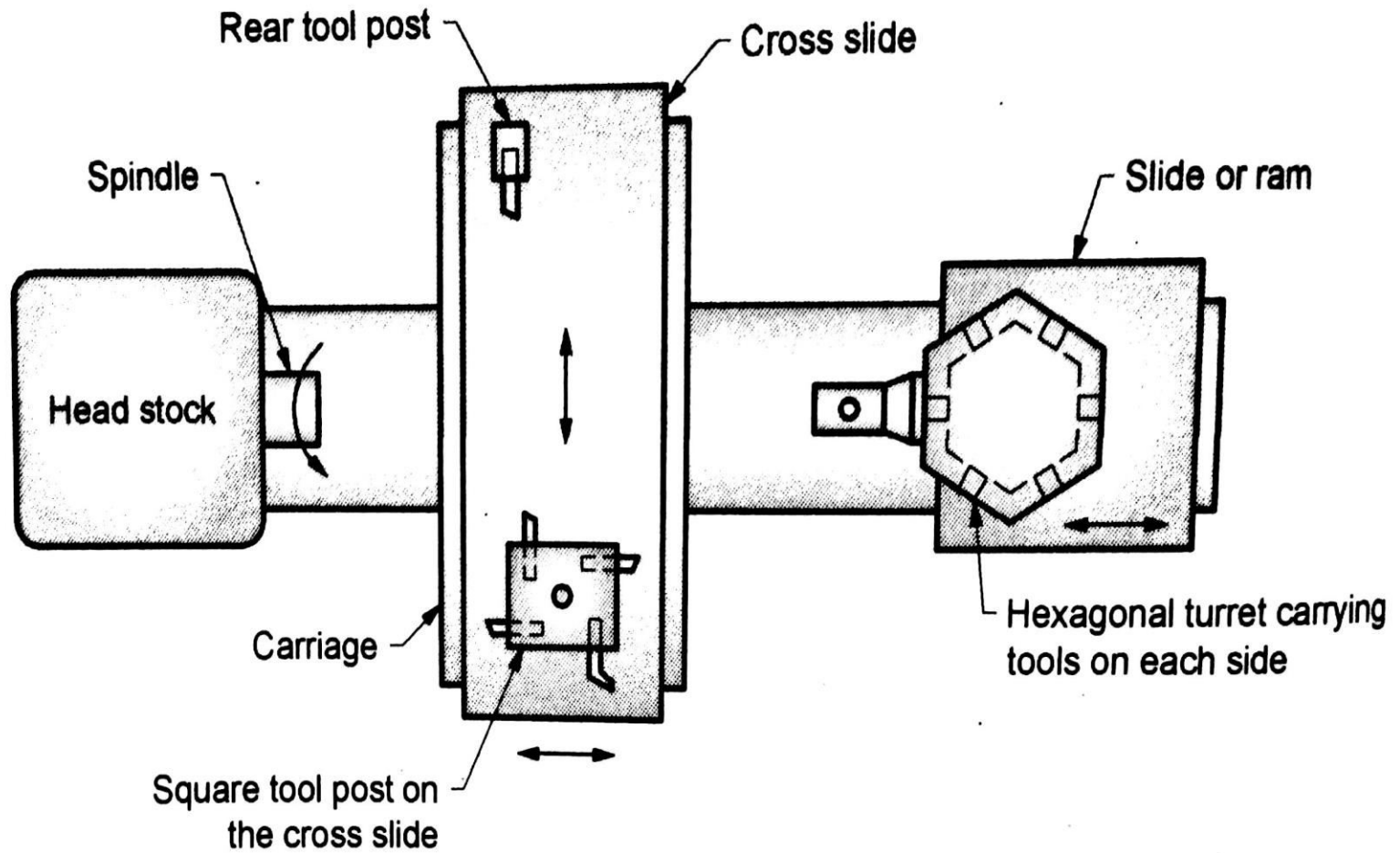
**□ These lathes different from the engine lathe following respects:**

- They do not have tail stock. The work piece is supported at the head stock and alone.
- They carry a much larger number and variety of tools than the engine lathe.
- More than one tool may be set to operate simultaneously.

## ❑ Essential features of capstan or turret lathe

- ❖ Spindle
- ❖ Head stock
- ❖ Carriage
- ❖ Rear tool post
- ❖ Cross slide
- ❖ Slide or ram
- ❖ Hexagonal turret
- ❖ Square tool post on the cross slide

# Fig. Essential features of capstan or turret lathe





# Capstan Lathe

- The turret of the capstan lathe machine is mounted on a slide or ram which can be moved longitudinally on the saddle for feeding the tools.
- The saddle itself is mounted on the bed.
- The turret is generally hexagonal but may also be square or round.
- This type of machine is lighter in construction and is suitable for machining bars of up to **60 mm** in diameter.
- More than one tool may be mounted on the same face on the turret making it possible to machine more than one surface at the same time.

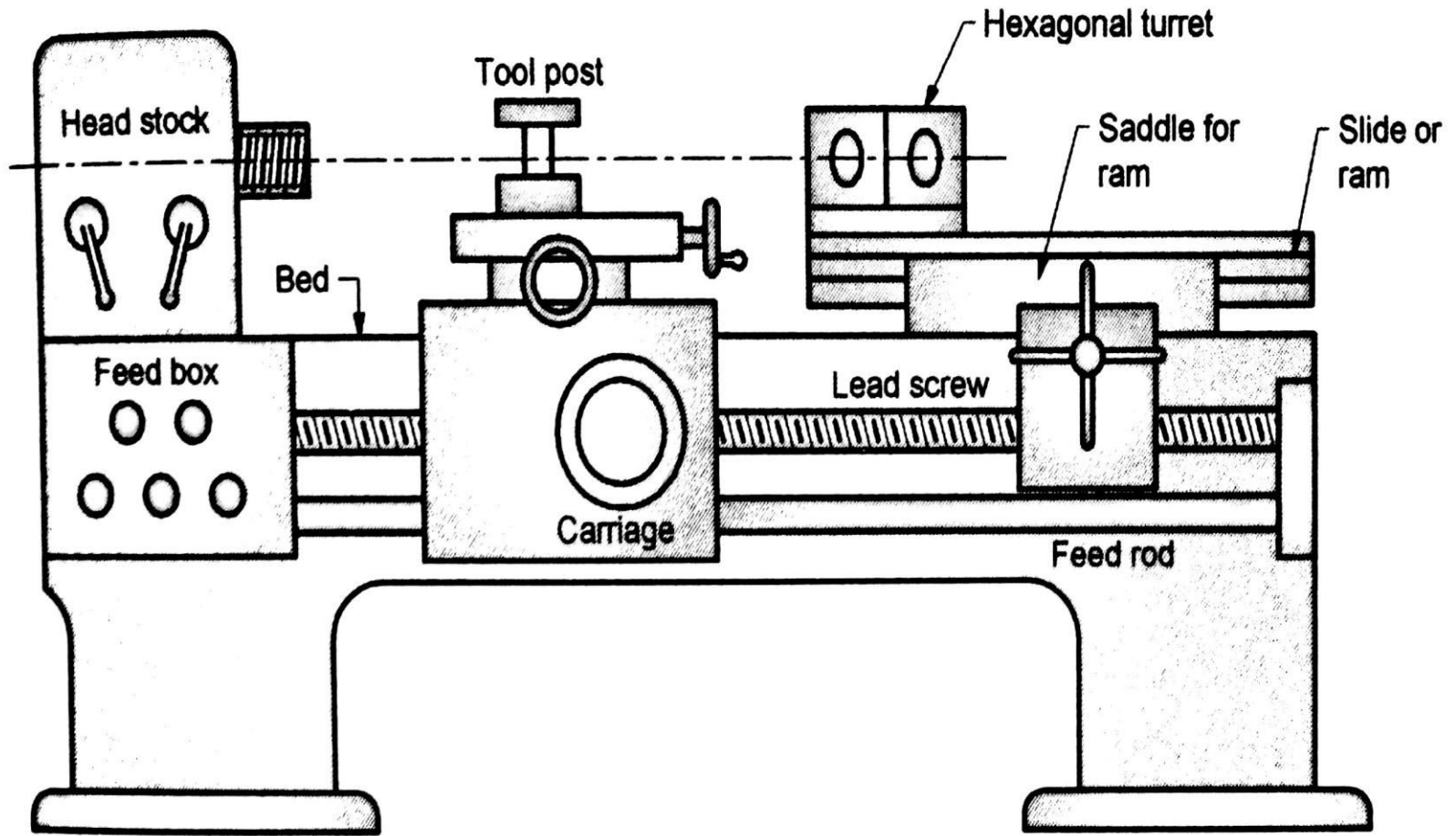
# Capstan Lathe



# Capstan Lathe Parts

- ❖ Head stock
- ❖ Bed
- ❖ Feed box
- ❖ Carriage
- ❖ Tool post
- ❖ Hexagonal turret
- ❖ Saddle for ram
- ❖ Lead screw
- ❖ Ram

# Schematic diagram of capstan lathe



# Turret Lathe

- The tool turret is mounted directly on the saddle and the feed is given by moving the entire unit.
- The turret lathe can thus operate under more severe condition accommodating heavier work pieces with higher cutting speeds, feeds and depth of cut.
- Turret lathes are capable of turning bars up to **200 mm** diameter using collets as well as handling irregular jobs like castings and forgings with chucks.
- Some turret types lathes are equipped with crosswise movement of the hexagonal tool turret by hand or power.
- Turret machines provided with so called side hung type of carriage do not require any support from the rear slide of the bed.

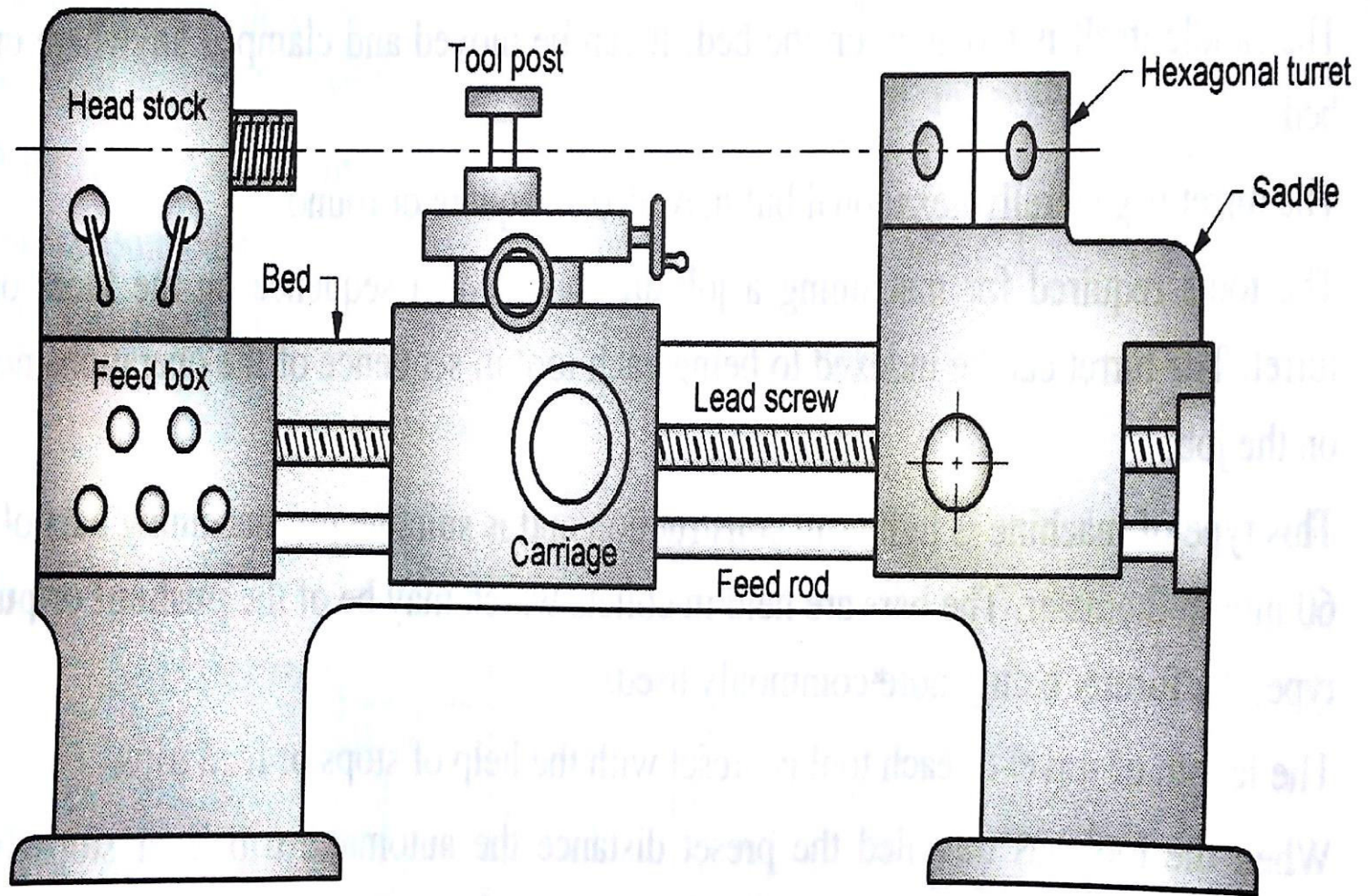
# Turret Lathe



# Turret Lathe Parts

- ❖ Head stock
- ❖ Bed
- ❖ Feed box
- ❖ Tool post
- ❖ Carriage
- ❖ Lead screw
- ❖ Feed rod
- ❖ Hexagonal turret
- ❖ Saddle

# Schematic diagram of turret lathe

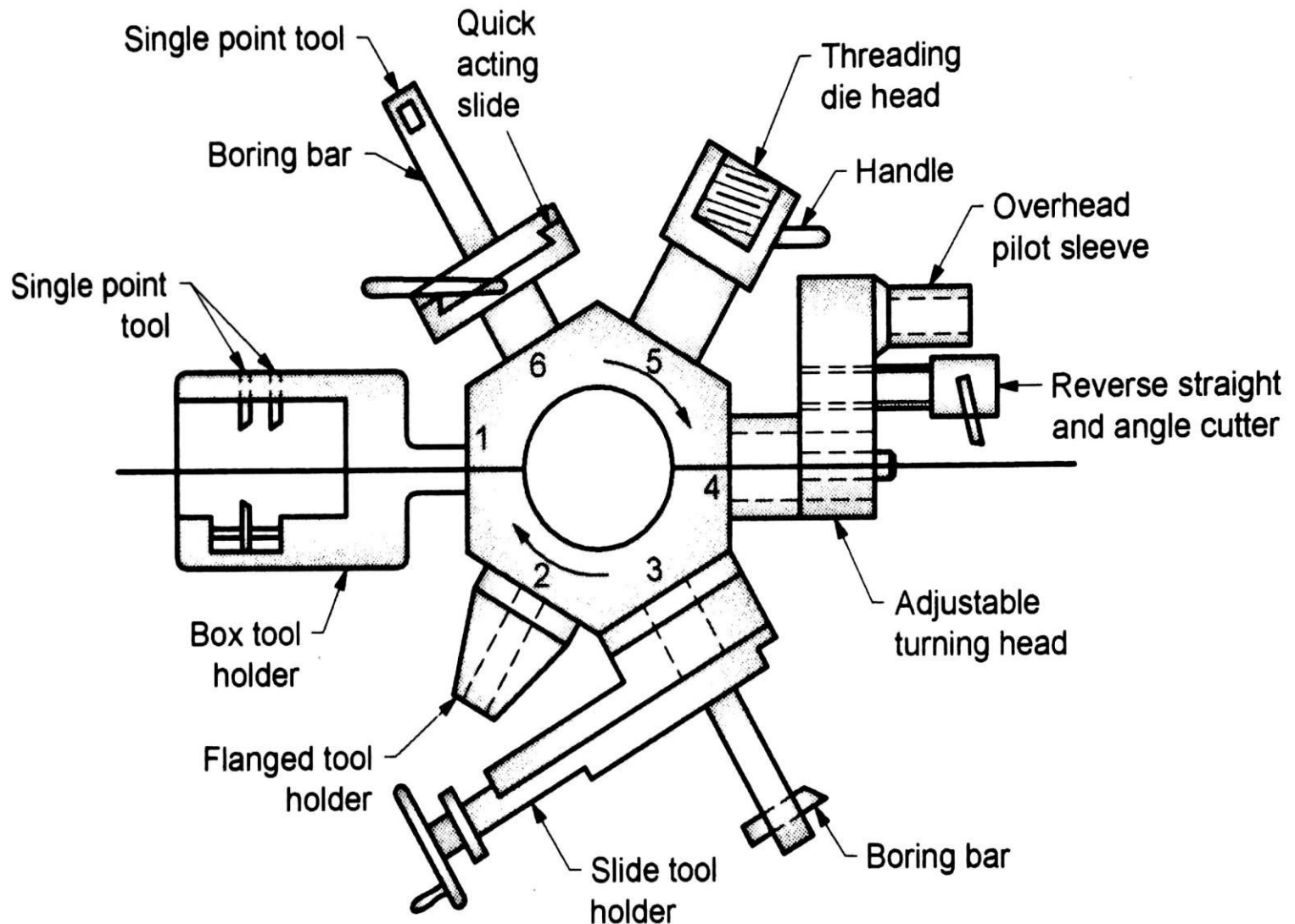




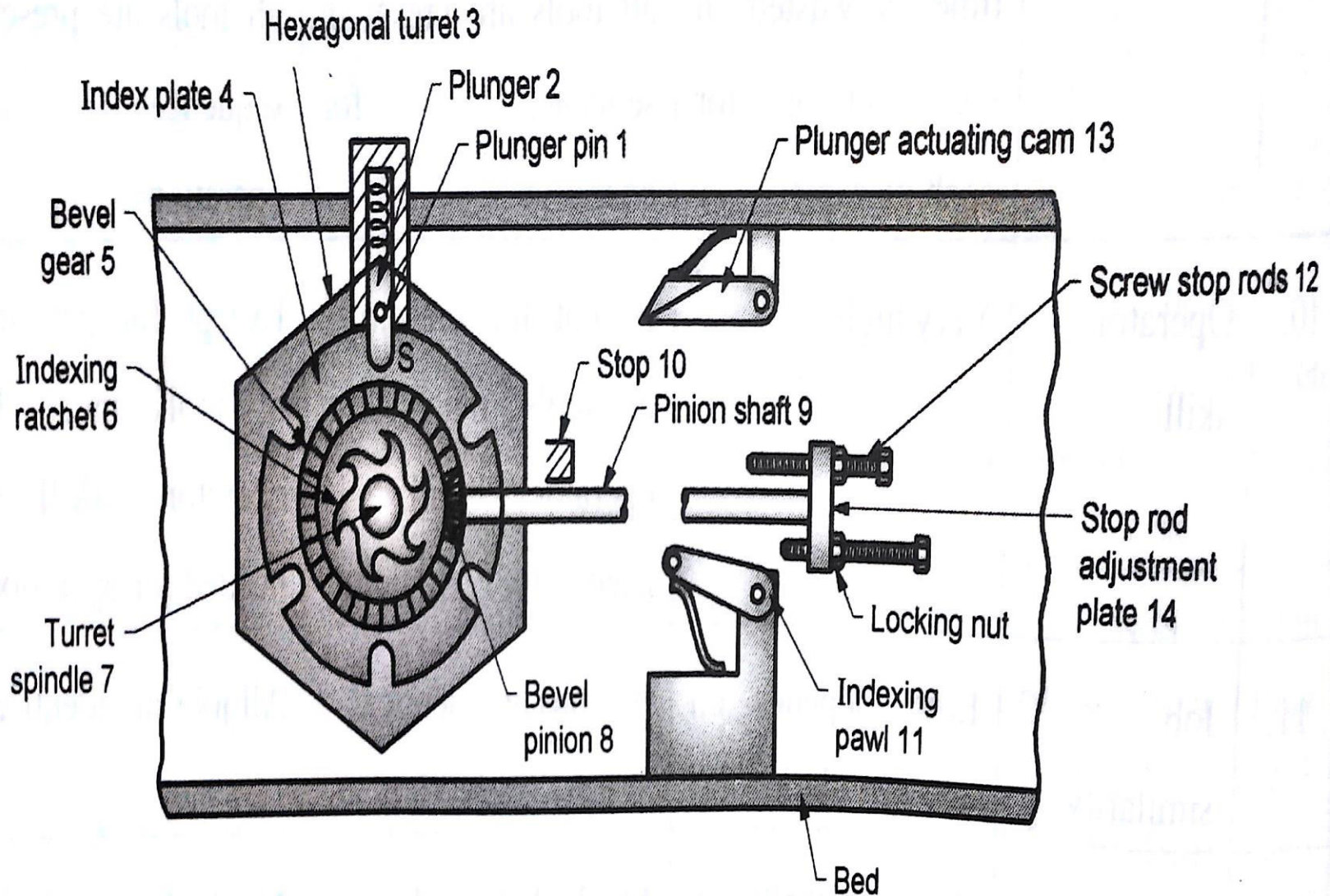
# Tools and Tooling Principles for Capstan and Turret Lathes

- ❖ Box tool holder
- ❖ Flanged tool holders
- ❖ Slide tool holders
- ❖ Adjustable turning head
- ❖ Threading die head
- ❖ Quick acting slide tool holder

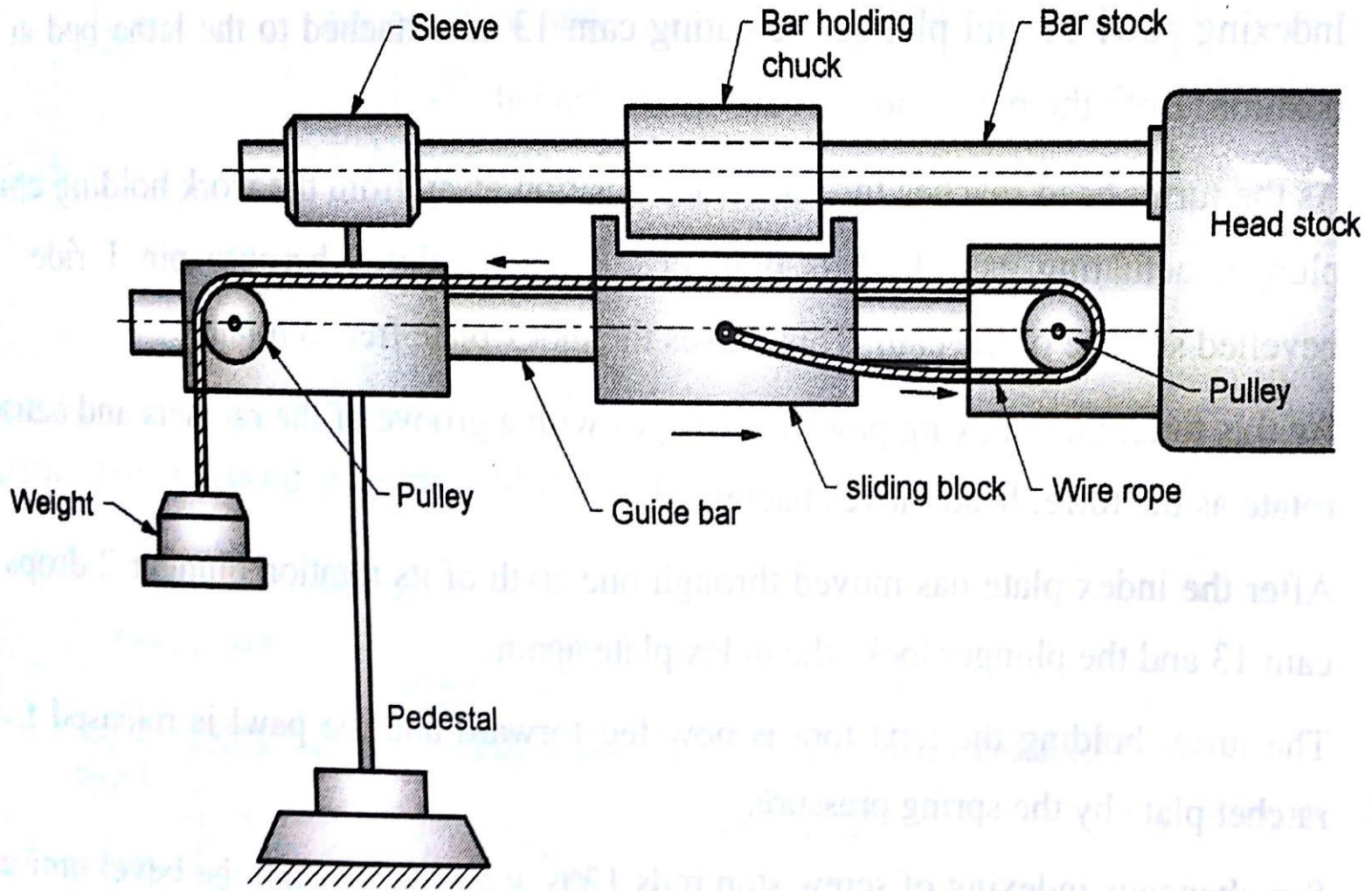
# Fig. Common tool holders used with Capstan and Turret lathes



# Turret Head indexing mechanism



# Bar Feed Mechanism



## Difference between capstan lathe and turret lathe:

S.No	Capstan lathe	Turret lathe
1	It is a light duty machine	It is a heavy duty machine
2	The turret head is mounted on the ram and the ram is mounted on the saddle.	The turret head is directly mounted on the saddle and the saddle slides over the bed ways
3	The saddle will not be moved during machining	The saddle is moved along with the turret head during machining
4	The lengthwise movement of turret is less	The lengthwise movement of turret is more
5	Short work pieces only can be machined.	Long work pieces can be machined
6	It is easy to move the turret head as it slides over the ram	It is difficult to move the turret head along with saddle
7	The turret head cannot be moved crosswise	The turret head can be moved crosswise in some turret lathes
8	As the construction of lathe is not rigid, heavy cut cannot be given	As the construction of lathe is rigid, heavy cut can be given
9	It is used for machining work pieces up to 60mm diameter	It is used for machining work pieces up to 200mm diameter
10	Collet is used to hold the work piece	Jaw chuck is used to hold the work piece

# ❖ Video Reference Links

➤ [http://www.youtube.com/results?search\\_query=C+apstan+and+turret+lathe](http://www.youtube.com/results?search_query=C+apstan+and+turret+lathe)

➤ <http://www.youtube.com/watch?v=FIS6BhSv6XA>

➤ [http://www.youtube.com/watch?v=tUt3P2\\_1fm0](http://www.youtube.com/watch?v=tUt3P2_1fm0)

➤ <http://www.youtube.com/watch?v=BXTd75acmTA>

➤ <http://www.youtube.com/watch?v=-bHPGcVTmM4>

➤ <http://www.youtube.com/watch?v=GbvNANL7Ns&list=PLDaIHhBnvpqm3Zj7x8AEVdGyen4synzDO>



**Thank you**