QUANTITY PRODUCTION

BY: JITENDER JADON

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CONTENTS

- Quantity production: Introduction, Characteristics and properties
- Economic Order Quantity
- Applications of quantity production
- Process planning and scheduling for quantity production
- Single spindle automatic lathe
- Transfer machines
- CNC machine tools
- Design and use of jigs and fixtures in machine shops.

INTRODUCTION

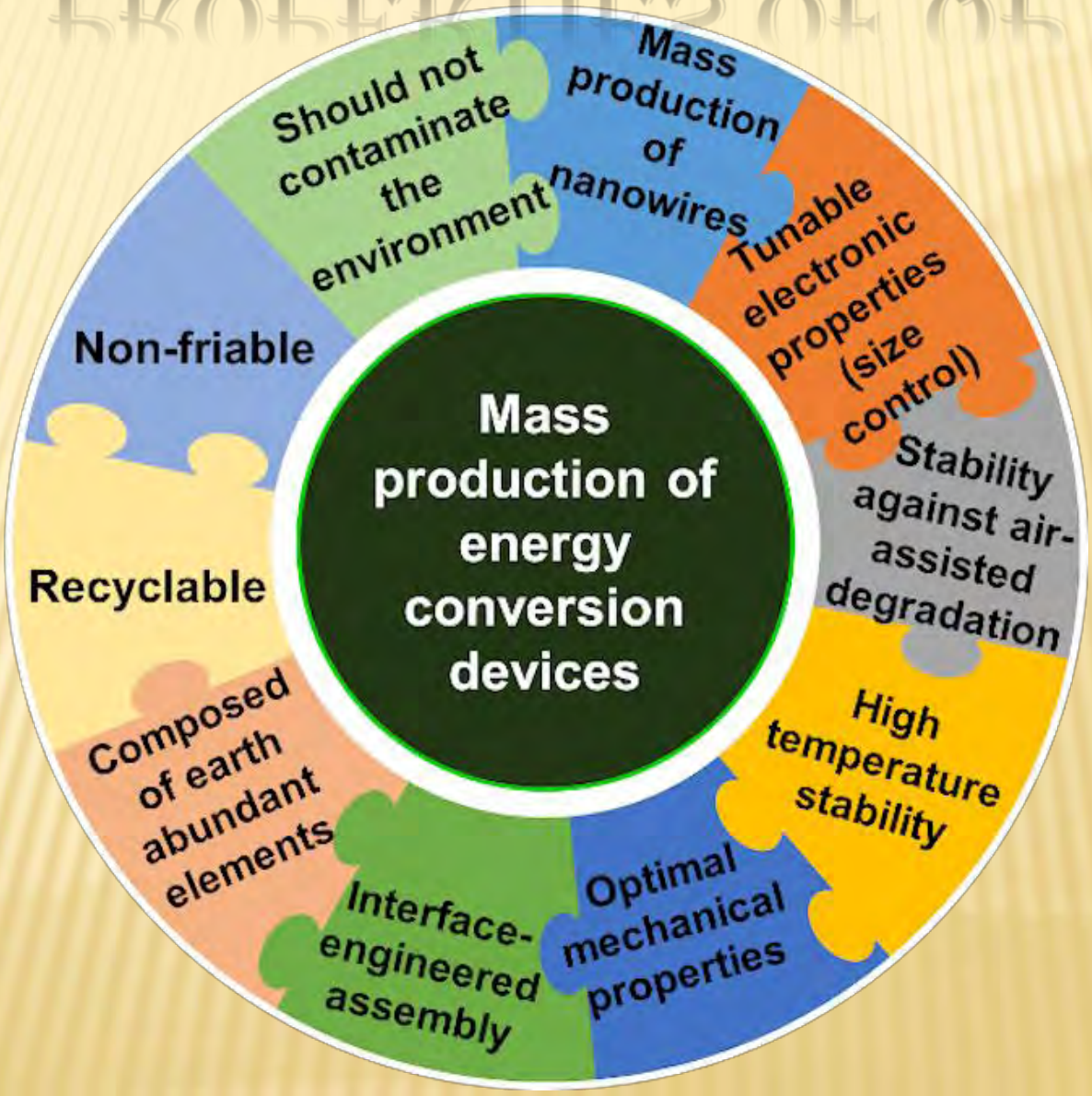
- Manufacture of discrete parts or assemblies using a continuous process are called Quantity production.
- This production system is justified by very large volume of production.
- The machines are arranged in a line or product layout. Product and process standardization exists and all outputs follow the same path.

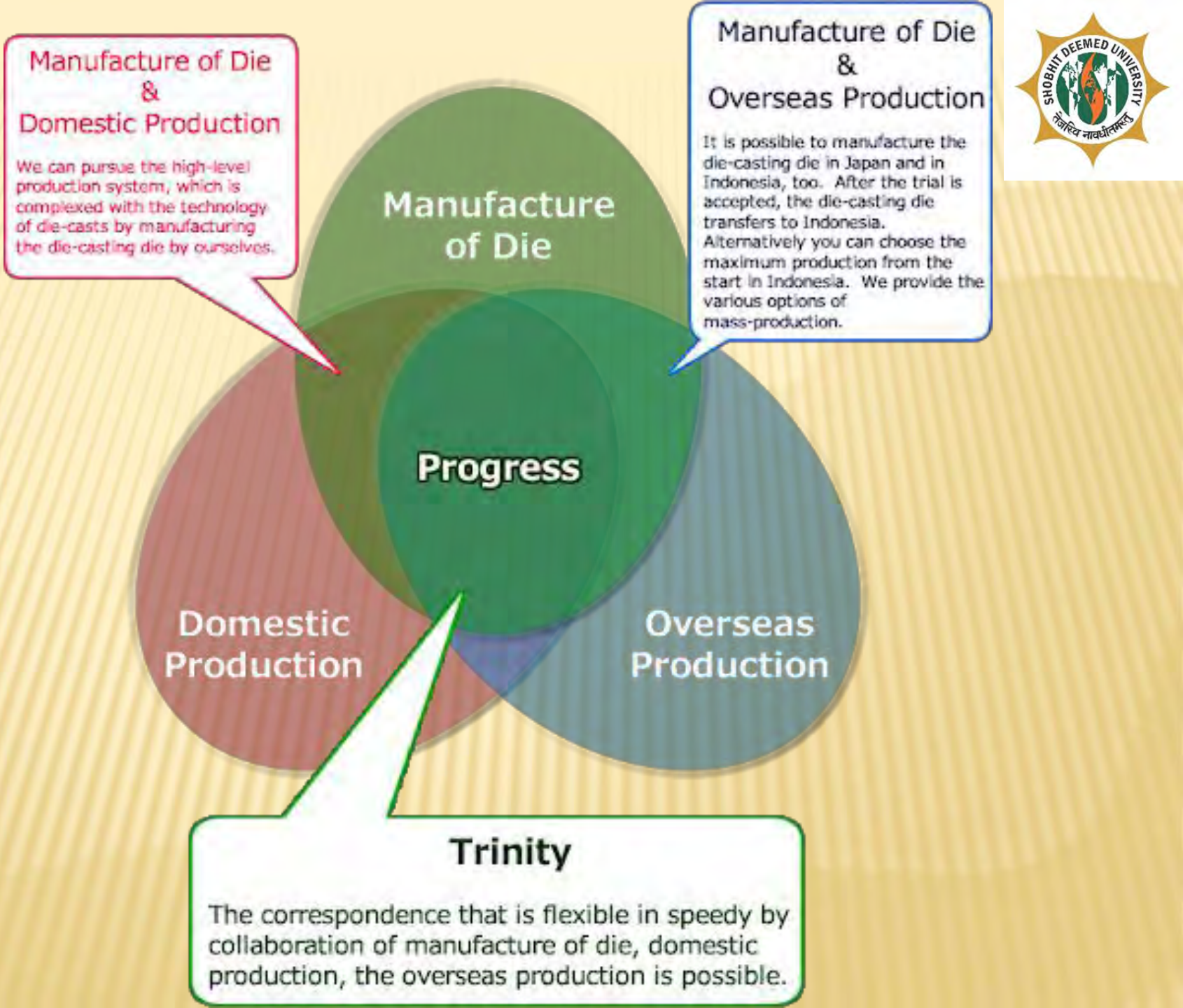
HELICAL GEAR PRODUCED IN QUANTITY

CHARACTERISTICS OF QP

- Standardization of product and process sequence.
- Large volume of products.
- Shorter cycle time of production.
- Lower in process inventory.
- Perfectly balanced production lines.
- Production planning and control is easy.
- Material handling can be completely automatic.

PROPERTIES OF QP

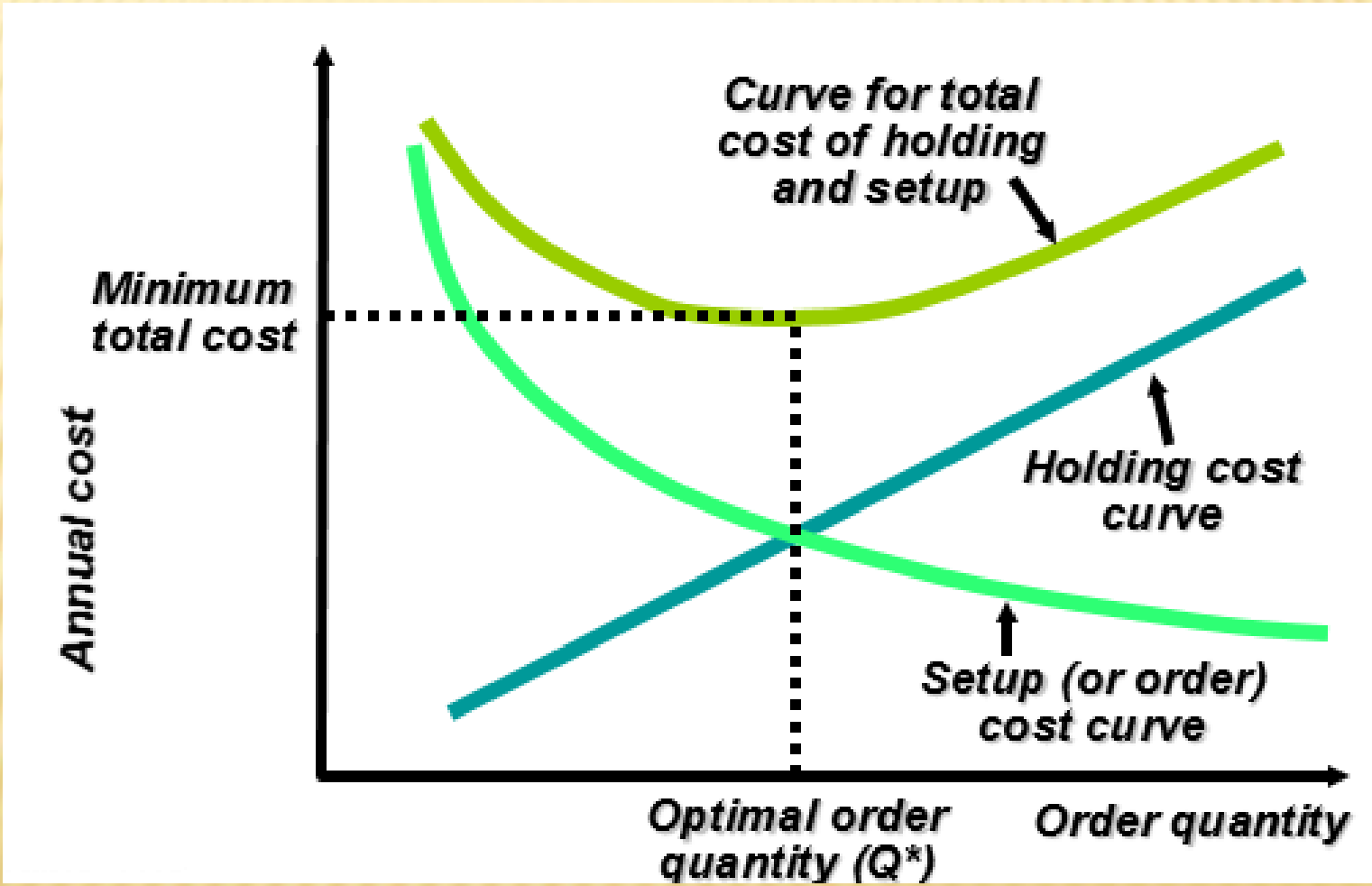



Manufacture of Die
&
Domestic Production
We can pursue the high-level production system, which is complexed with the technology of die-casts by manufacturing the die-casting die by ourselves.
Manufacture of Die
&
Overseas Production
It is possible to manufacture the die-casting die in Japan and in Indonesia, too. After the trial is accepted, the die-casting die transfers to Indonesia. Alternatively you can choose the maximum production from the start in Indonesia. We provide the various options of mass-production.
Manufacture of Die
Progress
Domestic Production
Overseas Production
Trinity
The correspondence that is flexible in speedy by collaboration of manufacture of die, domestic production, the overseas production is possible.

ECONOMIC ORDER QUANTITY

Economic order quantity (EOQ) is the ideal order quantity a company should purchase to minimize inventory costs such as holding costs, shortage costs, and order costs. This production-scheduling model was developed in 1913 by Ford W. Harris and has been refined over time. The formula assumes that demand, ordering, and holding costs all remain constant.

PRODUCTION COST CURVE AND ECONOMIC ORDER QUANTITY



Formula and Calculation of Economic Order Quantity

The formula for EOQ is:

$$Q = \sqrt{\frac{2DS}{H}}$$

where:

Q = EOQ units

D = Demand in units (typically on an annual basic)

S = Order cost (per purchase order)

H = Holding costs (per unit, per year)

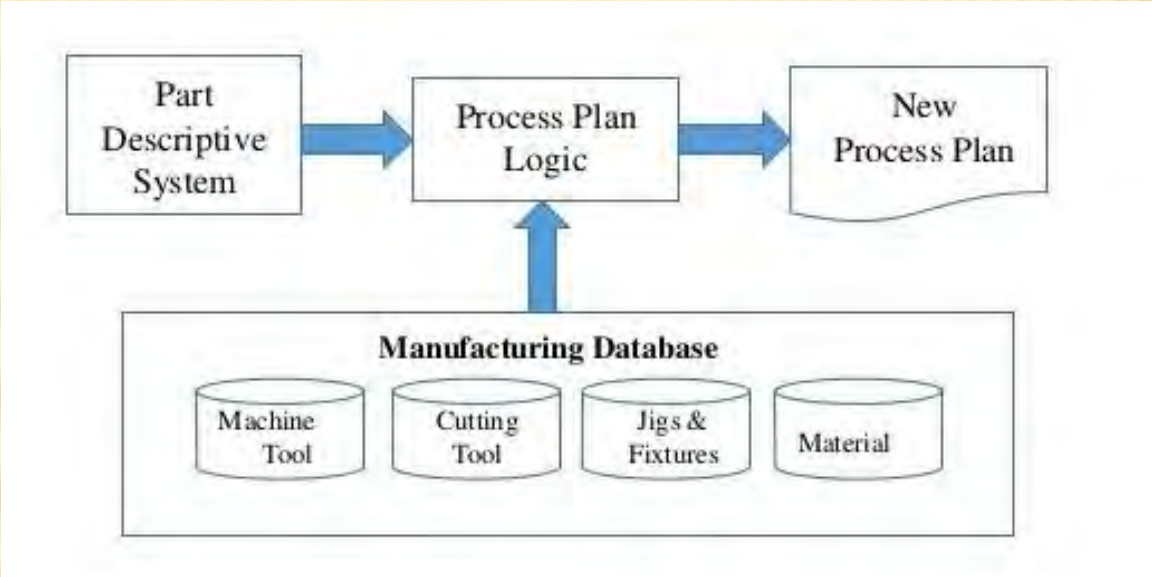
ADVANTAGES OF QP

- Higher rate of production with reduced cycle time.
- Higher capacity utilization due to line balancing.
- Less skilled operators are required.
- Low process inventory.
- Manufacturing cost per unit is low.

LIMITATIONS OF QP

- Breakdown of one machine can stop the entire production line.
- Line layout needs major change with the changes in product design.
- High investment in production facilities.
- The cycle time is determined by the slowest operation.

PROCESS PLANNING AND SCHEDULING



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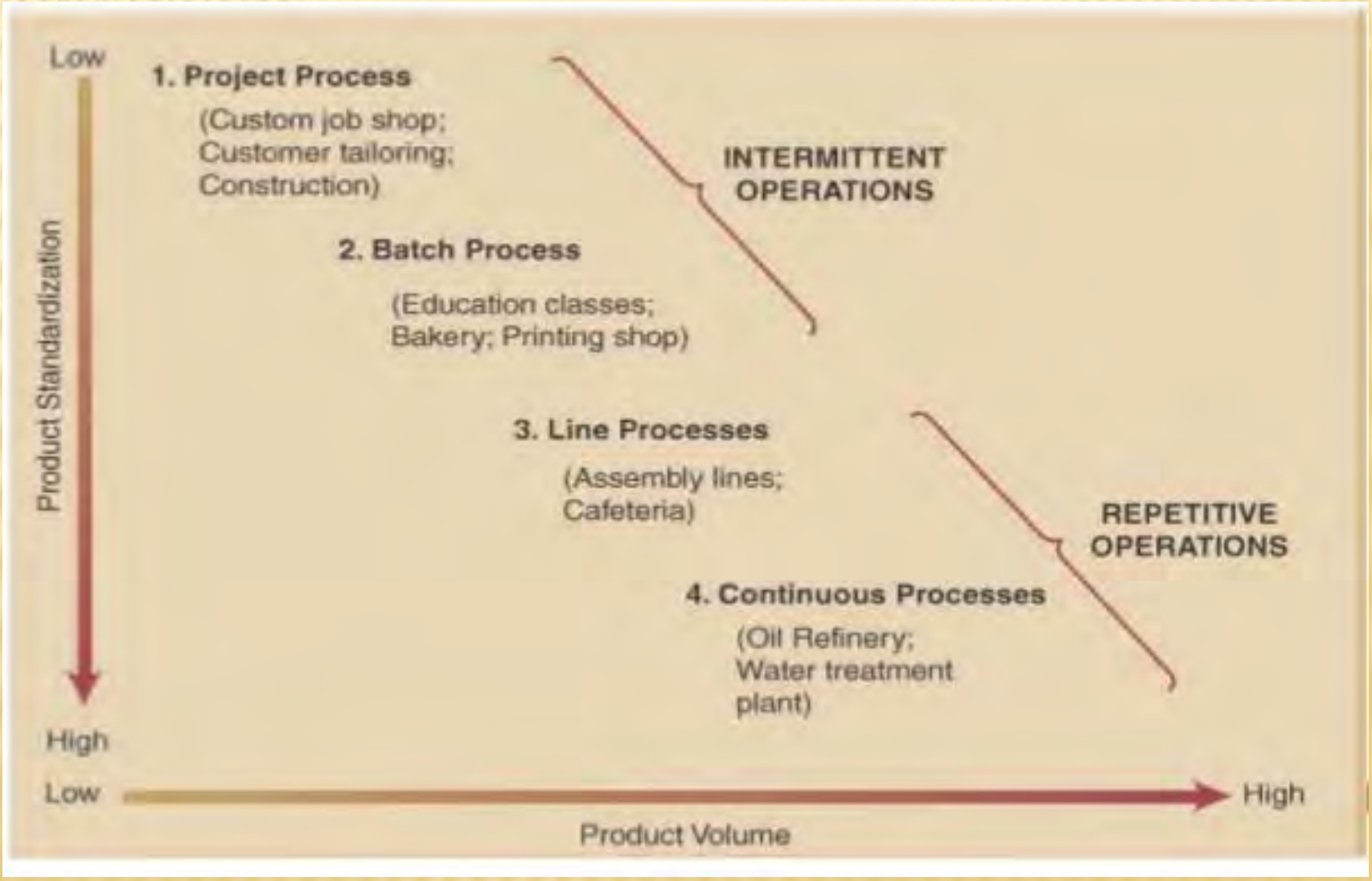
INTRODUCTION

- Planning in which conditions necessary for transforming materials from one state to another state are determined.
- It determines how a work to be done.
- It converts design into workable instructions for manufacture, along with associated decisions on component purchase or fabrication, processes and equipments selection.

TYPES OF PROCESSES

	Project	Batch	Mass	Continuous
Product	Unique	Made to order	Made to stock	Commodity
Customer	Singly	Few individuals	Mass market	Mass market
Demand	Infrequent	Fluctuates	Stable	Very stable
Volume	Very low	Low to med	High	Very high
Variety	Infinite	Many, high	Low	Very low
System	Long-term	Intermittent	Flow lines	Process industry
Equipment	Varied	General	Special	Highly automated
Type of work	Contracts	Fabrication	Assembly	Mix, treat, refine
Skills	Experts, craftspeople	Wide range	Limited range	Equipment monitors
Advantages	Custom work, quality	Flexibility, speed, low cost	Efficiency, large capacity	Highly efficient
Disadv.	Nonrepeating	Costly, slow	Capital invest.	Difficult to change
Example	Construction	Printing, bakery	Autos, TV's	Paint, oil, food

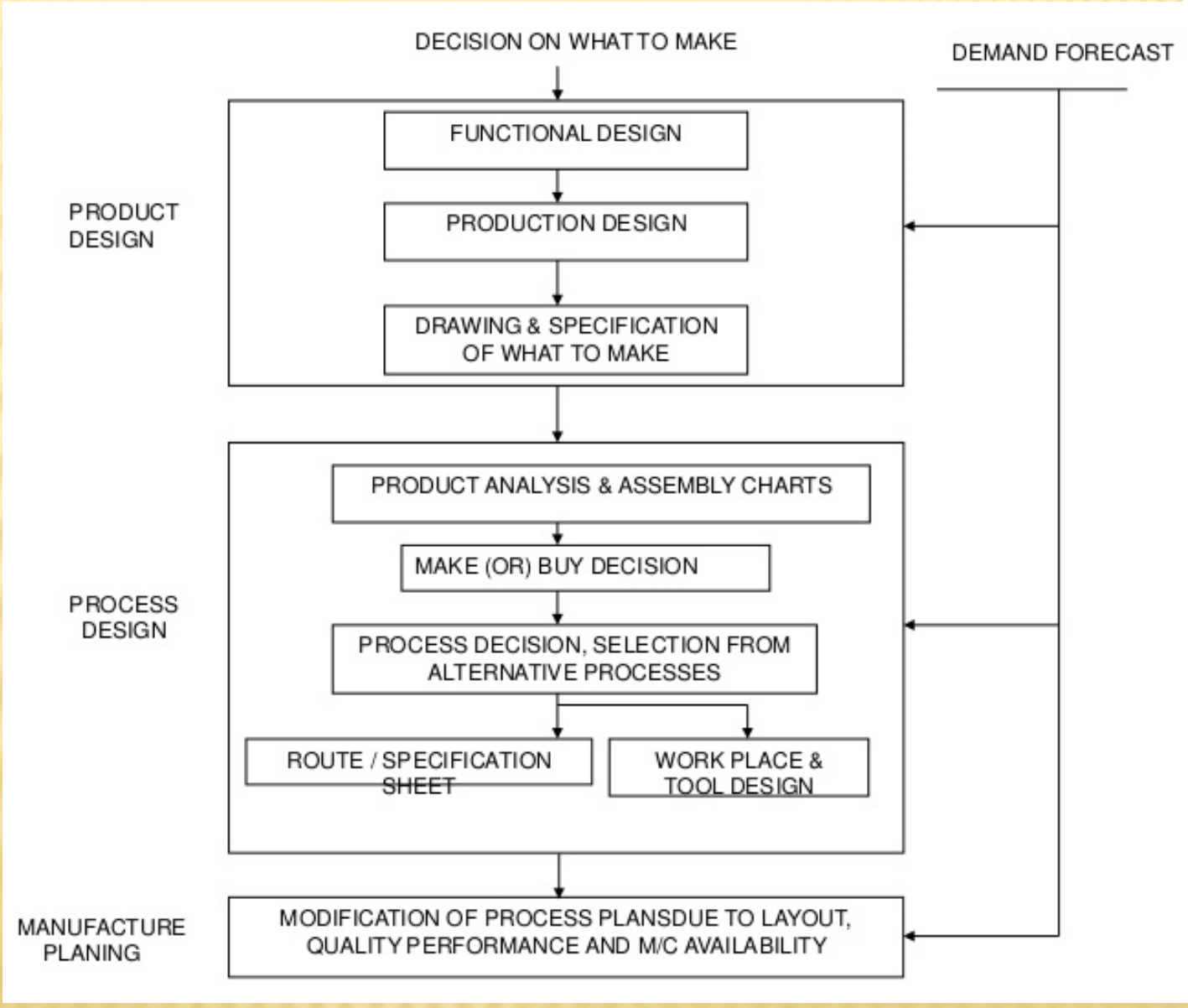
UNDERLYING PROCESS RELATIONSHIP BETWEEN VOLUME AND STANDARDIZATION CONTINUUM



PROCESS PLANNING

- Process planning is key element in project management that focuses on selecting resources for use in the execution and completion of a project.
- In a manufacturing setting, this aspect of planning also includes establishing the general sequence of steps that begin with the acquisition of materials and end with the creation of finished product.

PROCESS PLANNING FLOW CHART



PROCESS PLANNING

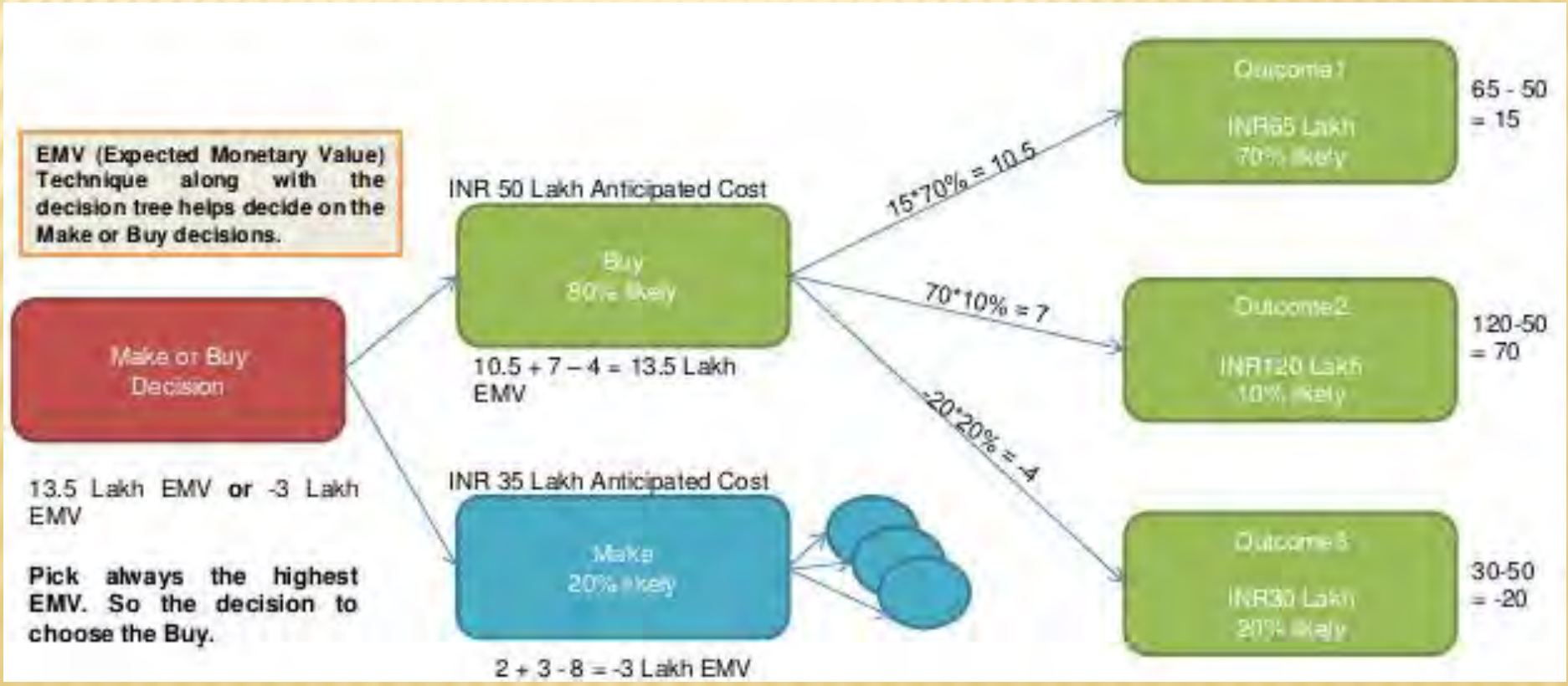
- Make or buy decisions
- Process selection
- Capacity planning
- Assembly chart

MAKE OR BUY DECISIONS

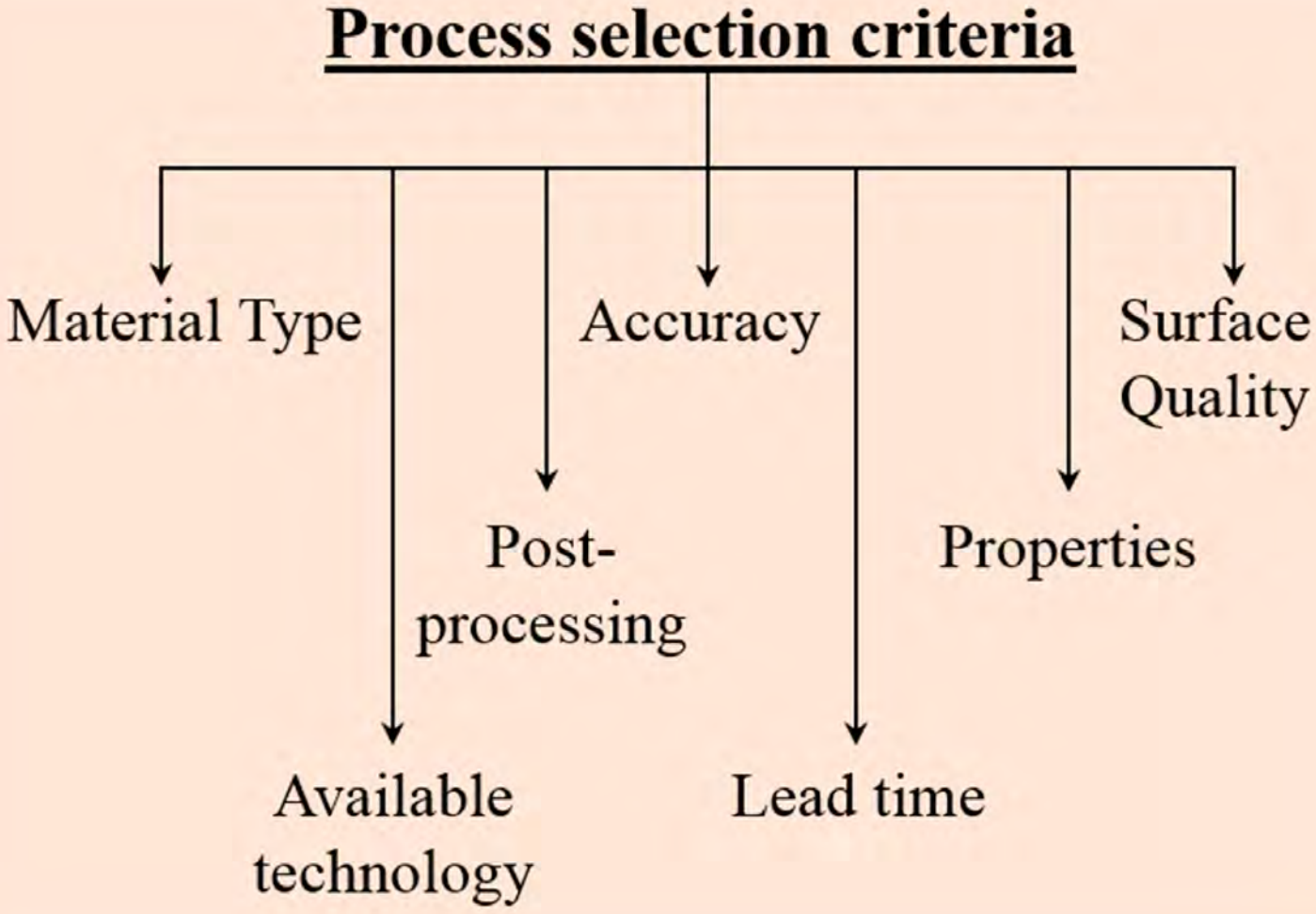
- Performed to decide weather the work be done internally or externally.
- In some cases the work is outsourced even if the expertise is available due to:
  - Excessive cost of implications.
  - Externally available cost effective deliveries.
  - Internal sources tied to some other projects.
- The lease option is also considered first whenever the buy option is considered.

MAKE OR BUY DECISIONS

Make or buy decision is decided by EMV (Expected Monetary Value) i.e. Cost, Available capacity, Quality consideration, speed, reliability and Expertise. Example is given below:



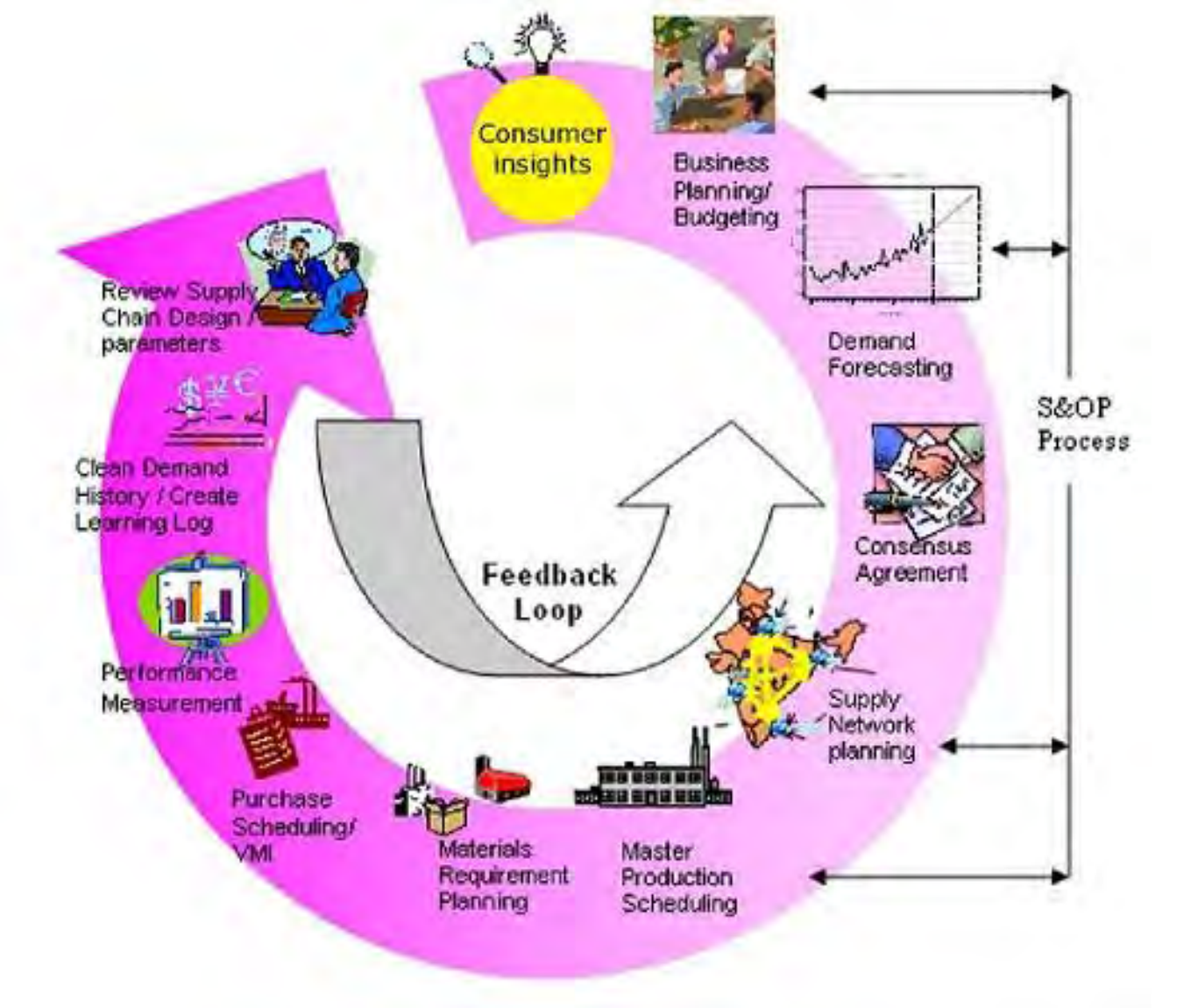
PROCESS SELECTION



CAPACITY PLANNING

- Capacity planning is the process of determining the production capacity needed by an organization to meet the demand for its products.
- A discrepancy between the capacity of an organization and the demands of its customers result in unfulfilled customers.

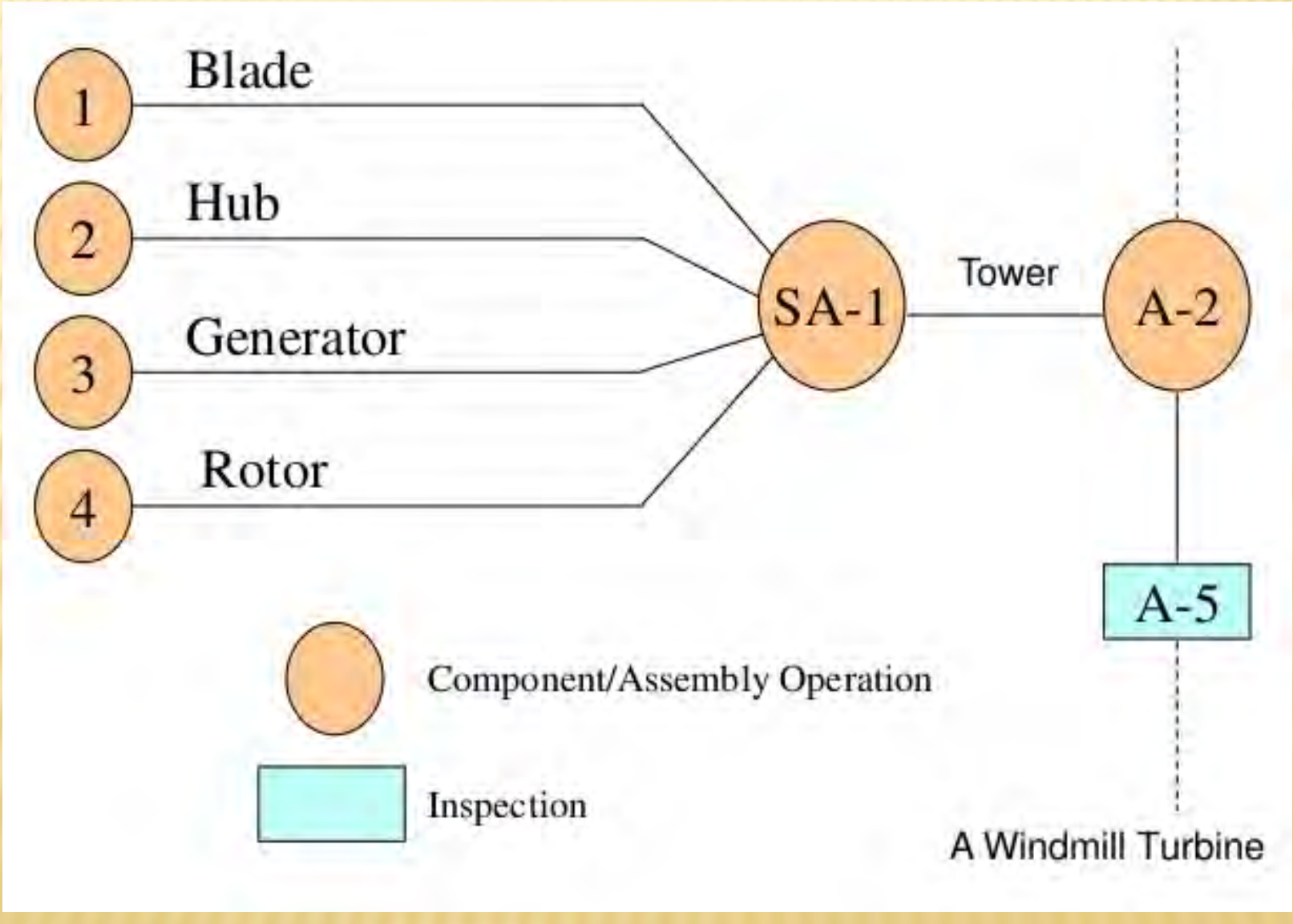
CAPACITY PLANNING



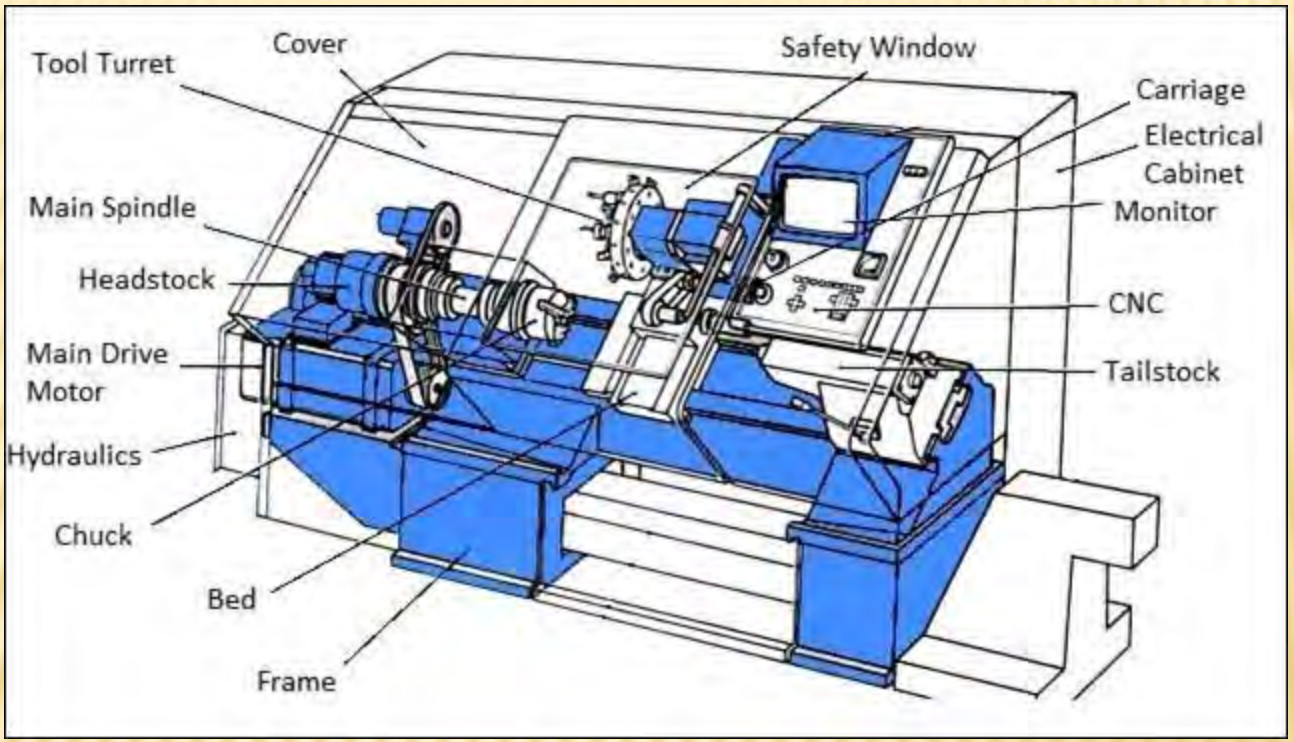
ASSEMBLY CHART

- Assembly chart gives pictorially step by step assembly sequence and what items to be assembled till finished product is produced.
- Assembly chart gives a macro view of how materials and sub assembly are united to form a finished product.
- It is a starting point to understand the factory layout needs, equipment needs, training needs for any company to deliver a finished product/service

EXAMPLE OF ASSEMBLY CHART



AUTOMATIC LATHE



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INTRODUCTION

- These are machine tools in which components are machined automatically.
- The working cycle is fully automatic that is repeated to produce duplicate parts without participation of operator.
- All movements of cutting tools, their sequence of operations, applications, feeding of raw materials, parting off, unloading of finished parts, all are done on machine.
- All working & idle operations are performed in definite sequence by control system adopted in automatic lathe, which is suitable for a given work.
- Only operation required 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 OF AUTOMATIC LATHE

- 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 or can inspect completed parts.

SEMI AUTOMATIC LATHES

- These are turning machines used for chucking work.
- In this type of lathes although all movements of work piece or tools are automatically controlled, but work piece 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 required to start subsequent cycle, i.e., to machine each work piece.
- Operator work is to load work piece or blank into machine, start the machine, checks the work & removes the completed part by hand.

NEED OF AUTOMATIC & SEMI-AUTOMATIC LATHES

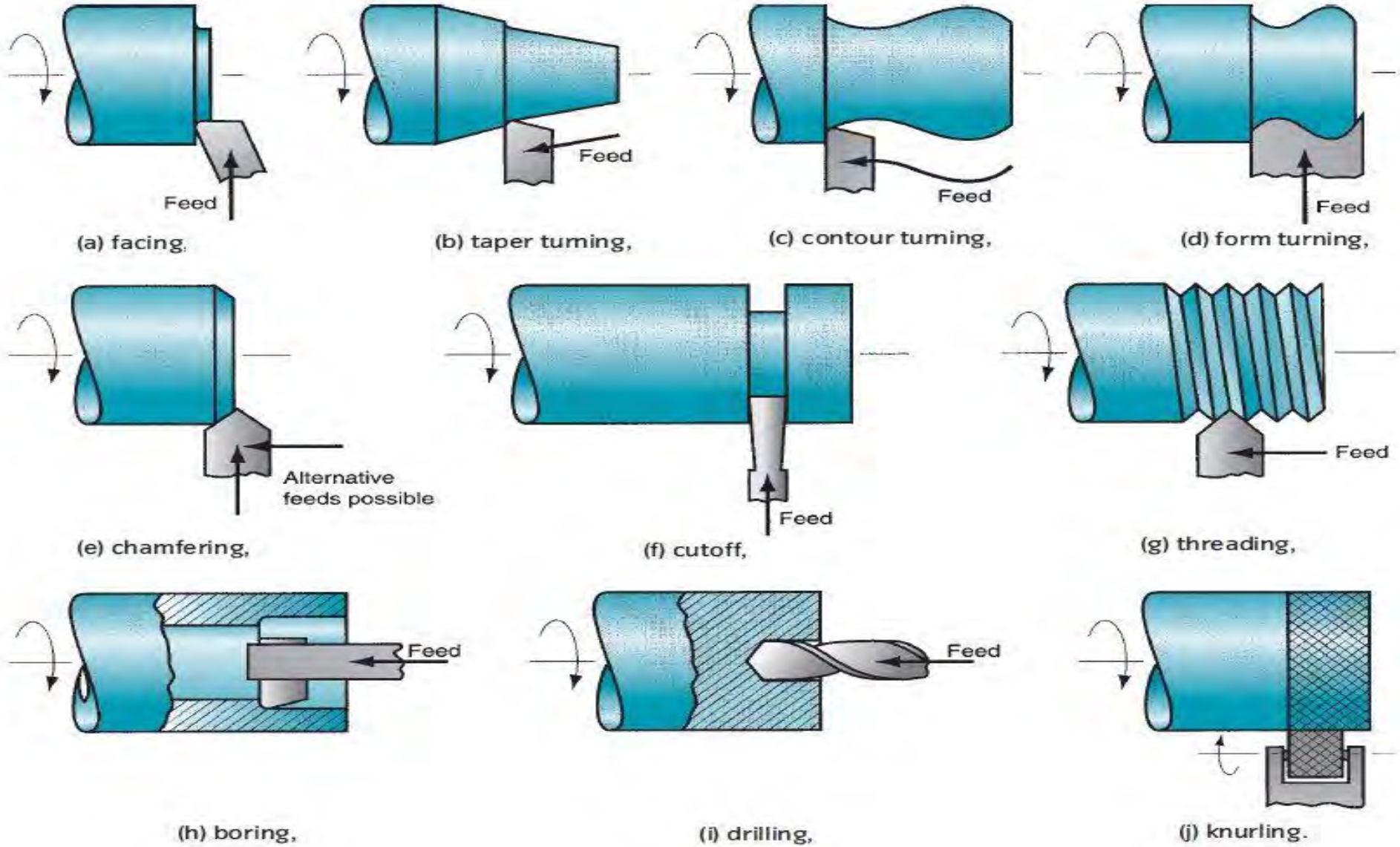
Automatic and semi automatic lathes are designed to perform following operations:

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

Same job can be machined on engines, capstan, turret and automatic lathes. Main considerations to select suitable lathe are:

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

OPERATIONS PERFORMED ON AUTOMATIC SEMI-AUTOMATIC LATHES



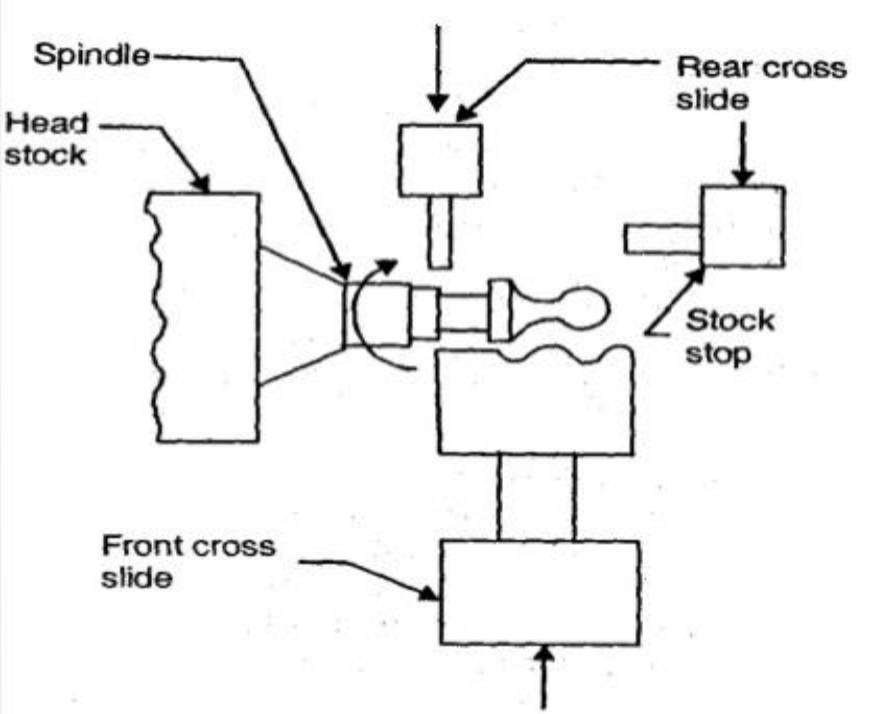
CLASSIFICATION OF AUTOMATIC LATHES

Sr. No.	Category of classification	Types
1	Type of work machined	a) Magazine Loaded Automatics b) Automatic Bar Machines
2	Number of work spindles	a) Single Spindle Automatics b) Multiple Spindle Automatics
3	Purpose of spindle	a) General purpose Machine b) Single purpose Machine
4	Arrangement of spindle	a) Horizontal Machine b) Vertical Machine

TYPES OF AUTOMATIC LATHE BASED ON NUMBER OF SPINDLE

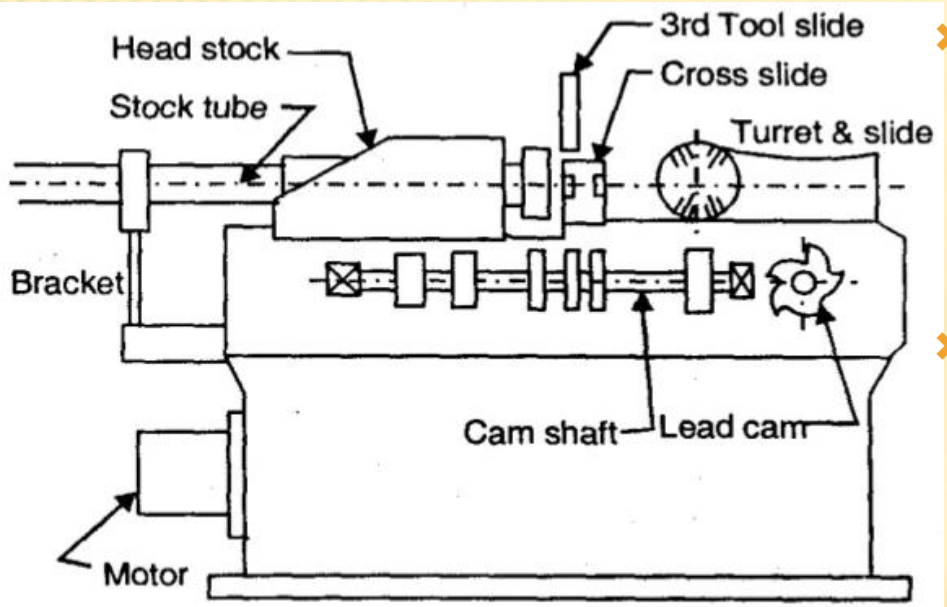
- **Single Spindle Automatics**
  - Automatic cutting off Machine
  - Automatic screw machine
  - Swiss type Automatic screw/ Sliding head screw
- **Multiple Spindle Automatics**
  - Parallel action Automatics/ Multiple flow Machine
  - Six spindle progressive action multi spindle

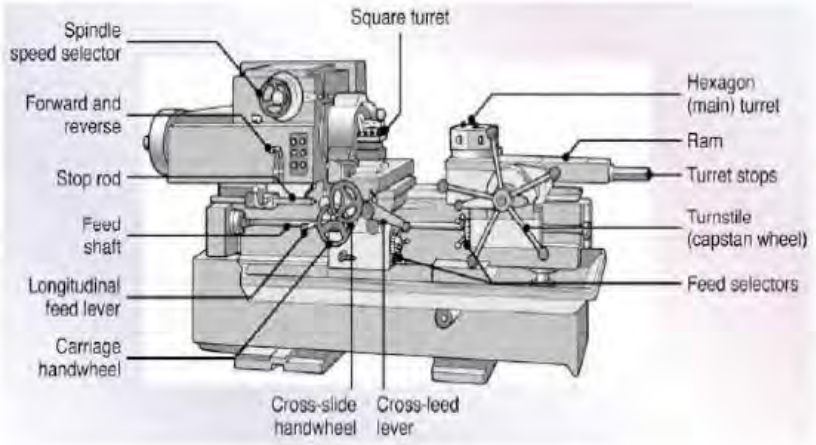
AUTOMATIC CUTTING OFF MACHINE



- These machines produce short work piece of 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.
- The required 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 collect chuck of rotating spindle.
- Machining is done by tolls that are held in slides operating only in crosswise direction.
- Typical simple parts (3 to 20 mm dia.) machined on such a machine is shown in figure.

AUTOMATIC SCREW LATHE MACHINE



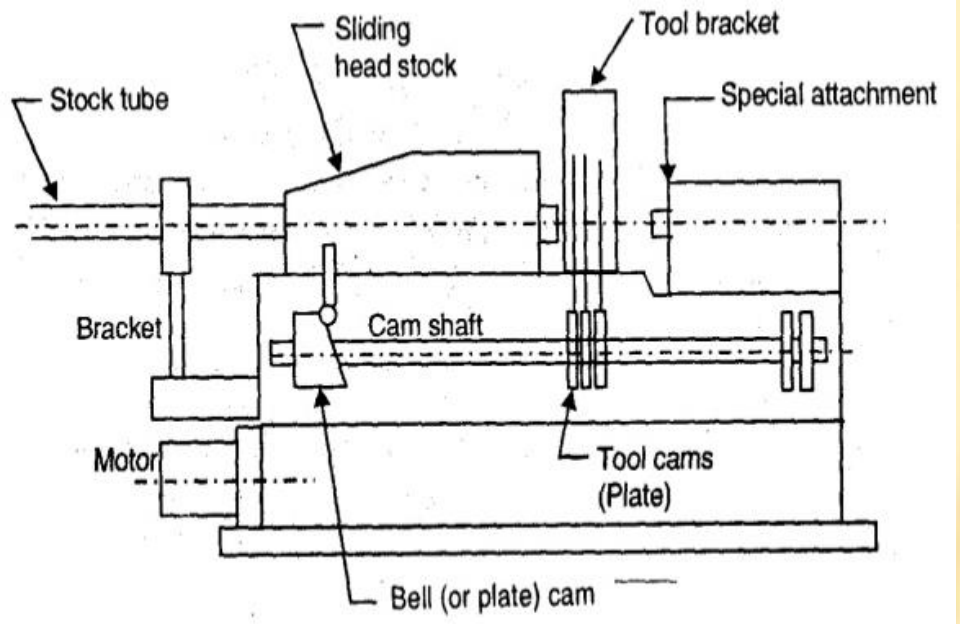


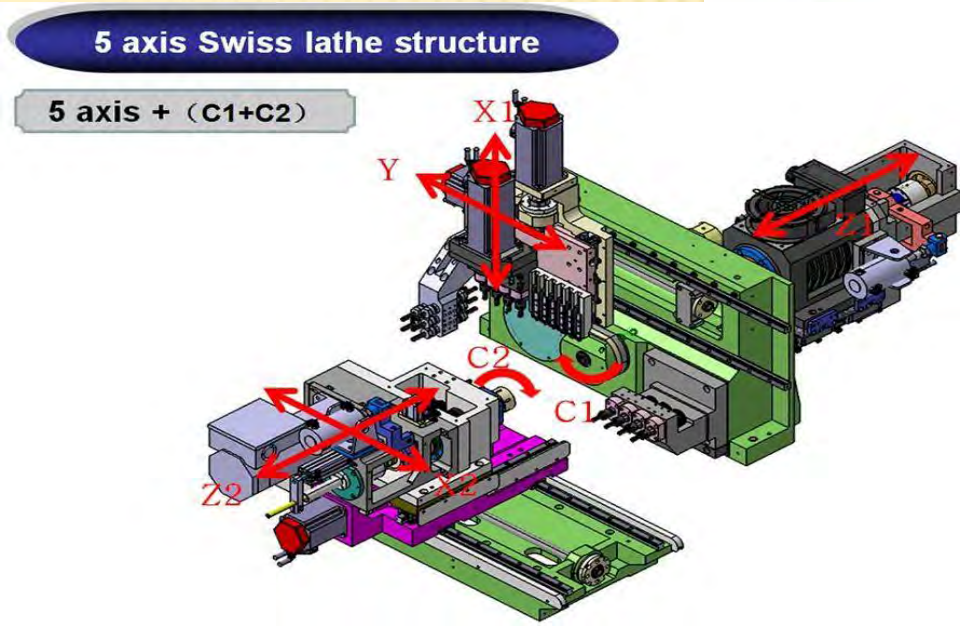
- Used for producing small screws (12.7 to 60mm dia.) generally, but also in production of all sorts of small turned parts.
- These are completely automatic bar type turret lathes, designed for machining complex internal & external surfaces on parts made of bar stock/ separate blanks.
- Up to 10 different 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.

AUTOMATIC SCREW LATHE MACHINE

- Vertical tools 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 side.
- Parting off from tools are mounted on cross slide.
- At end of each cut turret slide is withdrawn automatically & indexed to bring next tool to position.

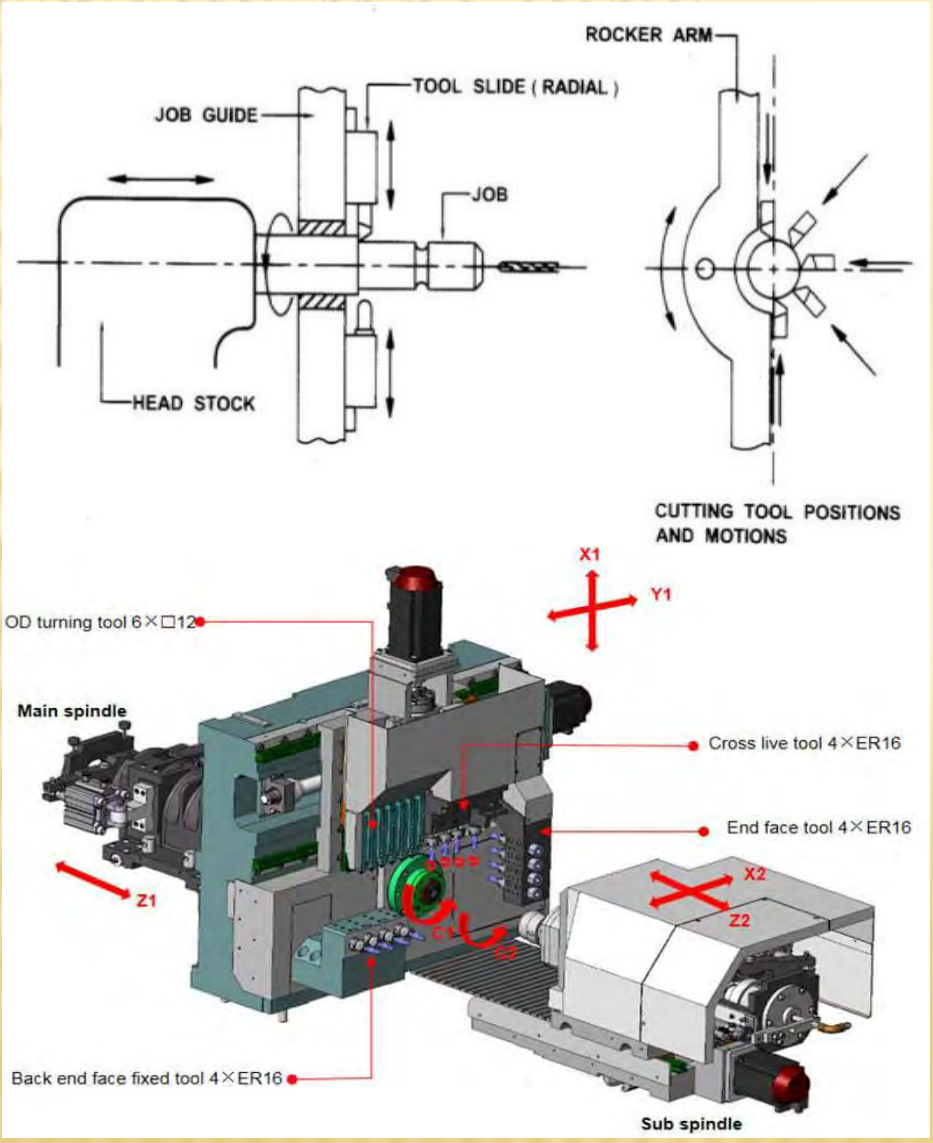
SWISS TYPE AUTOMATIC SCREW LATHE MACHINE





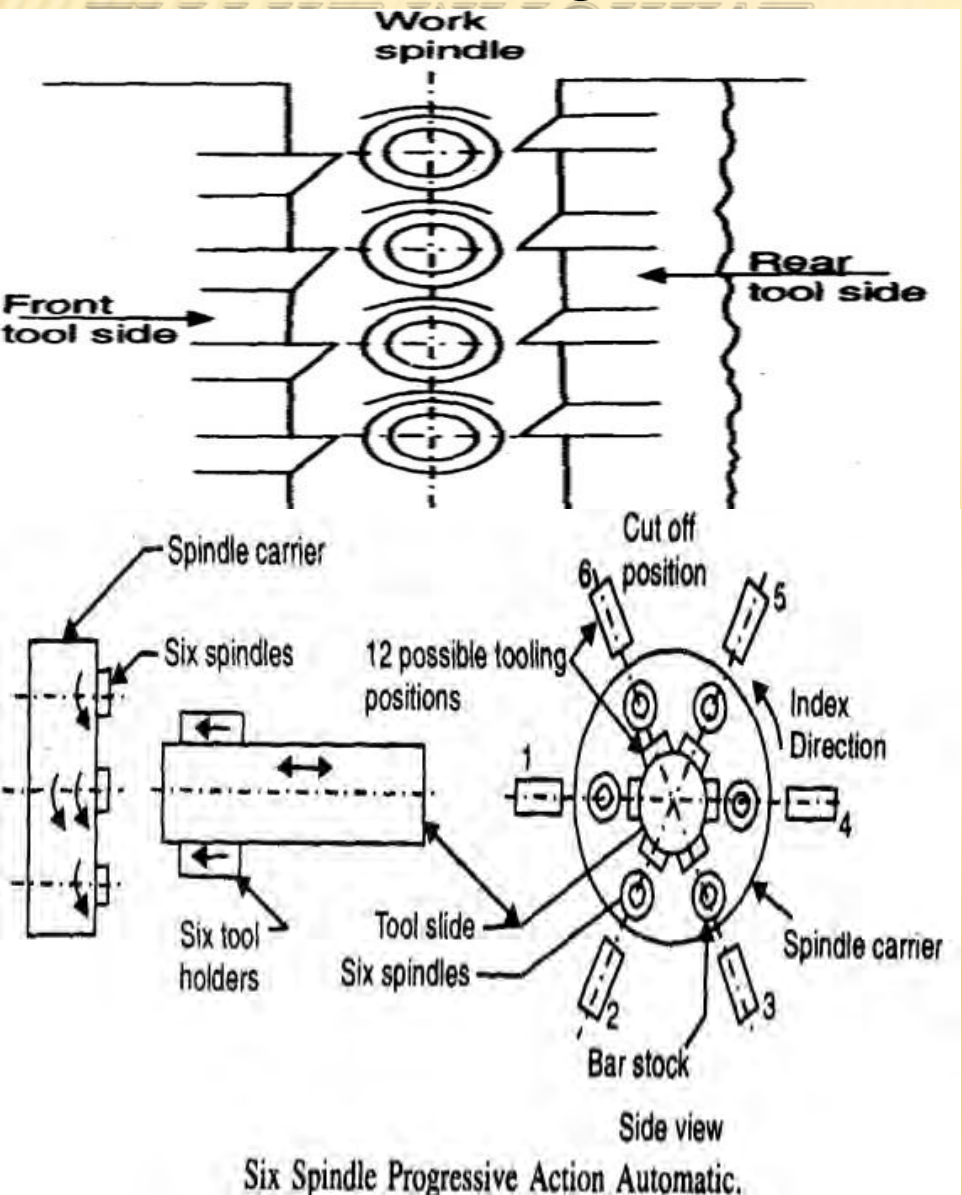
- As name implies in this machine head stock is movable & tools are fixed.
- These machines are used for machining long accurate parts of small dia.(2 to 25mm).
- Bar stock is held in rotating collet in head stock & all longitudinal feeds are obtained by cam which moves entire head stock as unit.
- Rotating bar stock is fed through hard bushing in center of tool head.

SWISS TYPE AUTOMATIC SCREW LATHE MACHINE



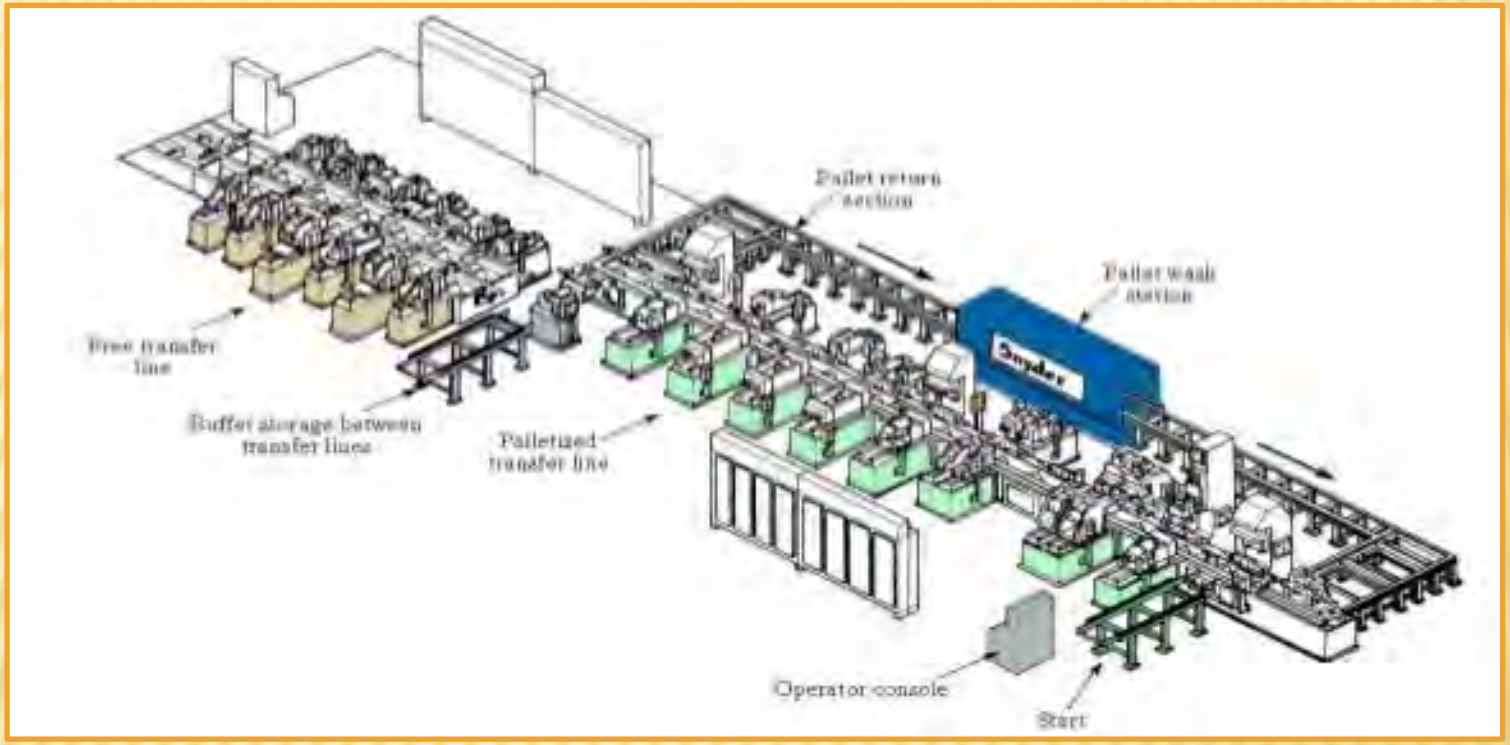
- Tool head consists of 5 single point tools is placed radically around bushing.
- Mostly diameter turning is done by 2 horizontal slides, other 3 slides used for operations such as knurling, chamfering, cutoff.
- Tools are controlled & positioned by cams that bring tool in as needed to turn, face, form, cutoff work piece from bar as it emerges from bushing. Close tolerances (0.005 to 0.00125mm) are obtained.

MULTIPLE SPINDLE AUTOMATIC LATHE MACHINE



- 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 machine where one turret face at a time is working on one single spindle, in multi spindle machine 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.

TRANSFER MACHINE



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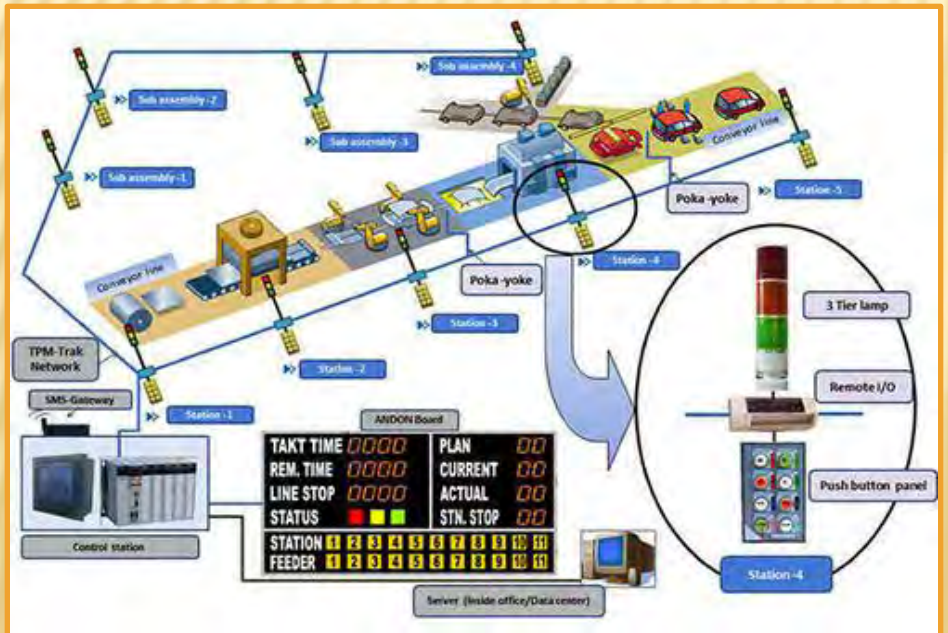
INTRODUCTION

A **transfer machine** is a manufacturing system which consists of a predetermined sequence of machines connected by an automated material handling system and designed for working on a very small family of parts. Parts can be moved singularly because there's no need for batching when carrying parts between process stations (as opposed to a job shop for example). The line can synchronous, meaning that all parts advance with the same speed, or asynchronous, meaning buffers exist between stations where parts wait to be processed. Not all transfer lines must geometrically be straight lines, for example circular solutions have been developed which make use rotary tables, however using buffers becomes almost impossible.

ADVANTAGES OF TRANSFER MACHINE

- Easy management: low work in progress and scheduling without simultaneous processing of different products
- Less need for manpower
- Less space needed (compare with job shop)
- Less output variability: no alternative technological cycles and quality control is more effective (less WIP and easier to automate)
- High system saturation: less production mix variability
- Fast lead time.
- High volume of production is possible.

IN-LINE TRANSFER MACHINES

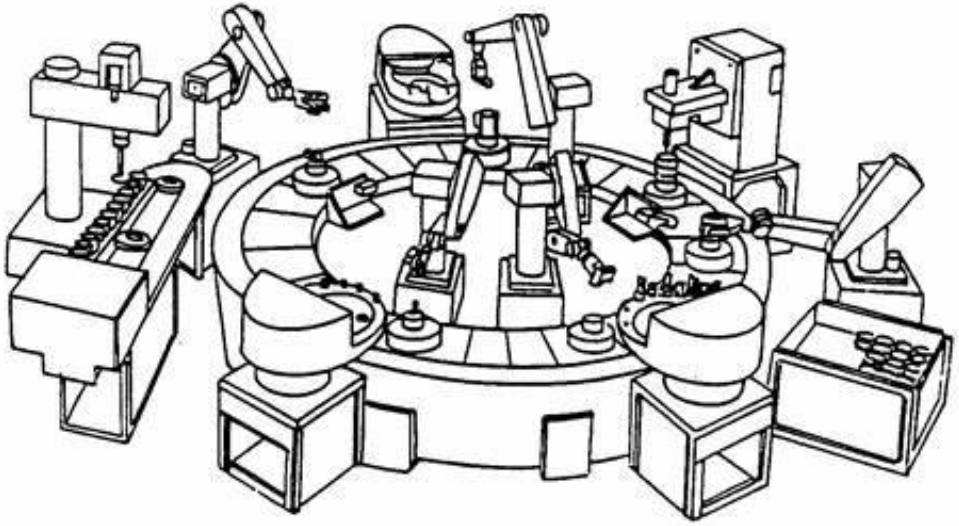


It consists of a central bed and the machining heads are arranged on the sides at a convenient pitch. The components are transferred along guide rails on the central bed. Cylinder blocks, gear box castings and axle box castings are transfer machined by this method.

ROTARY TRANSFER MACHINES

In rotary transfer machines, the work pieces are located and clamped in pallet type fixtures that are indexed in a circular path. During one cycle, sequential machining operations are performed simultaneously on the work pieces. The indexed table turns vertically or horizontally, and its movement could be continuous or intermittent. As the indexing table turns, the subsequent machining operation is repeated on the work piece which was just machined by the previous station. This design combines automated part feed with simultaneous operations, enabling rapid completion of parts.

ROTARY TRANSFER MACHINES



Rotary transfer machines are commonly used for mass-production of metal parts in the automotive industry and for pneumatic and hydraulic fittings. The parts can range from simple to complex, depending on the layout of the machining tool, which is often custom designed for manufacturing of a single part or family of parts. Rotary arrangement presents a compact arrangement which saves floor space. Annual production capacity of one rotary transfer machine can range from 100'000 units to tens of millions of units. .

DRUM TYPE TRANSFER MACHINES

- Like rotary table type, this machine also transfers the components in a circular path to workstations positioned around at equal distances.
- This machine instead of having a table has got a drum which rotates about a horizontal axis.
- The work fixtures are fixed around the periphery of the drum.

Limitations:

- Lower station remains idle due to limitations of space.
- Work at the lower station is always hanging, therefore needs firm clamping.
- The Drum size is limited

CONSTRUCTIONAL FEATURES OF TRANSFER MACHINES

- Central Bed
  - May be straight, circular or U shaped.
- Machining head
  - Usually made as multiple spindle tool heads driven by self contained motors and reduction gear boxes.
- Work loading devices
  - Manual loading
  - Automatic loading
- Work Transfer mechanisms
  - Table indexing mechanisms are employed in rotary and drum type machines. E.g.: Geneva Gear Mechanism.
  - In In-Line machines, endless chain conveyers or hydraulically operated transfer bars may be employed.

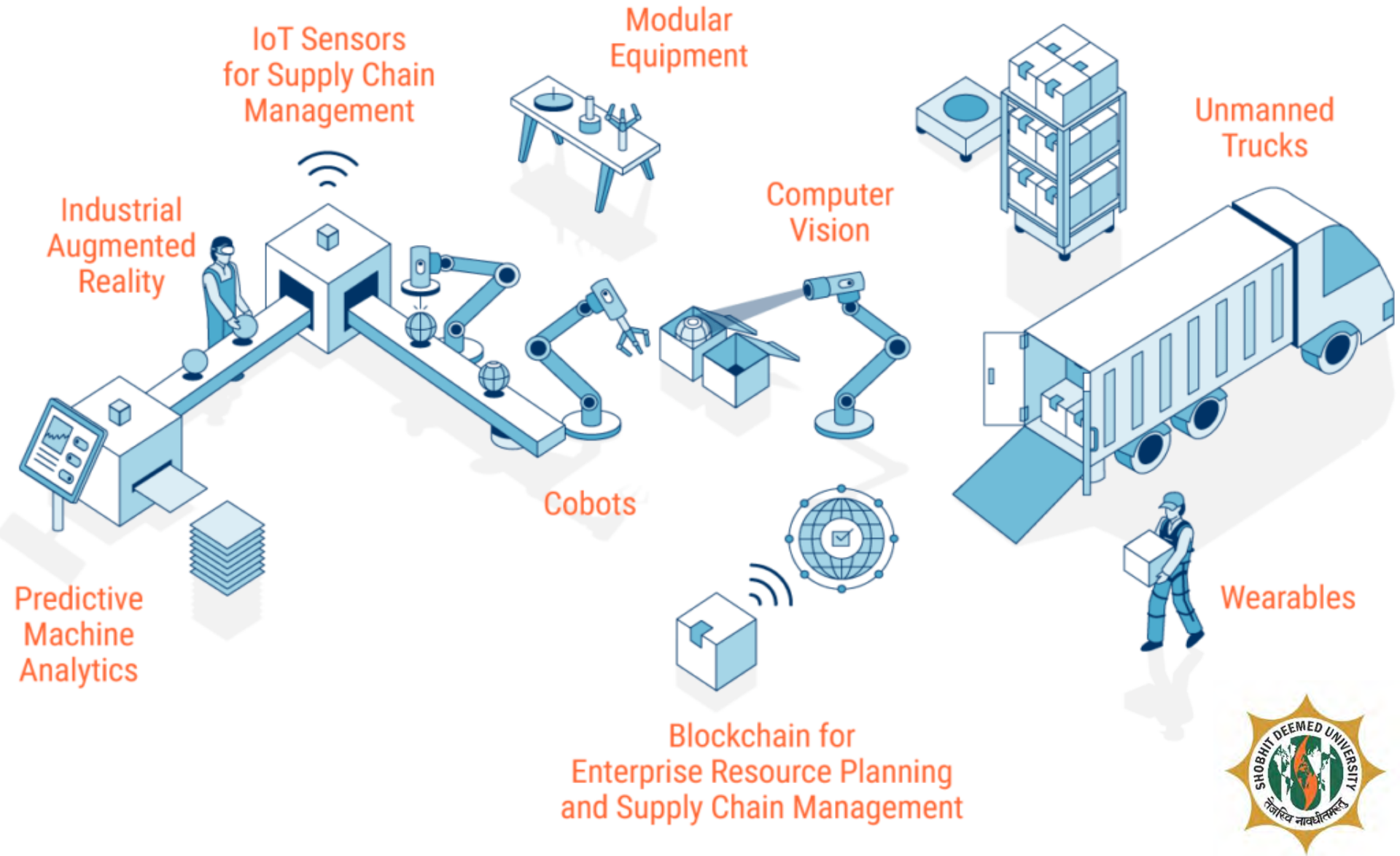
CONSTRUCTIONAL FEATURES OF TRANSFER MACHINES

- Transfer line control Systems
  - It employs electrical, hydraulic or pneumatic inter-linkage devices.
- Coolant supply
  - Centralized supply
  - Separate coolant feed mechanism attached with machining heads.
- Chip Disposal
  - Mechanical method by means of scrapper, bush and screw conveyor.
  - Gravity method with chutes and chip collectors.
  - Removal of chip by liquid or compressed air jet.
  - By means of electromagnets.

Advantages and Limitations of Transfer Machines

- Advantages
  - Grater Accuracy
  - Reduces production time
  - Greater output
  - Reduced component cost
  - Less floor space is required
  - Heavy and irregular parts can be machined
- Limitations
  - Initial cost is high
  - Break down of one machine can stop entire transfer line.
  - Control systems are complex.
  - High skills are required for initial settings.
  - Lack of flexibility.

FACTORY OF THE FUTURE



CNC MACHINE TOOLS

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INTRODUCTION (CNC MACHINES)

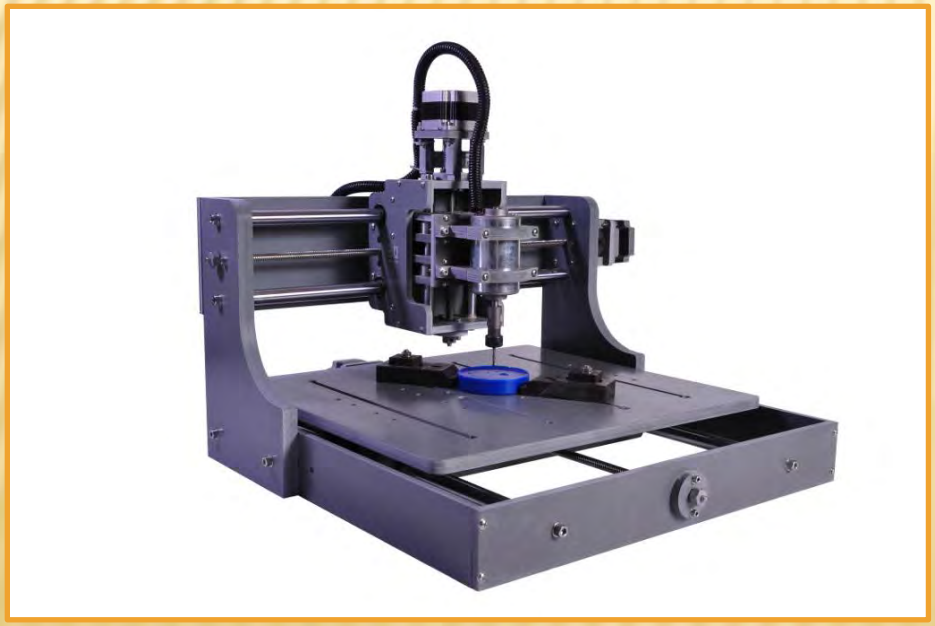
Computer numerical control was operated using a discrete numerical value and two necessary input technical data will be stored on floppy disk, hard disk etc. The definition of CNC is as follows: “A method in which actions are managed by the insertion of numerical information at some point. The system or method must automatically interpret some part of this information.

“In a CNC machine, all the operations and slide movements are restrained by motors using the list of instructions of a computer.CNC machines can be used 24*7 or throughout the year as it requires less effort, less trained persons are required to run these devices. The CNC machines are software based and as these are software based there is the only one-time investment which lowers the cost of a product.

WHY USE CNC MACHINES?

- The CNC machines helped in producing parts with complicated outlines.
- They were used in manufacturing parts that require good repeatability.
- They helped in generating parts that require costly jigs and fixtures.
- Also used in manufacturing parts that requires several engineering modifications.
- It helps in producing the products which cannot be efficiently produced by human beings.

BASIC TYPES OF CNC MACHINES

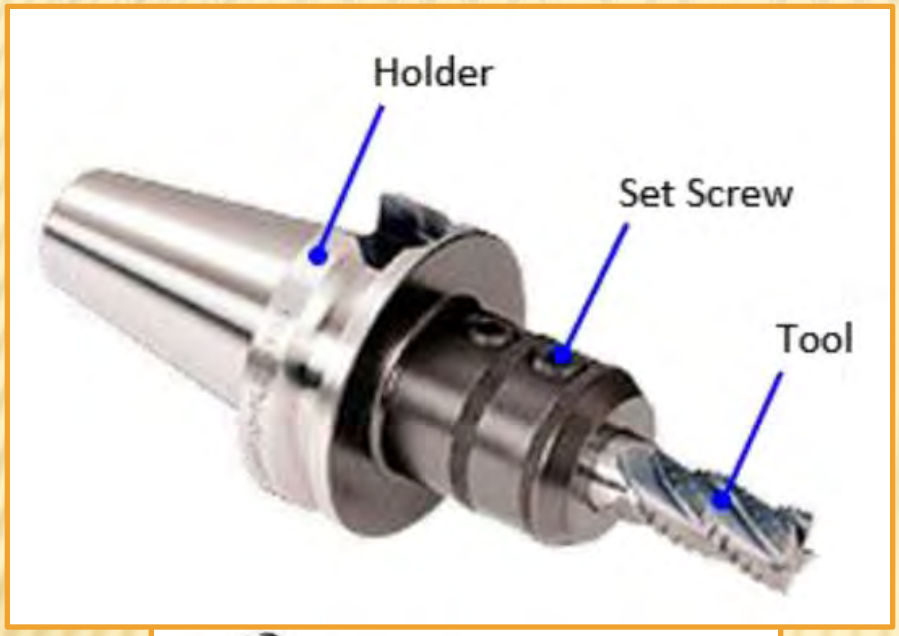


- Drilling device
- Punching device
- Grinding device
- Laser cutting device
- Water jet cutting device
- Industrial robot
- Electro discharge device

PARTS OF THE CNC MACHINES

- **Part program:** A part program is a program that is required to manufacture a part. It controls the machine tool's movement and also controlling of auxiliary functions. In this the group of instructions which are nothing but the programs that consists of letters, symbols, and numbers.
- **Program input device:** The program input device is a way of entering the program into the CNC control. The program input devices like punch tape reader, magnetic tape reader are the most commonly used program input devices.
- **Machine control unit:** The machine control unit is an important part of CNC device and is also known as the heart of CNC machine.
- **Drive System:** The drive system consists of drive motors and much more.
- **Machine tools:** To control the machine tools the CNC controls are used. The machine is controlled along the x-axis and y-axis whereas the spindle runs along the z-axis.

ANATOMY OF MILLING TOOLS



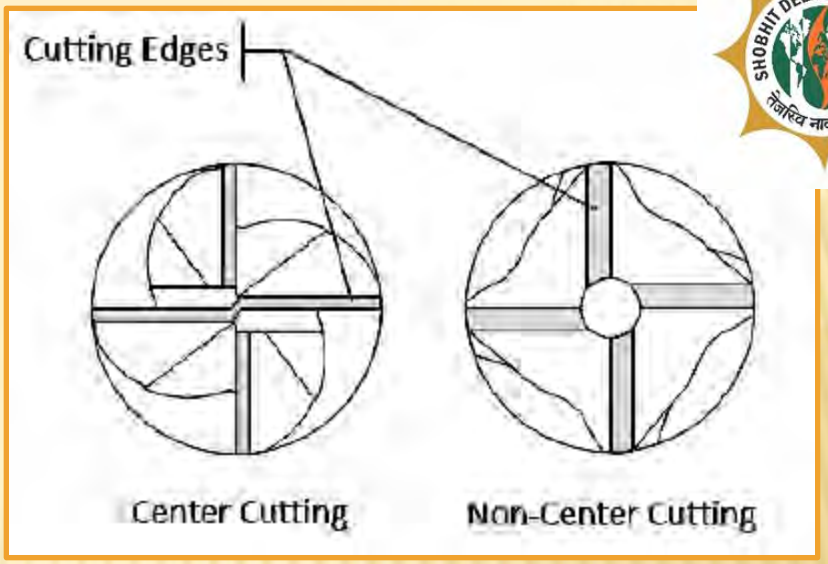
Milling is done using a cylindrical milling tool mounted in a milling tool holder that is then mounted in the tool spindle on the machine.

End Mills:

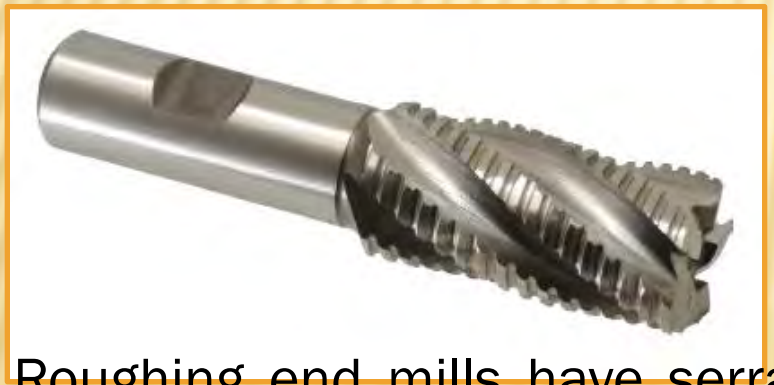
End mills are the most common milling cutters. End mills are available in a wide variety of lengths, diameters, and types.

A square end mill is used for most general milling applications. It produces a sharp edge at the bottom of pockets and slots.

End mills can be center cutting and non-center cutting. As their name implies, center cutting end mills have cutting edges on both the end face of the cutter and the sides. Center cutting end mills are essential for plunge milling.

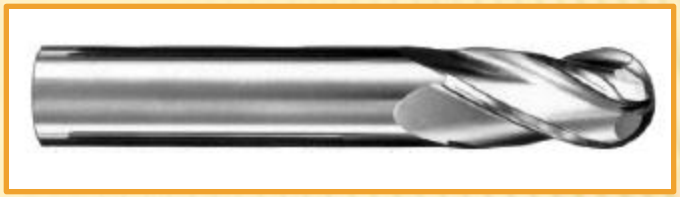


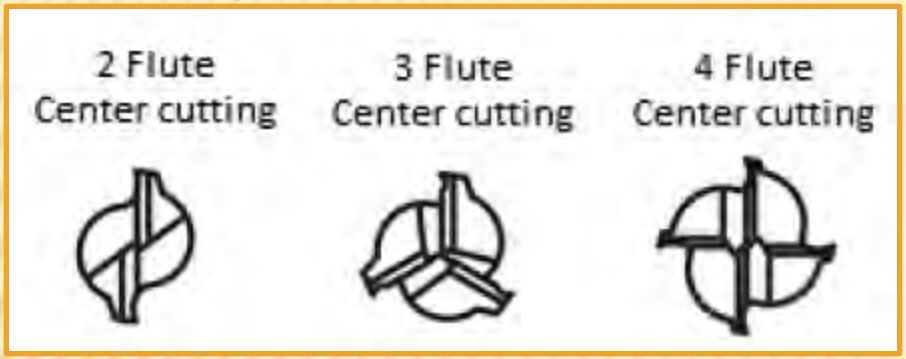
Non-center cutting end mills have cutting edges only on the sides and are used only for side milling. These tools are identified by a small hole at the center.



Roughing end mills have serrations in the teeth to quickly remove large amounts of material without creating vibration. The serrations produce many small chips and a rough finish.

Ball end mills produce a radius at the bottom of pockets and slots. Ball end mills are used for contour milling, shallow slotting, contour milling and pocketing applications.





An important consideration when choosing the number of flutes is called “chip load”.

“Chip load” is a measurement of the thickness of material removed by each cutting edge during a cut.

Flutes:

Spiral-shaped cutting edges are cut into the side of the end mill to provide a path for chips to escape when an end mill is down in a slot or a pocket.

The most common options are 2, 3, or 4 flutes. The more flutes, the more cutting edges but the narrower the channel for chip evacuation.

APPLICATIONS FOR END MILLS

Side Milling	Face Milling	Slot Milling	Plunge Milling	Ramping
				
Machining of an edge surface on the part.	Machining of a top face on the part.	Machining between two edge surfaces.	Axial feeding into a part along the Z axis. Requires a center cutting end mill.	Axial feeding into a part along the Z axis as well as X or Y. Requires a center cutting end mill.

END MILL MATERIALS

End mills are made out of either cobalt steel alloys (known as high speed steel, or HSS), or from tungsten carbide in a cobalt lattice (shortened to "carbide").

- **High Speed Steel (HSS):** Provides good wear resistance and costs less than cobalt or carbide end mills. HSS is used for general purpose milling of both ferrous and non-ferrous materials. While usually inexpensive, HSS does not offer the tool life or speed advantages of cobalt and carbide end mills.
- **Cobalt:** Cobalt is an M42 tool steel with an 8% cobalt content. Cobalt is more expensive but provides better wear resistance and toughness than HSS (M7). Because the tool can run 10% faster than HSS, metal removal rates and finish are better than HSS.
- **Solid Carbide:** Carbide is considerably harder, more rigid, and more wear resistant than HSS. However, carbide is brittle and tends to chip instead of wear. Carbide is used primarily in finishing applications. Carbide tools are best suited for shops operating newer milling machines or machines with minimal spindle wear. Rigidity is critical when using carbide tools. Carbide end mills may require a premium price over the cobalt end mills, but they can also be run at speeds 2 1/2 times faster than HSS end mills.

END MILL COATINGS

- The use of coatings will increase the surface hardness of the tool. This will allow for greater tool life and faster cutting speed.
- Standard coatings include Titanium Nitride (TiN), Titanium Carbonitride (TiCN), and Aluminum Titanium Nitride (AlTiN).
- Long-life TiN (titanium nitride) coating is good for use on alloy steel, aluminum, and plastic. Color is gold.
- Extra-life TiCN (titanium carbonitride) coating has better wear resistance than TiN coating, making it a good choice for tough-to-machine materials such as ductile cast iron, stainless steel, aluminum, and plastic. Color is blue-gray.
- Super-life AlTiN (aluminum titanium nitride) coating is the best for very high feeds/speeds and high-temperature applications. Use to mill cast iron, stainless steel, nickel-based alloys, and titanium. Not for use on aluminum. Color is purple-gray.

DRILLS, TAPS AND REAMERS

High Speed Steel (HSS) tools such as drills, taps and reamers are commonly used on CNC machining centers for hole making operations.

Twist Drills:

Holes are by far the most common feature in CNC machining. The material removal rate of twist drills is outstanding, and usually better than equivalent sized end mills. Twist drills come in many more diameters and sizes than end mills. It often makes sense to drill the ends of a slot and then machine out the web between the holes with an end mill.

Twist drills coated with titanium nitride (TiN) are easily identified by a gold like color. This coating increases the hardness of the bit and adds a self-lubricating property.

Indexable Drills:

Considering how often holes are made and the advantages of indexable tooling for end and face milling, indexable drills are also available. These are generally best used for larger holes.

Spot Drills and Center Drills:

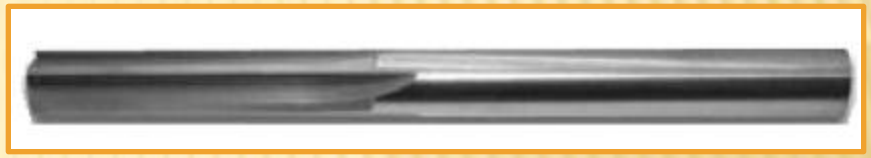
These two are special purpose drills with very short flutes.

Spot drills are designed to be extremely rigid so that they can precisely spot a hole for a twist drill. The goal is use the spot drill to make a little dimple in the work piece that keeps the twist drill from walking so that the hole winds up in the right place.

Center drills are intended to be used to create a 60° center in the end of lathe stock. They have a 2-part tip that has a small pilot as well as the larger countersinking area of the bit.

Reamers:

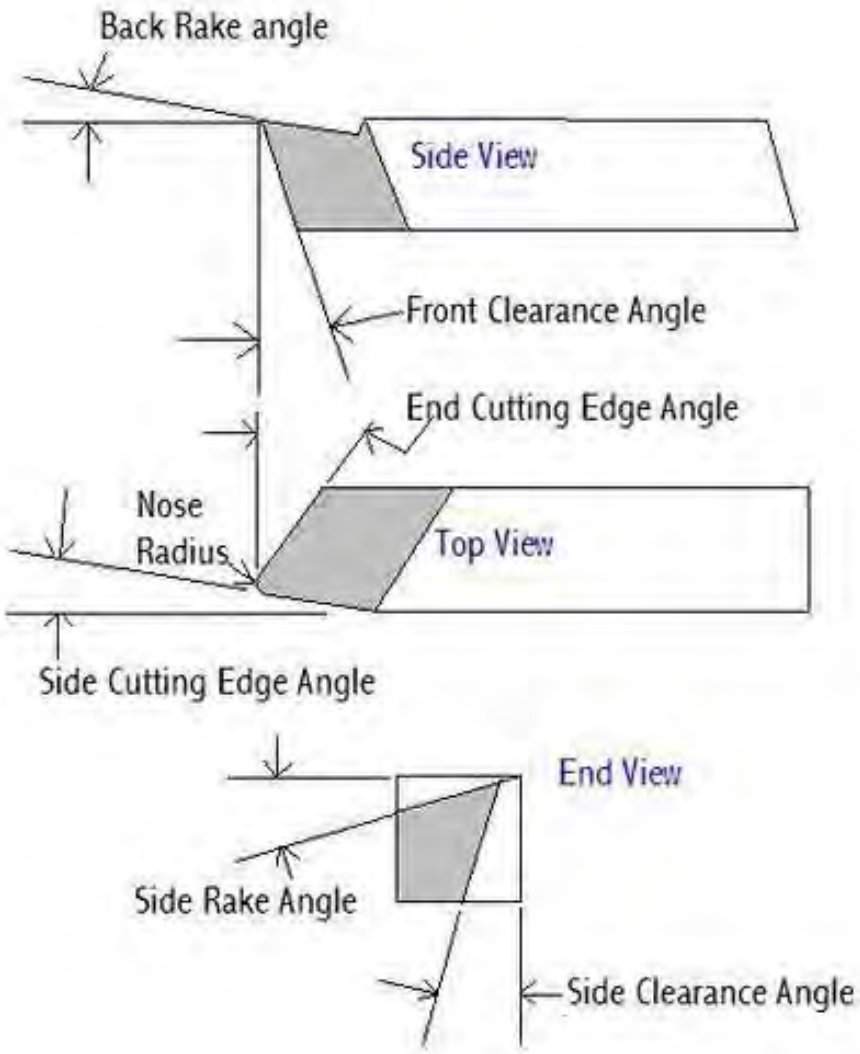
Reamers are used to enlarge an existing hole to a precise tolerance and to add a high quality surface finish. Reamers require a hole be drilled first that is fairly close to the final size so that the reamer actually removes relatively little material. Reamers ensure a hole has an accurate diameter, roundness, and good surface finish.



Taps:

Taps are used to cut internal threads of a specific size and pitch. Like reamers, a tap requires a hole be drilled first to the size of the minor diameter.

SINGLE POINT CUTTING TOOLS



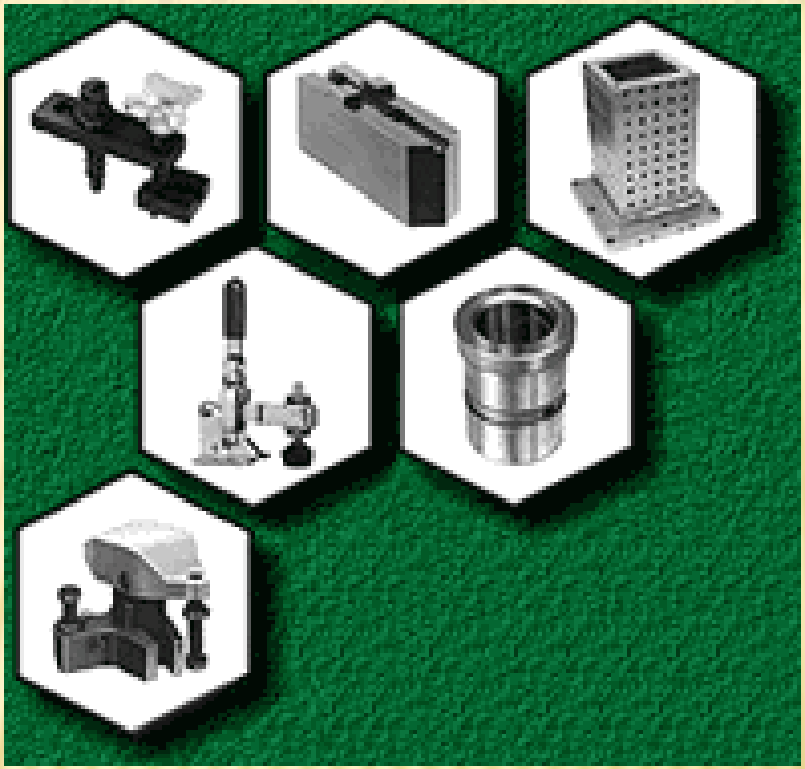
Characteristics of Single Point Cutting Tools:

- hardness even at high temperatures
- toughness
- chemically inert
- resistant to wear

These characteristics have traditionally been found through the adoption of carbon and low alloy steels, although they did have a tendency to wear a little too easily.

ROTARY TRANSMISSION OF MULTIPLE CNC MACHINE TOOLS

JIGS AND FIXTURES



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SHOBHIT INSTITUTE OF ENGINEERING AND TECHNOLOGY

DEEMED TO BE UNIVERSITY

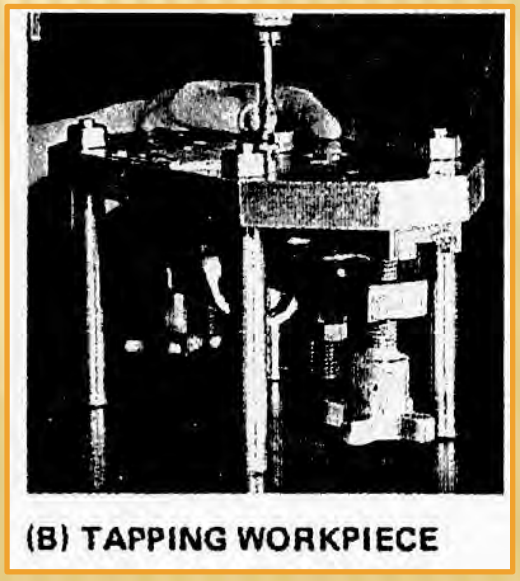
DEFINITIONS

- *Jig: A device that holds the work and locates the path of the tool.*
- *Fixture: A device fixed to the worktable of a machine and locates the work in an exact position relative to the cutting tool.*
- Anything used to hold a work piece in a desired location
  - Locate parts for precision
  - Repeating process on a series of parts
  - Holding parts for machining, painting, assembly

TWO MAIN TYPES OF JIGS:

- *For machining purposes*
  - Locates the component, holds it firmly in place, and guides the cutting tool.
- *For assembly purposes*
  - Locates separate component parts and holds them rigidly in their correct positions while they are being connected.

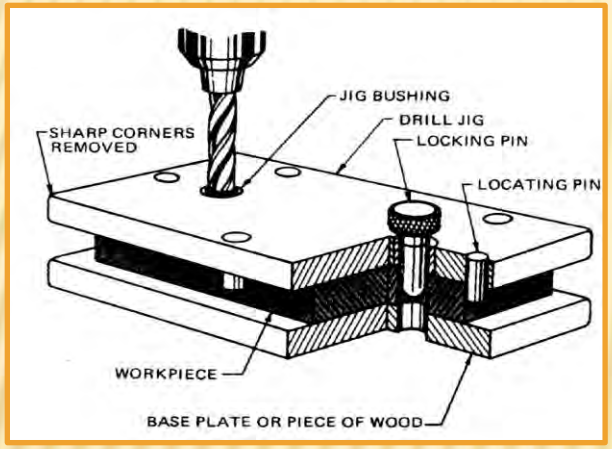
(A) LOADING WORKPIECE

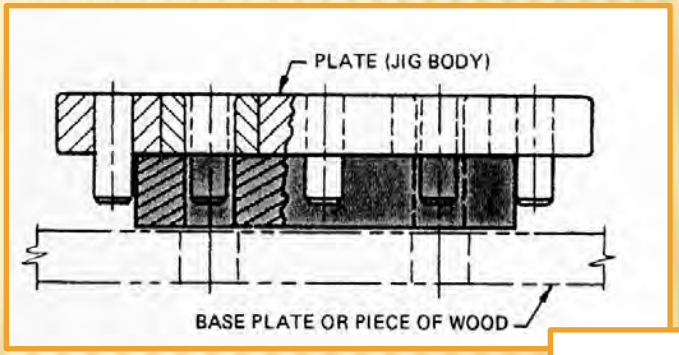


(B) TAPPING WORKPIECE

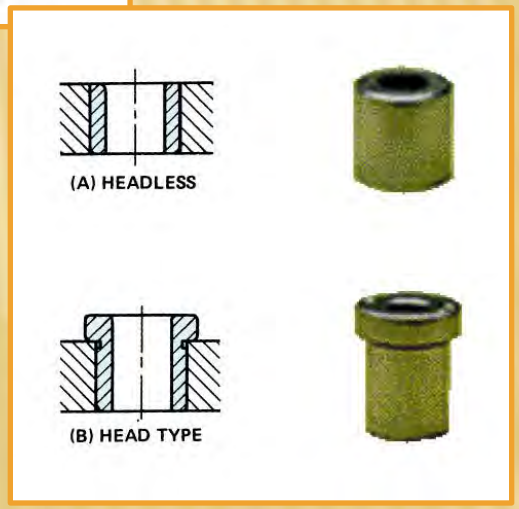
DRILL JIG TERMS

- *Open jig (also called plate jig or drill template)*
  - The simplest type of drill jig
  - Consists of a plate with holes to guide the drills, and may have locating pins that locate the work piece on the jig.



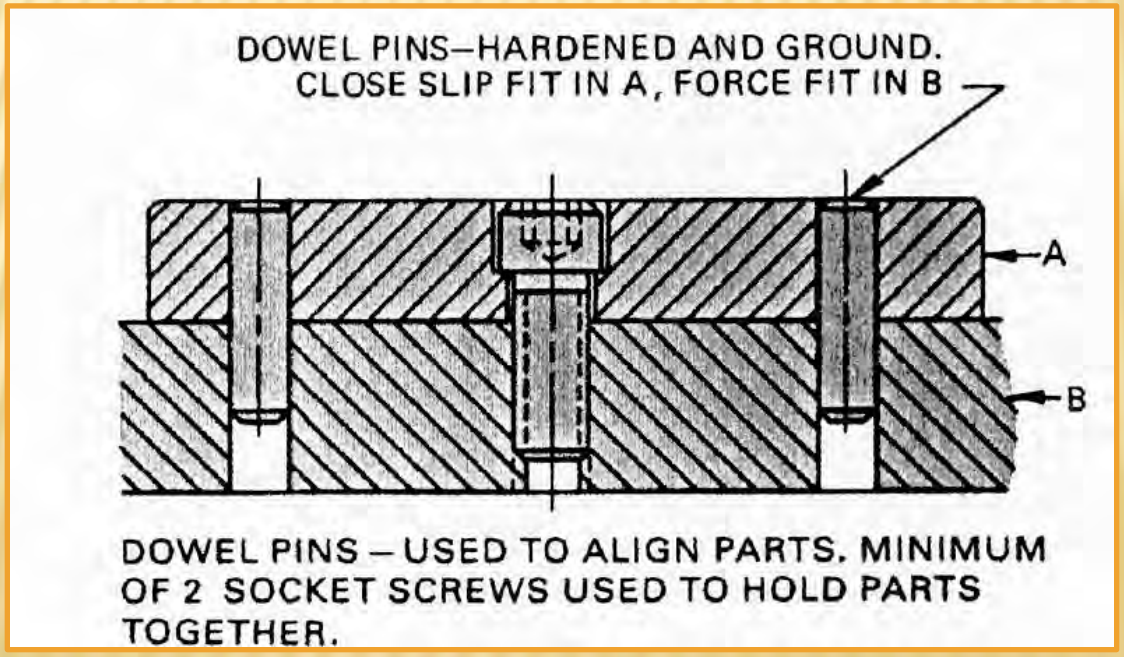


- *Drill bushings*
  - Precision tools that guide cutting tools such as drill and reamers into precise locations in a work piece.



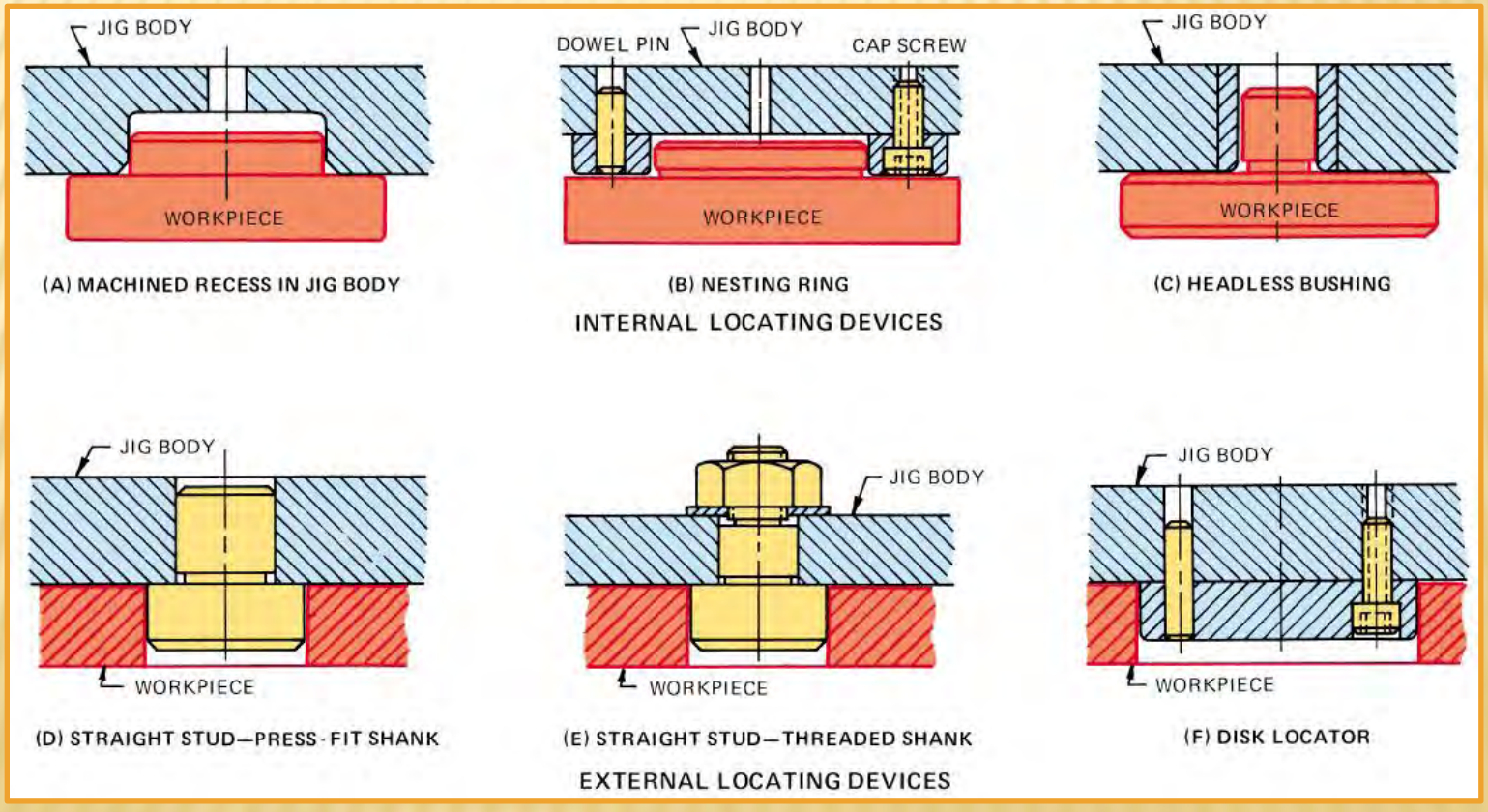
DRILL JIG COMPONENTS

- *Jig body*
  - Holds the various parts of a jig assembly.
- *Cap screws and dowel pins*
  - Hold fabricated parts together



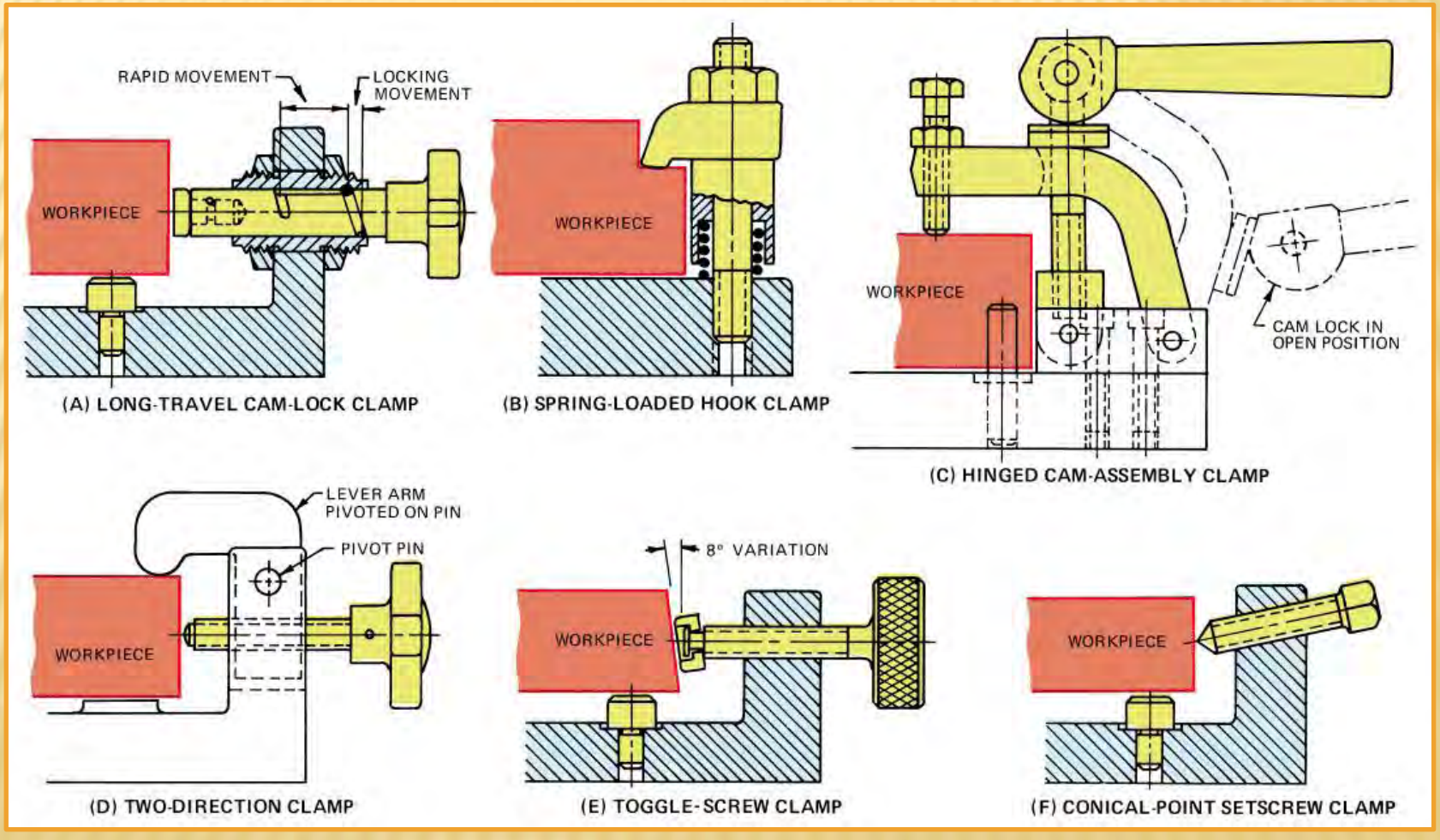
DRILL JIG COMPONENTS

- *Locating devices*
  - Pins, pads, and recesses used to locate the work piece on the jig.



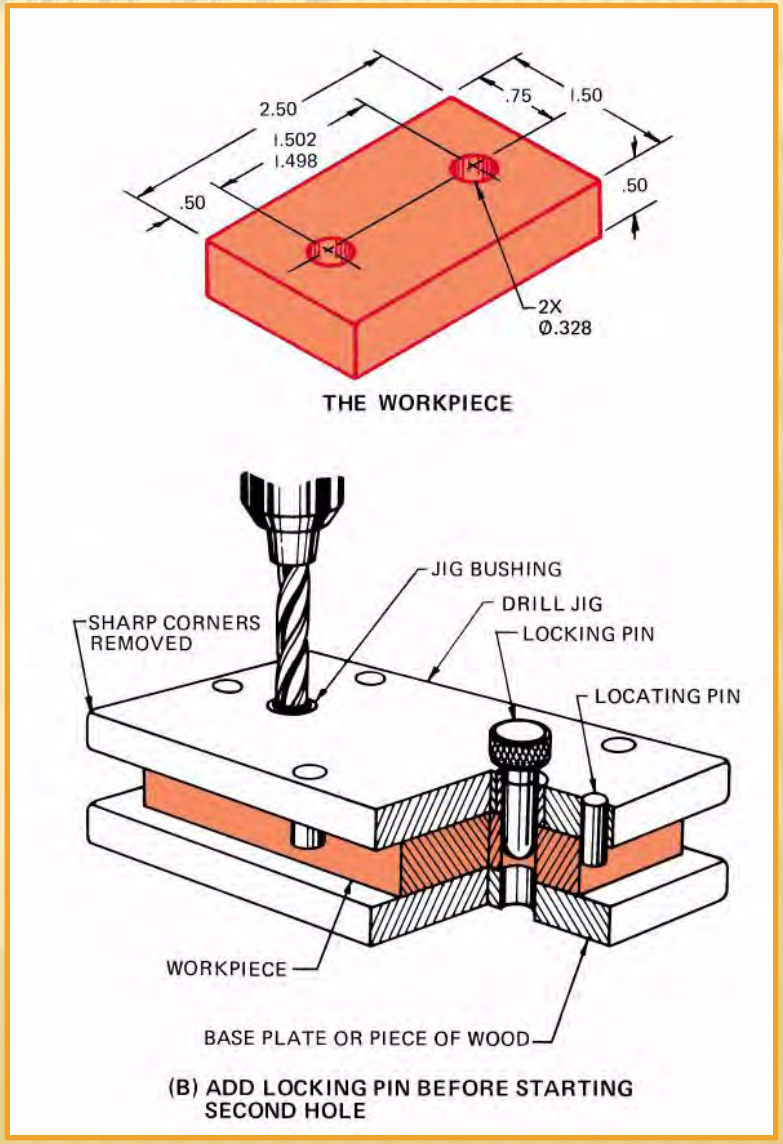
DRILL JIG COMPONENTS

- *Clamping devices*



DRILL JIG COMPONENTS

- *Locking pins*
  - Inserted to lock or hold the work piece securely to the jig plate while subsequent holes are being drilled.



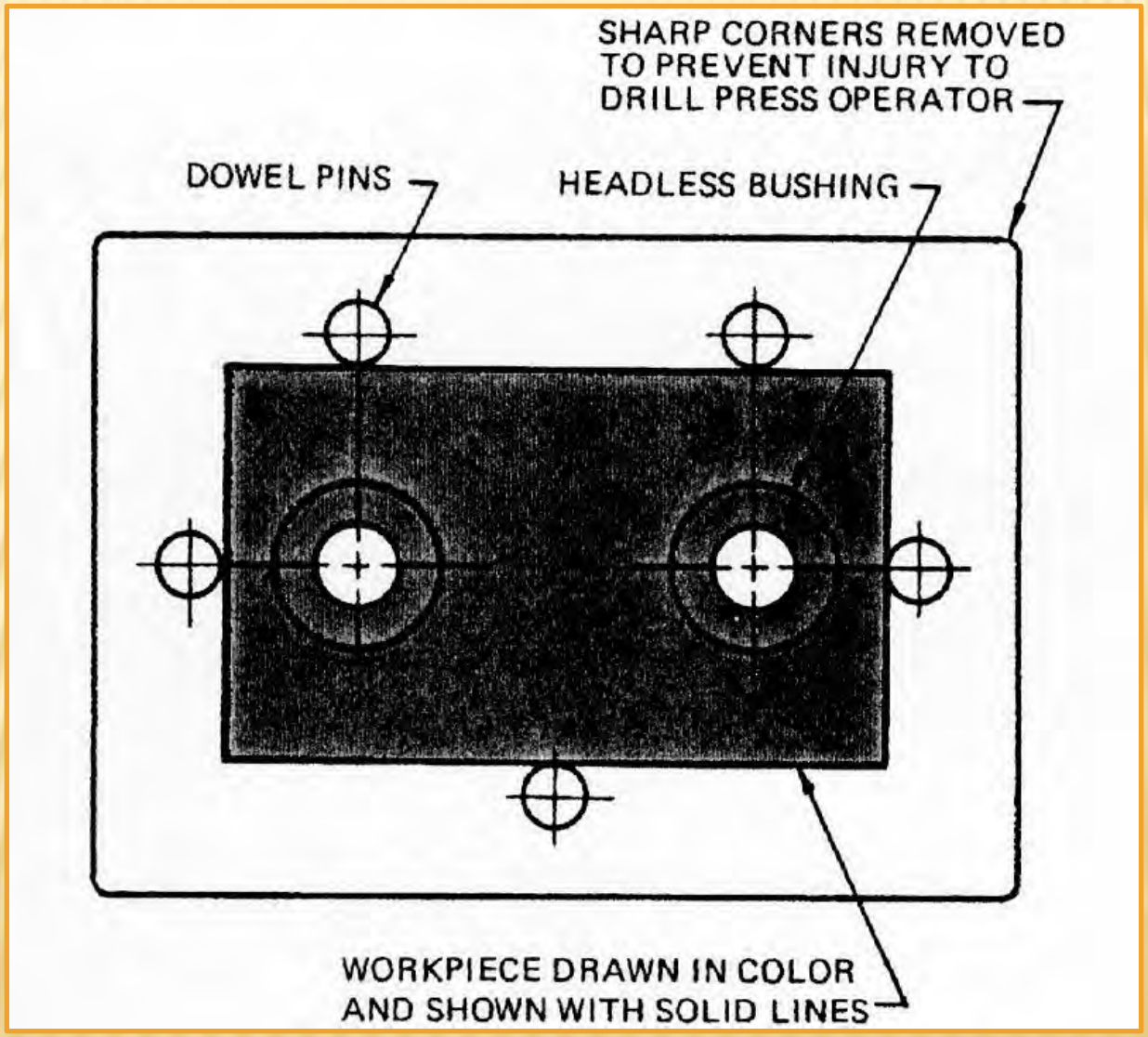
USES OF JIG AND FIXTURE

- Reduce cost of production.
- Increase the production.
- To assure high accuracy of parts
- Provide for interchangeability
- Enable heavy and complex parts to machine
- Reduced quality control expenses.
- Increased versatility of machine tool.
- Less skilled labour.
- Saving labour.
- Partially automates the machine tools
- Use improve the safety, accidents low

ELEMENTS OF JIG AND FIXTURE

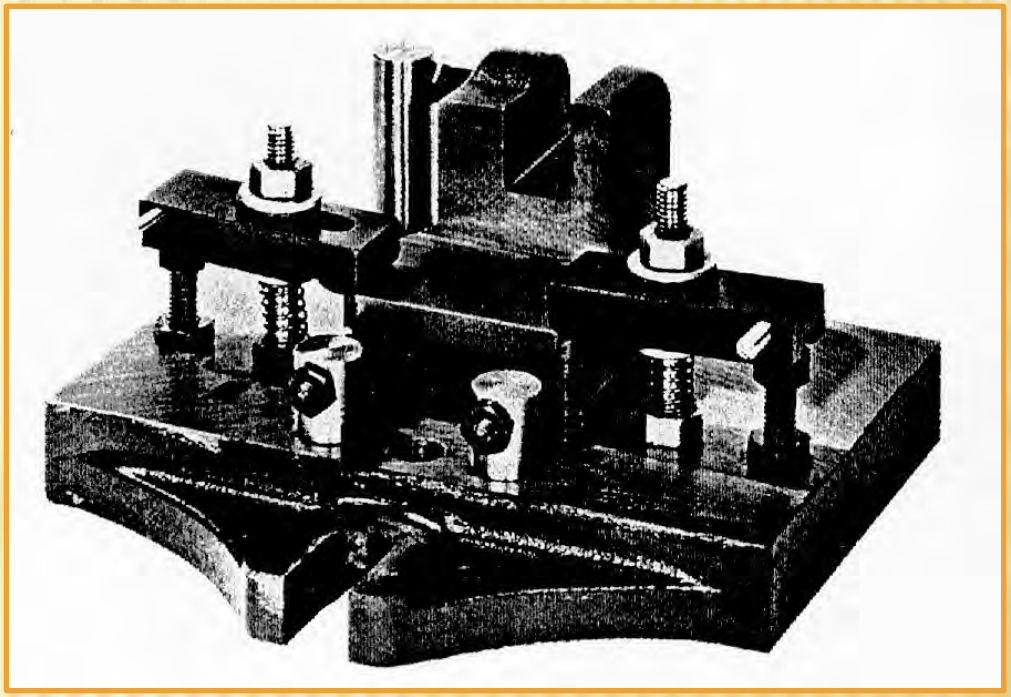
- Sufficiently rigid bodies (plate, box or frame structure
- Locating elements.
- Clamping elements.
- Tool guiding elements.
- Elements for positioning or fastening the jig or fixture.

DIMENSIONING JIG DRAWINGS

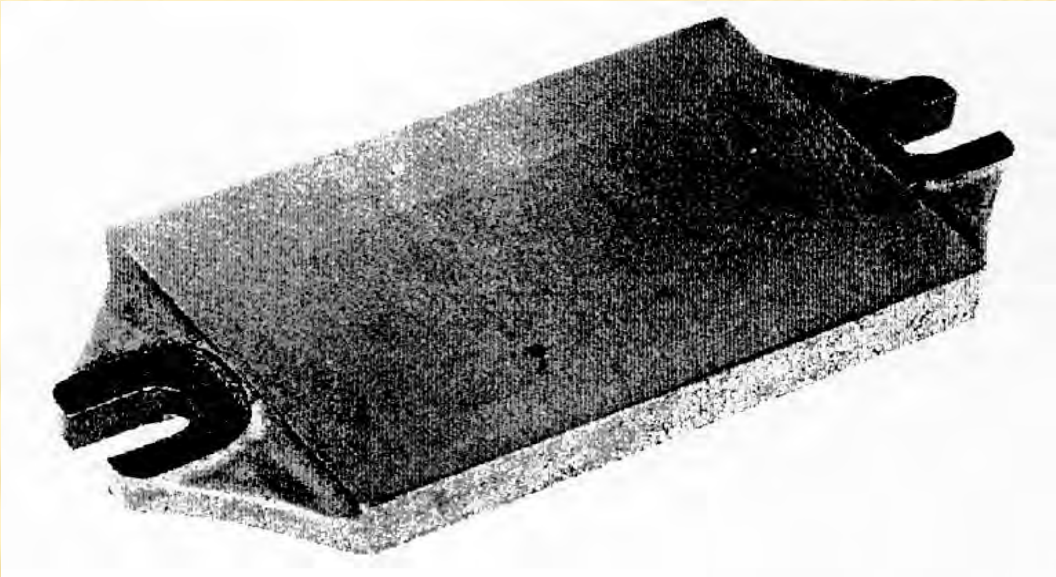


TYPES OF FIXTURE

- Milling fixtures
- Fixture components
- Fixture design considerations
- Sequence in laying out a fixture



FIXTURE COMPONENTS

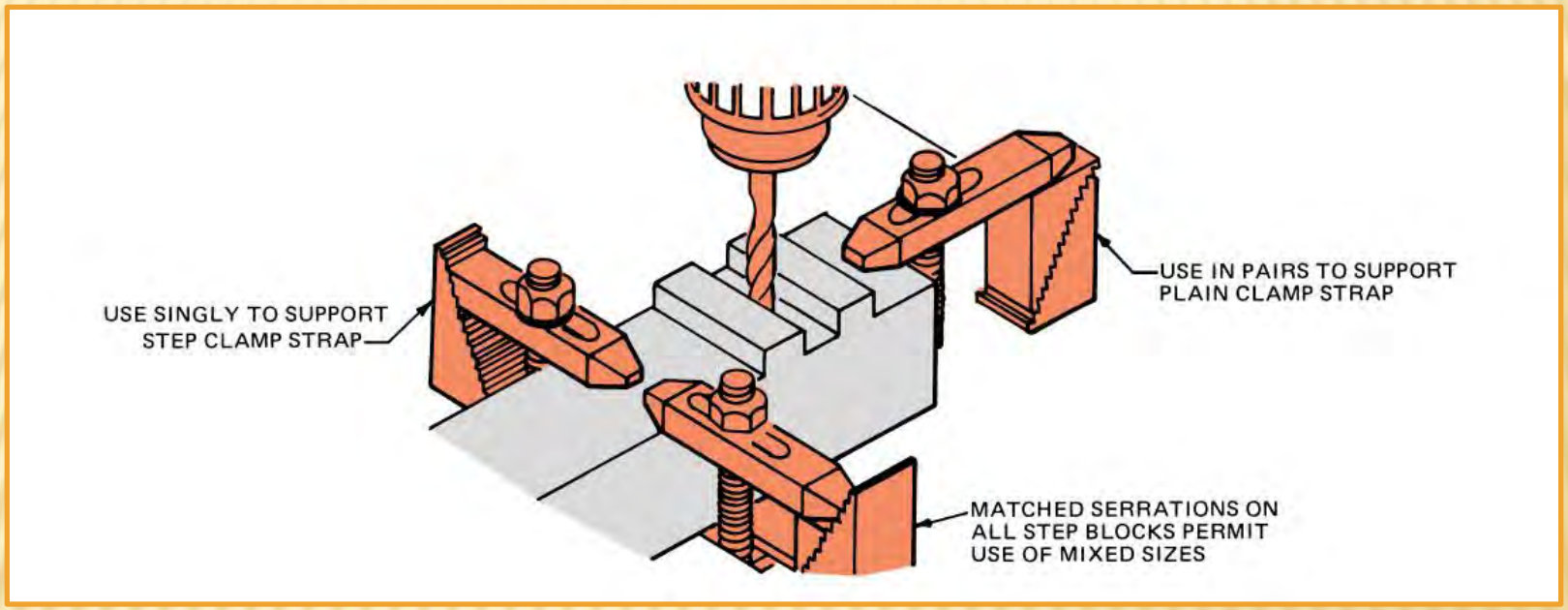


- *Fixture base*
  - Fixture components and the workpiece are usually located on a base, which is securely fastened to the milling machine table.

FIXTURE COMPONENTS

- *Clamps*
  - Clamps counteract forces from the feed of the table and rotation of the cutter.

FIXTURE COMPONENTS

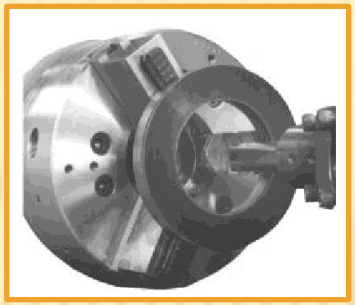


- *Set blocks*
  - Cutter set blocks are mounted on the fixture to properly position the milling cutter in relation to the workpiece.

BASIC CATEGORIES OF JIGS

- Clamps

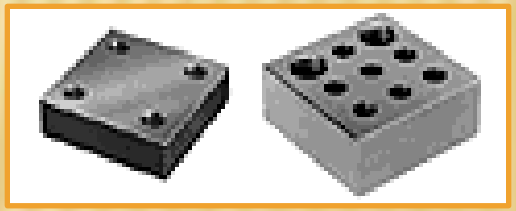
- Chucks

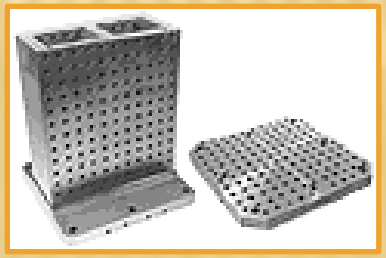


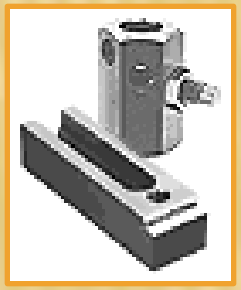
- Vises

- Bushings

- Modular Fixtures







APPLICATIONS

KNURLED-HEAD SCREW

ADJUSTABLE FIXED STOP

C WASHER

T-SLOT NUT

FLANGED NUT

QUARTER-TURN SCREW

LOCATING PIN

SWING C WASHER

SWING BOLT

HAND KNOB SCREW

SHOULDER SCREW

SPHERICAL WASHER

FIXTURE KEY

SURE-LOCK FIXTURE KEY

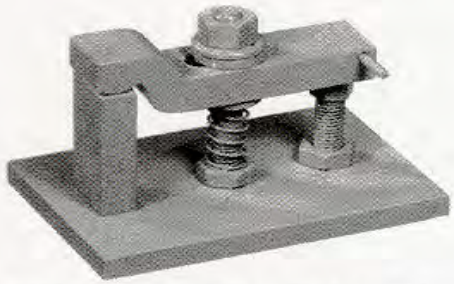
HAND KNOB SCREW
WITH SWIVEL TOGGLE

LEVER NUT

TORQUE SCREW

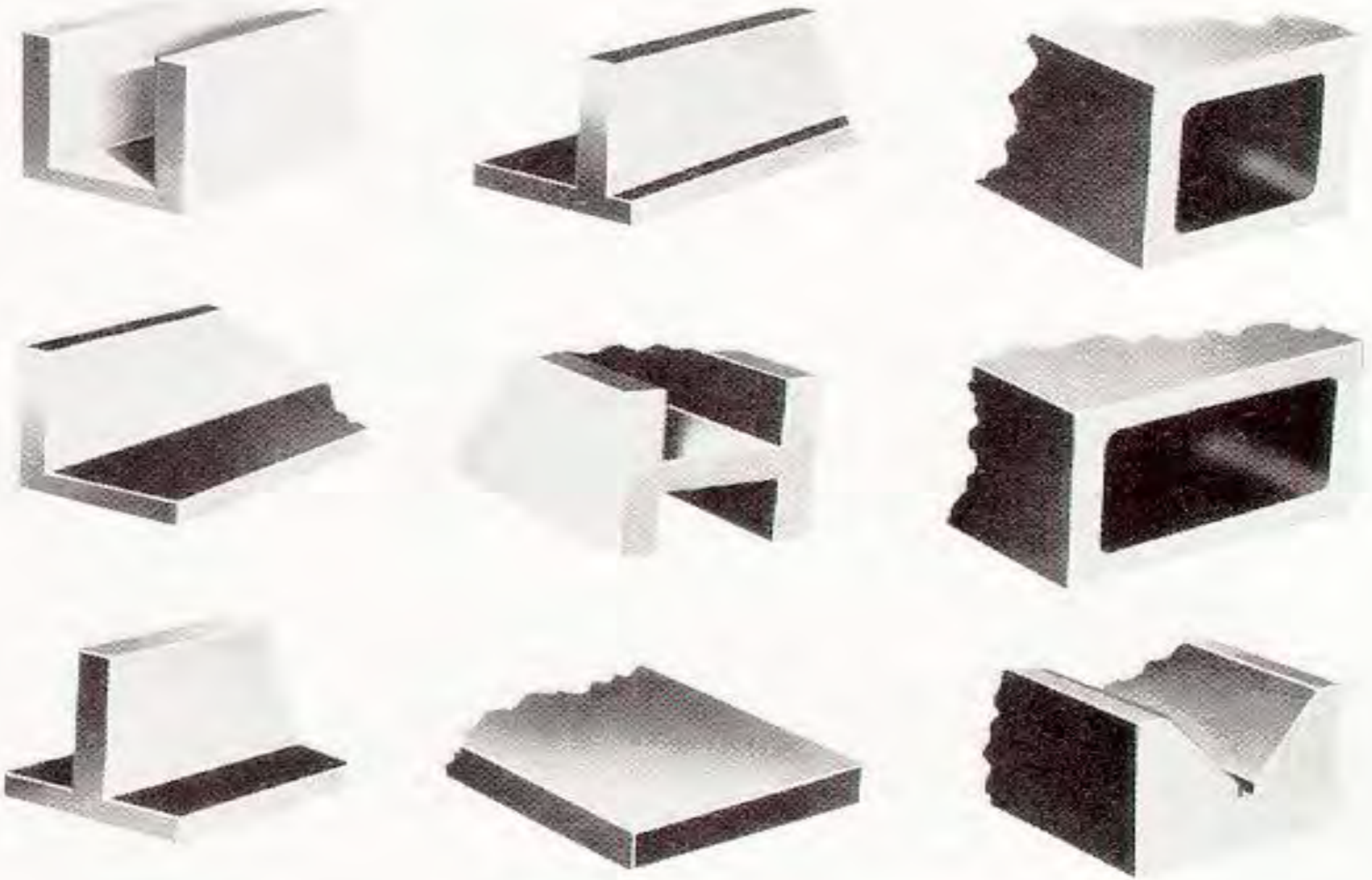
BALL-HANDLE KNOB

SWING CLAMP



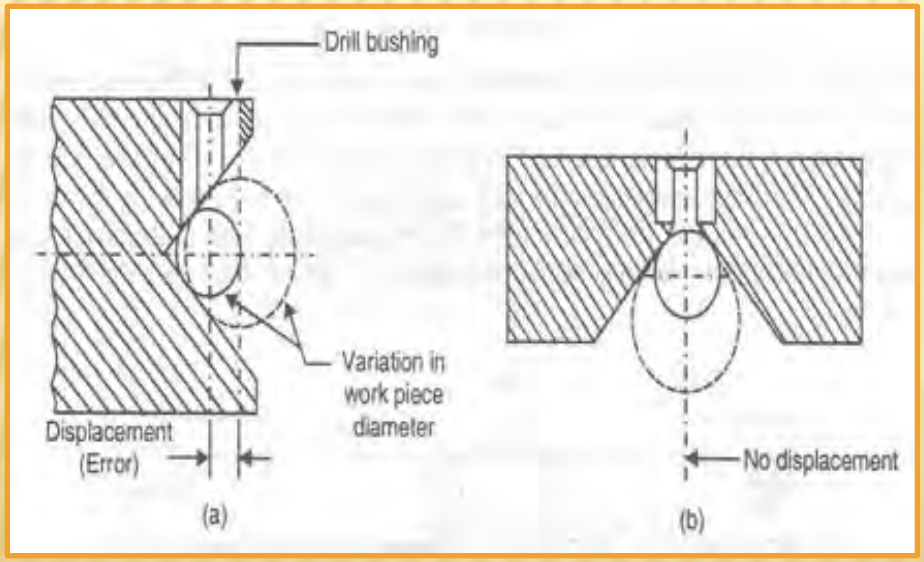
ADJUSTABLE GOOSE NECK CLAMP

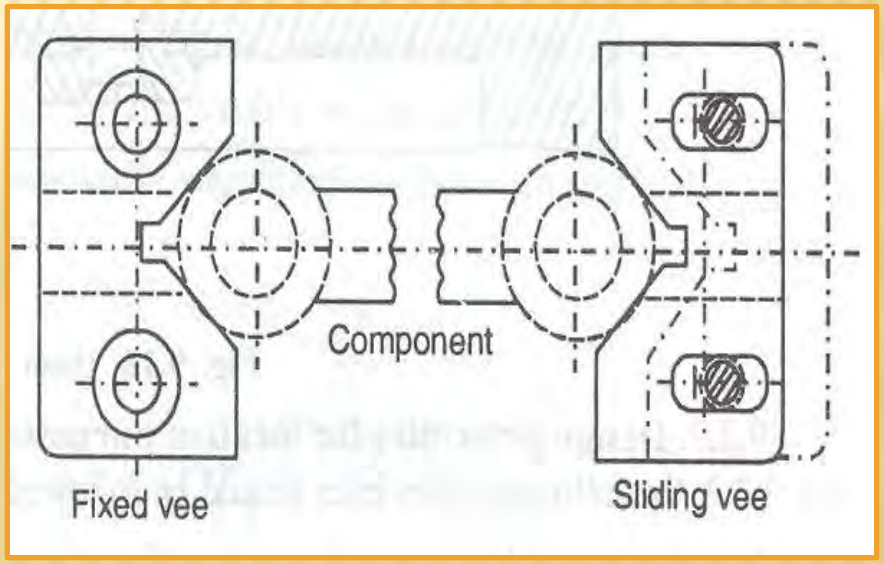
JIGS AND FIXTURES



V-LOCATION

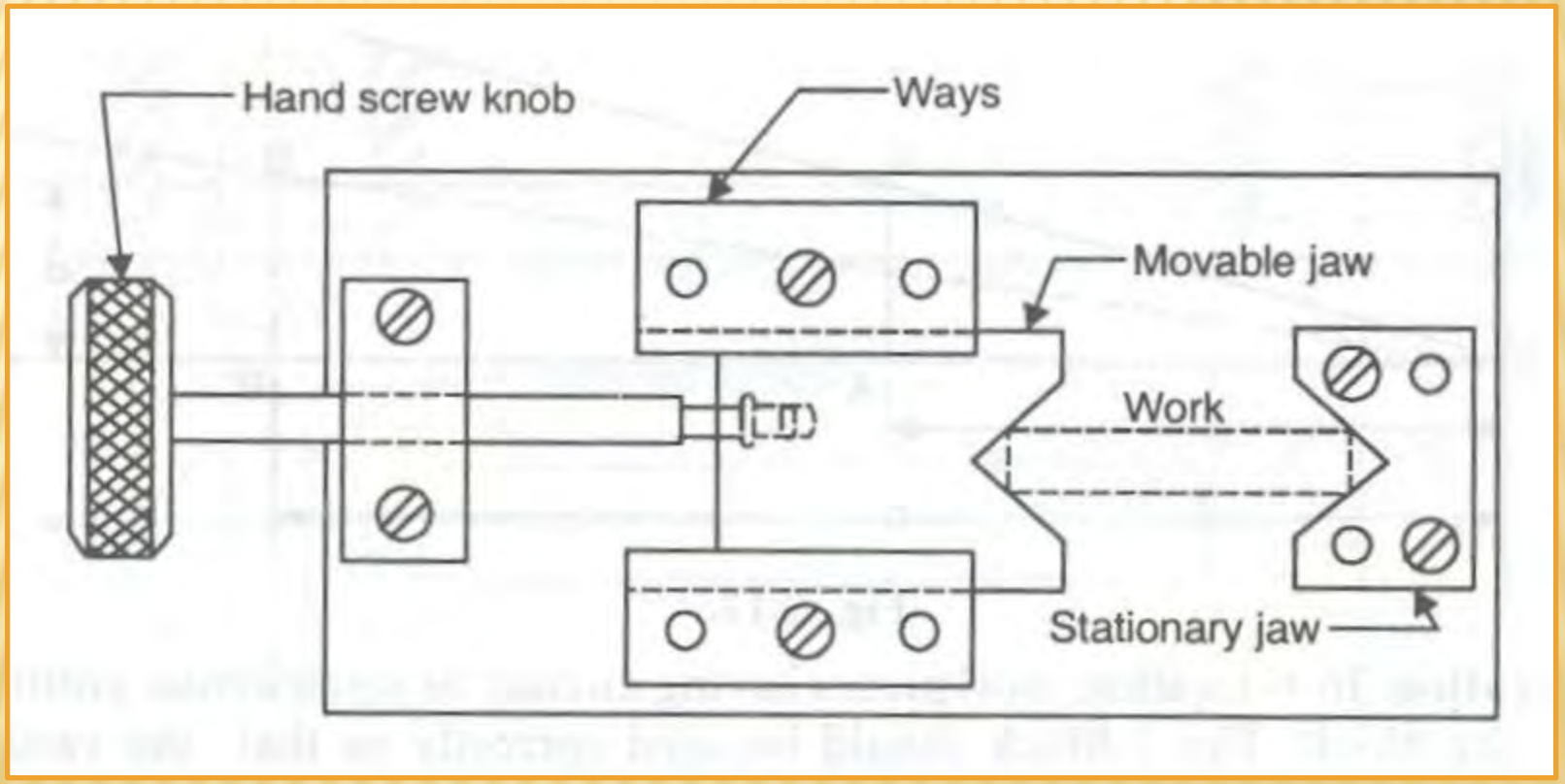
- In V-location, work pieces having circular or semicircular profile are located by means of a Vee block. The block should be used accurately so that the variation in the work piece size are not detrimental to location.
- Vee can be used for both locating and clamping purpose for this two Vee can be used, one fixed other sliding one. Fixed Vee is used for locating and sliding one for clamping.





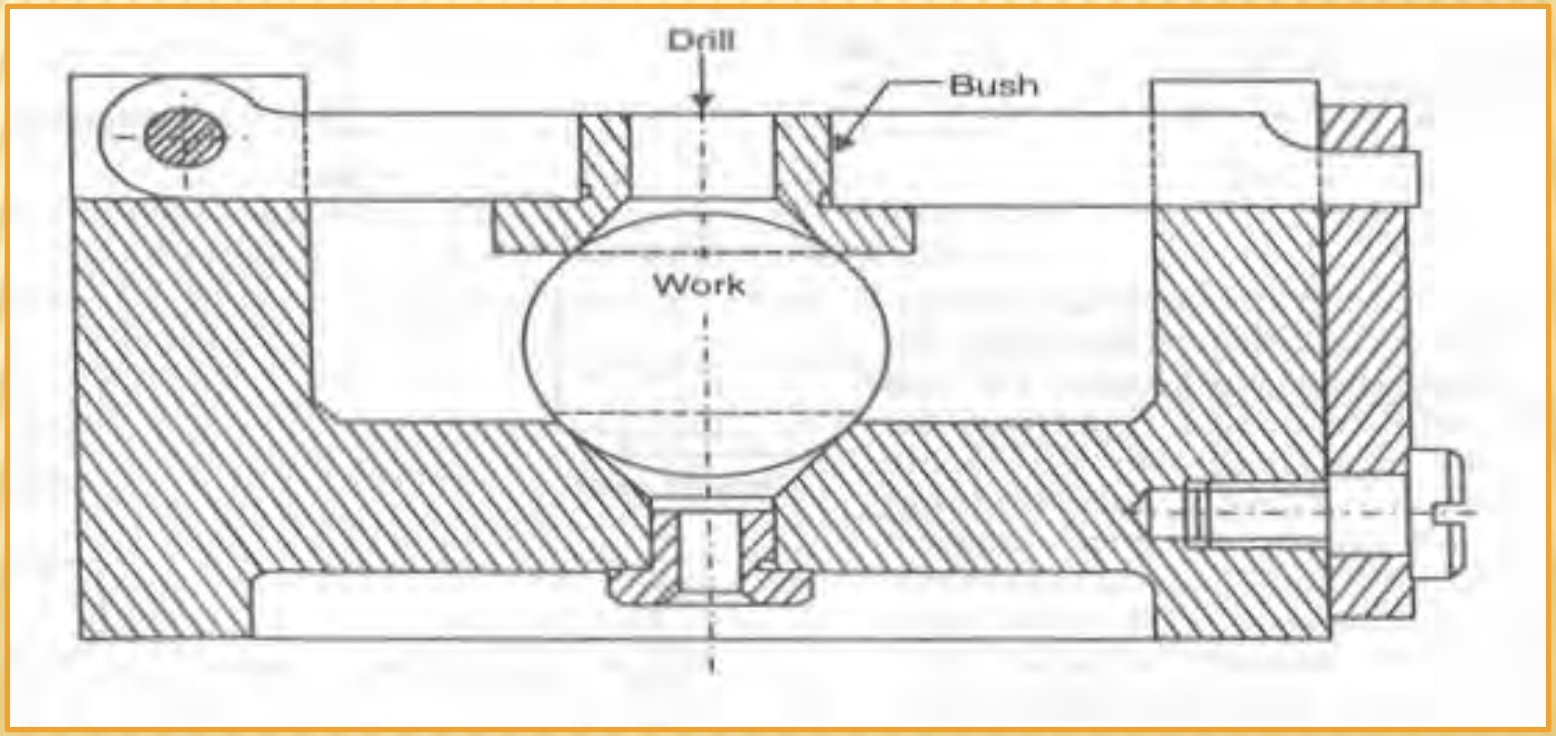
V-LOCATION

- The sliding Vee block may be actuated by means of a hand operated screw.



BUSH LOCATION

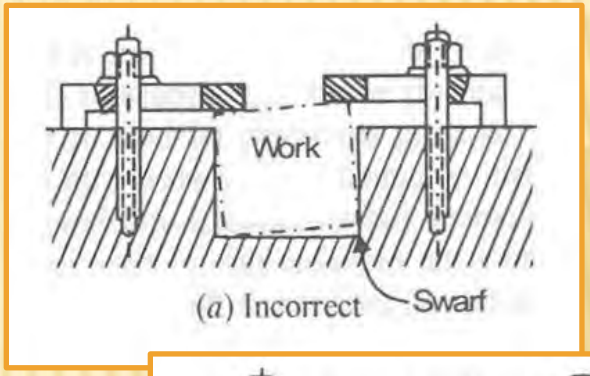
- Shaft type work pieces can be easily locate in a hardened steel bushes. The bushes can be plain or flanged type. A flange straighten the bush and also prevent it from being driven into the jig body if it is left unlocked.

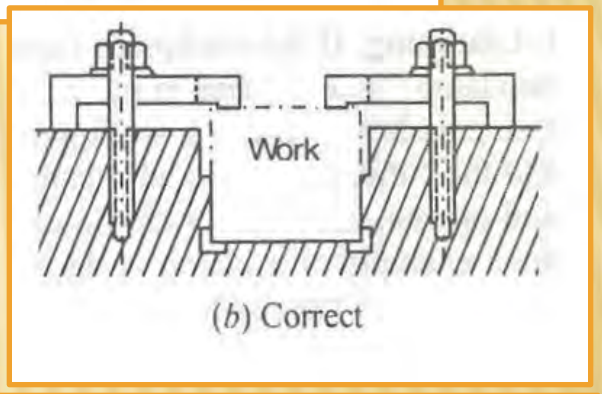


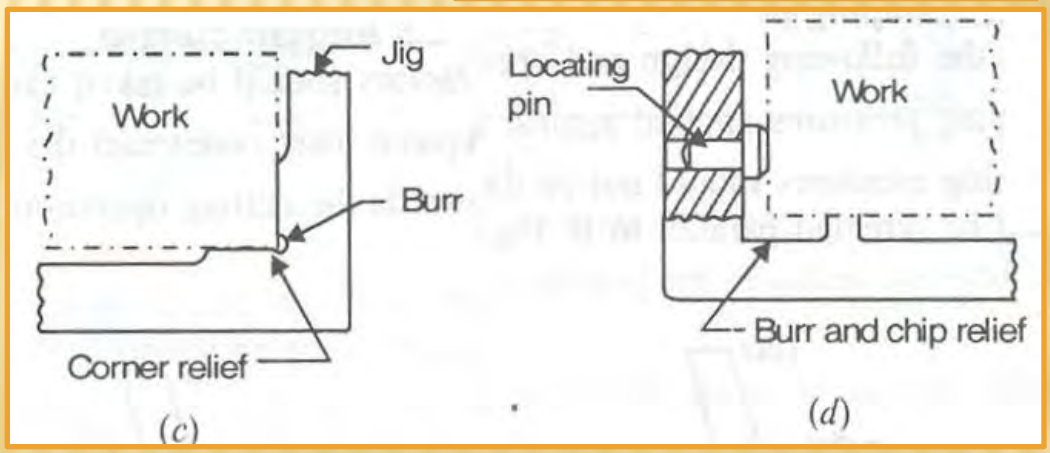
DESIGN PRINCIPLES OF LOCATION PURPOSE

The following principles should be followed while locating surfaces:

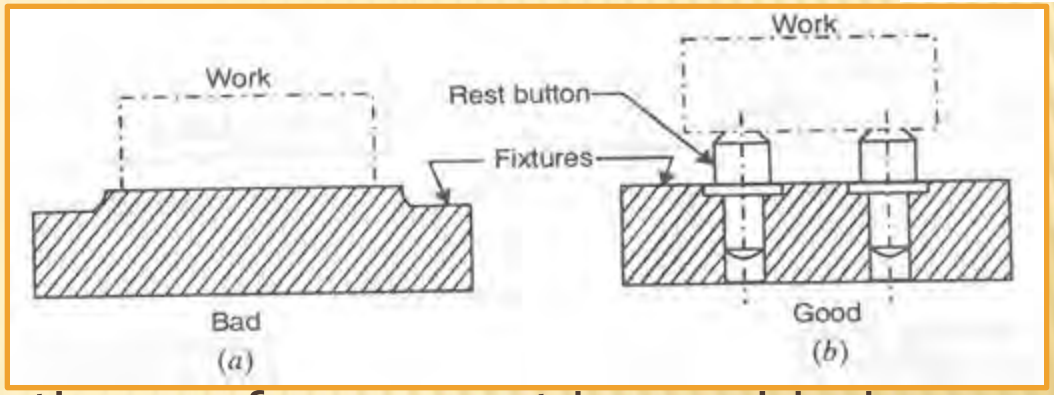
- At least one datum or reference surface should be established at the first opportunity.
- For ease of cleaning, locating surfaces should be as small as possible.
- The locating surfaces should not hold swarf and thereby misalign the work piece.



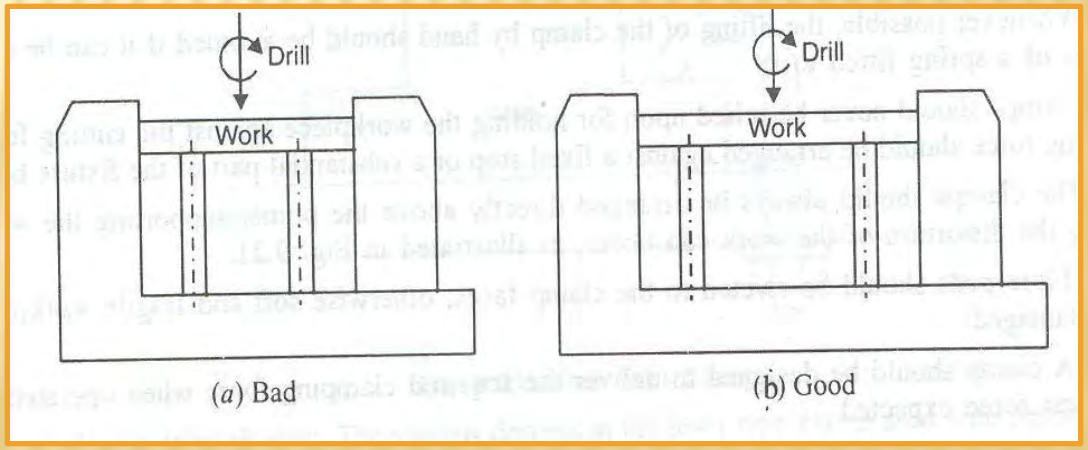




- Locating surfaces should be raised above surrounding surfaces of the jigs or fixture.



- Sharp corners in the locating surfaces must be avoided.
- Adjustable type of locaters should be used for the location on rough surfaces.
- Locating pins should be easily accessible and visible to the operator.
- To avoid distortion of the work, it should be supported as shown in fig.



THANK YOU