



## SEMIAUTOMATIC AND AUTOMATIC LATHES.

Automation is incorporated in a machine tool or machining system as a whole for higher productivity with consistent quality aiming meeting the large requirements and overall economy. Such automation enables quick and accurate auxiliary motions, i.e., handling operations like tool – work

mounting, bar feeding, tool indexing etc. repeatedly with minimum human intervention but with the help of special or additional mechanism and control systems. These systems may be of mechanical, electro-mechanical, hydraulic or electronic type or their combination.

According to degree of automation machine tools are classified as,

- Non automatic where most of the handling operations irrespective of processing operations, are done manually, like centre lathes etc.
- Semiautomatic
- Automatic where all the handling or auxiliary operations as well as the processing operations are carried out automatically.

General purpose machine tools may have both fixed automation or flexible automation where the latter one is characterized by computer Numerical Control (CNC).

Amongst the machine tools, lathes are most versatile and widely used. Here automation of lathes only have been discussed.

The conventional general purpose automated lathes can be classified as,

(a) Semiautomatic : Capstan lathe (ram type turret lathe)

- Turret lathe
- Multiple spindle turret lathe
- Copying (hydraulic) lathe

(b) Automatic : Automatic cutting off lathe

- Single spindle automatic lathe
- Swiss type automatic lathe
- multiple spindle automatic lathes

The other categories of semiautomatic and automatic lathes are :

- Vertical turret lathe

- Special purpose lathes
- Non conventional type, i.e., flexibly automatic CNC lathes, turning centre etc.

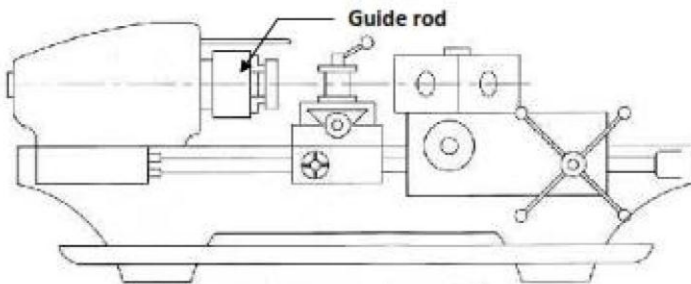
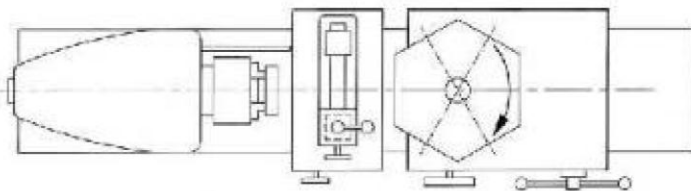
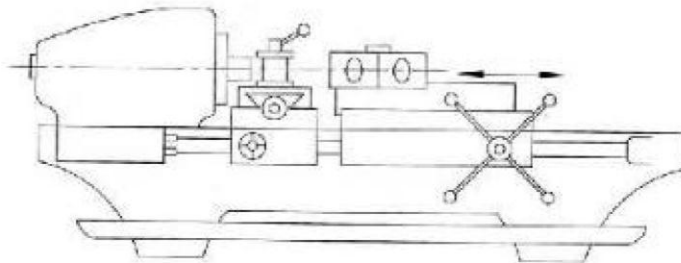
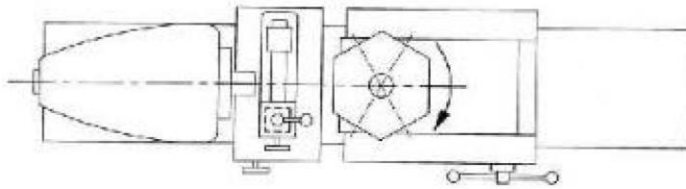
**(a) Semiautomatic lathes**

The characteristic features of such lathes are ;

- some major auxiliary motions and handling operations like bar feeding, speed change, tool change etc. are done quickly and consistently with lesser human involvement
- the operators need lesser skill and putting lesser effort and attention
- suitable for batch or small lot production
- costlier than centre lathes of same capacity.

**Capstan and Turret lathes**

The semiautomatic lathes, capstan lathe and turret lathe are very similar in construction, operation and application.



In contrast to centre lathes, capstan and turret lathes

- are semiautomatic

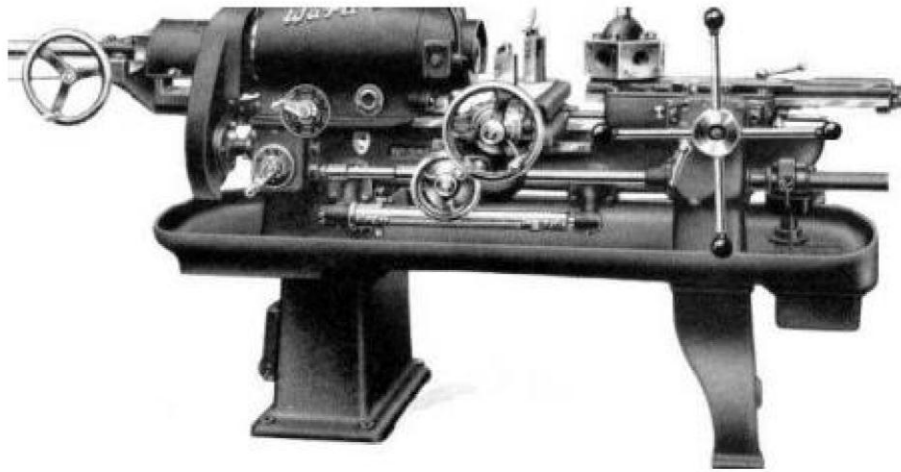
- possess an axially movable indexable turret (mostly hexagonal) in place of tailstock
- holds large number of cutting tools; upto four in indexable tool post on the front slide, one in the rear slide and upto six in the turret (if hexagonal) as indicated in the schematic diagrams.
- are more productive for quick engagement and overlapped functioning of the tools in addition to faster mounting and feeding of the job and rapid speed change.
- enable repetitive production of same job requiring less involvement, effort and attention of the operator for pre-setting of work-speed and feed rate and length of travel of the cutting tools
- are relatively costlier
- are suitable and economically viable for batch production or small lot production.

There are some differences in between capstan and turret lathes such as,

- Turret lathes are relatively more robust and heavy duty machines
- Capstan lathes generally deal with short or long rod type blanks held in collet, whereas turret lathes mostly work on chucking type jobs held in the quick acting chucks
- In capstan lathe, the turret travels with limited stroke length within a saddle type guide block, called auxiliary bed, which is clamped on the main bed , whereas in turret lathe, the heavy turret being mounted on the saddle which directly slides with larger stroke length on the main bed.
- One additional guide rod or pilot bar is provided on the headstock of the turret lathes , to ensure rigid axial travel of the turret head
- External screw threads are cut in capstan lathe, if required,



using a self opening die being mounted in one face of the turret, whereas in turret lathes external threads are generally cut, if required, by a single point or multipoint chasing tool being mounted on the front slide and moved by a short lead screw and a swing type half nut.



Ram type turret lathes, i.e., capstan lathes are usually single spindle and horizontal axis type. Turret lathes are also mostly single spindle and horizontal type but it may be also

- Vertical type and
- Multi spindle type

Some more productive turret lathes are provided with preoptive drive which enables on-line presetting and engaging the next work-speed and thus help in reducing the cycle time.

#### **Multiple spindle Vertical Turret lathe**

Turret lathes are mostly horizontal axis single spindle type. The multiple spindle vertical turret lathes are characterised by :

- Suitably used for large lot or mass production of jobs of generally ;
  - Chucking type

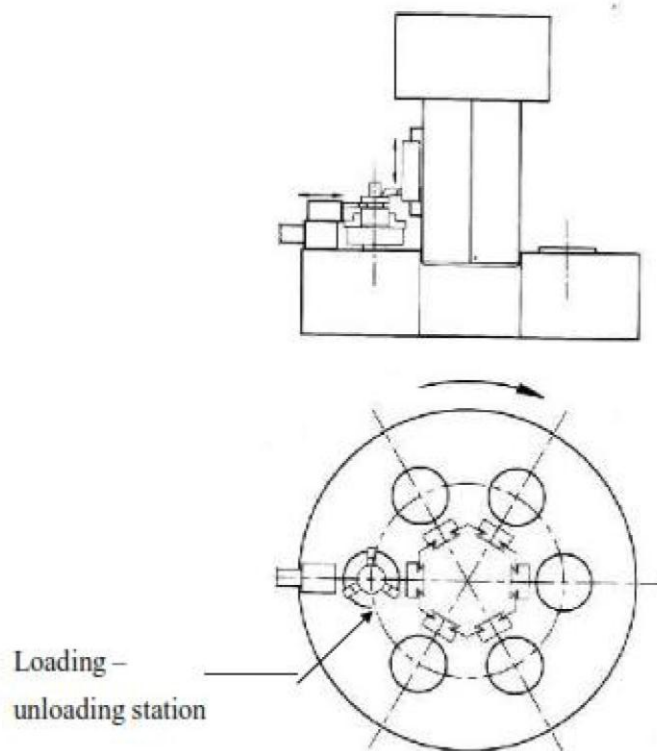
- Relatively large size
  - Requiring limited number of machining operations
- Machine axis – vertical for
  - lesser floor space occupied
  - easy loading and unloading of blanks and finished jobs
  - relieving the spindles of bending loads due to job - weight.
- Number of spindle – four to eight.

The basic configuration of multiple spindle vertical turret lathes which are comprised mainly of a large disc type spindle carrier and a tool holding vertical ram as shown.

Such vertical turret lathes are of three categories :

• **Parallel processing type :**

The spindle carrier remains stationary. Only the tool slides move with cutting tools radially and axially. Identical jobs (say six) are simultaneously mounted and machined in the chucks parallelly at all stations each one having same set of axially and / or radially moving cutting tools.



### **Basic configuration of multispindle automatic vertical lathe**

- **Progressively processing type :**

The spindle carrier with the blanks fitted in the chucks on the rotating spindle is indexed at regular interval by a Geneva mechanism. At each



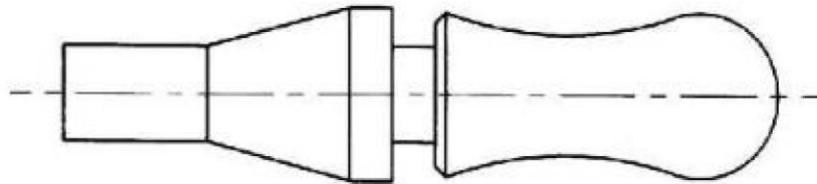
station the job undergoes a few preset machining work by the axially and / or radially fed cutting tools. The blank getting all the different machining operations progressively at the different work stations is unloaded at a particular station where the finished job is replaced by another fresh blank. This type of lathes are suitable for jobs requiring large number of operations.

- **Continuously working type :**

Like in parallel processing type, here also each job is finished in the respective station where it was loaded. The set of cutting tools, mostly fed only axially along a face of the ram continuously work on the same blank throughout its one cycle of rotation along with the spindle carrier. The tool ram having same tool sets on its faces also rotate simultaneously along with the spindle carrier which after each rotation halts for a while for unloading the finished job and loading a fresh blank at a particular location. Such system is also suitable for jobs requiring very few and simple machining operations.

- **Hydraulic copying (tracer controlled) lathes**

Jobs having steps, tapers and / or curved profiles, are conveniently and economically produced in batch or lot in semi automatically operated tracer controlled hydraulic copying lathe. The movement of the stylus along the template provided with the same desired job-profile) is hydraulically transmitted to the cutting tool tip which replicates the template profile.



**A typical job suitable for copy turning.**

#### **(b) General Purpose Automatic lathes**

Automatic lathes are essentially used for large lot or mass production of small rod type of jobs. Automatic lathes are also classified into some distinguished categories based on constructional features, operational characteristics, number of spindles and applications as follows

- Single spindle
  - Automatic cutting off lathes
  - Automatic (screw cutting) lathe
  - Swiss type automatic lathe
- Multispindle automatic lathe

#### **Automatic cutting off lathe**

These simple but automatic lathes are used for producing short work pieces of simple form by using few cross feeding tools. In addition to parting some simple operations like short turning, facing, chamfering etc. are also done.

#### **Single spindle automatic lathe**

The general purpose single spindle automatic lathes are widely used for

quantity or mass production (by machining) of high quality fasteners; bolts, screws, studs etc., bushings, pins, shafts, rollers, handles and similar small metallic parts from long bars or tubes of regular section and also often from separate small blanks.

Unlike the semiautomatic lathes, single spindle automats are :

- preferably and essentially used for larger volume of production i.e., large lot production and mass production
- used always for producing jobs of rod, tubular or ring type and of relatively smaller size.
- run fully automatically, including bar feeding and tool indexing, and continuously over a long duration repeating the same machining cycle for each product
- provided with upto five radial tool slides which are moved by cams mounted on a cam shaft
- of relatively smaller size and power but have higher spindle speeds



**A typical single spindle automatic lathe.**

### **Swiss type automatic lathe**

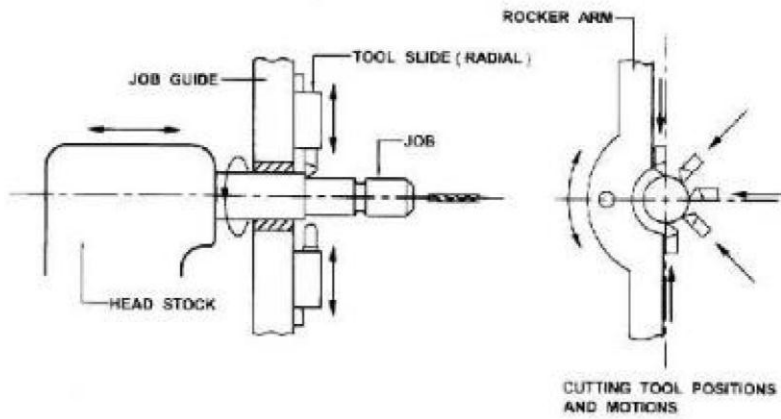
The characteristics and applications of these single spindle automatic lathes are :

- In respect of application :  
Used for lot or mass production of thin slender rod or tubular jobs, like components of small clocks and wrist watches, by precision machining;

- Job size (approximately)
  - ✦ Diameter range – 2 to 12 mm
  - ✦ Length range – 3 to 30 mm

Dimensional accuracy and surface finish – almost as good as provided by grinding

- In respect of configuration and operation
  - The headstock travels enabling axial feed of the bar stock against the cutting tools
  - There is no tailstock or turret
  - High spindle speed (2000 – 10,000 rpm) for small job diameter
  - The cutting tools (upto five in number including two on the rocker arm) are fed radially
  - Drilling and threading tools, if required, are moved axially using swivelling device(s)
  - The cylindrical blanks are prefinished by grinding and are moved through a carbide guide bush as shown.



**Basic principle of Swiss type automatic lathe**