MACHINE SHOP PRACTICE (422)

TURNING MACHINES

Feed mechanism on Lathe

There are several mechanisms to make the carriage and cross -slide move automatically and to change the direction of their movement. Some important mechanisms are dealt with as follows.

Tumbler gear arrangement

Tumbler gears are located in the headstock just below the spindle gear. For the purpose of moving the carriage towards or away from the headstock, this mechanism along with feed rod or lead screw is used. Tumbler gears are two small pinions mounted on a bracket. This bracket is pivoted about the axis of the stud gear. The position of the bracket can be arranged in three different stages namely i) neutral ii) forward & iii) reverse. Hence, the direction of rotation of the lead screw and the feed rod is reversed.

Neutral position

When the bracket is held in neutral position, both the tumbler gears A and B stand disengaged from the spindle gear and main gear train. And so carriage will not get any movement.

Forward position

When the bracket is arranged in the forward position as shown in the diagram, only one of the tumbler gears (B) comes between the spindle gear and the main gear train. In that position, the lead screw or the feed rod rotates in the direction of the headstock spindle rotation. The carriage moves towards the headstock providing the cutting tool with longitudinal feed.

Reverse position

When the bracket is arranged in the reverse position, both the tumbler gears come in contact between the spindle gear and the main gear train. The carriage moves towards the tailstock to give the tool the longitudinal feed in the opposite direction.

Spindle mechanism

The spindle is located in the headstock and it receives the driving power from the motor. The spindle speed should be changed to suit different machining conditions like type of material to be cut, the diameter and the length of the work, type of operation, the type of cutting tool material used, the type of finish desired and the capacity of the machine. In order to change the spindle speeds, any one of the following methods are employed.

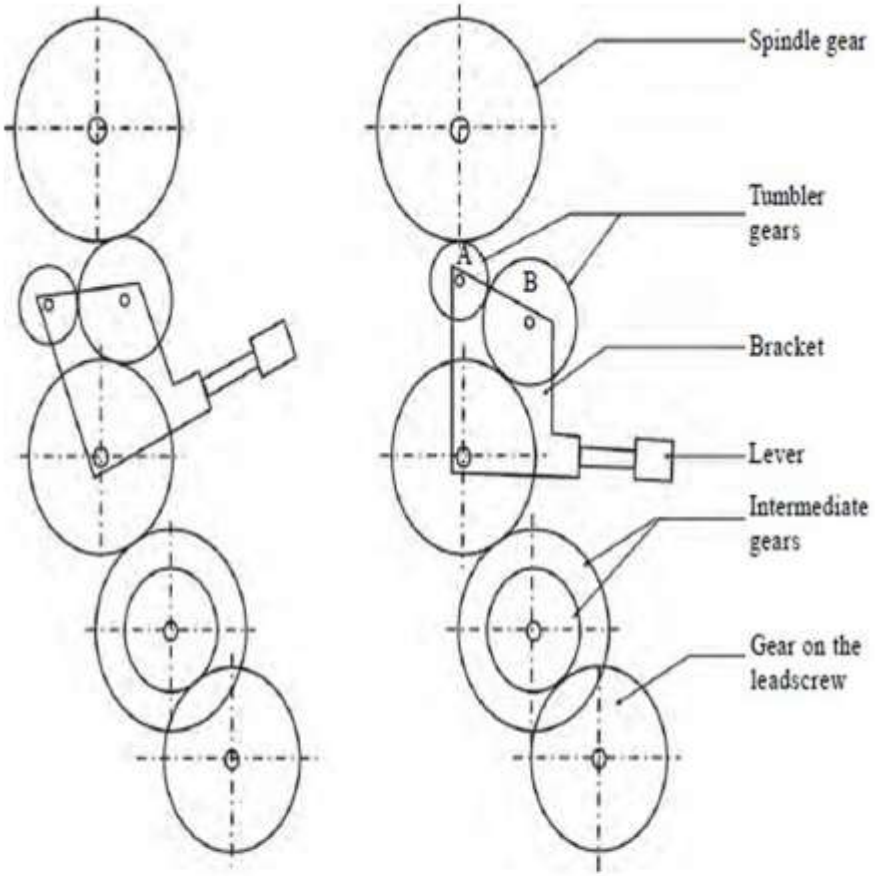
1. Step cone pulley drive
2. Back geared drive
3. All geared drive

Step cone pulley drive

It is simple in construction. The belt is arranged on the four different steps of the cone pulley to obtain four different speeds. A step cone pulley is attached with the spindle contained within the headstock casting. The cone pulley has four steps (A, B, C & D). Another cone pulley having four steps (E, F, G and H) is placed parallel to the spindle cone pulley. Both the cone pulleys are connected by a flat belt. The belt can be arranged between the steps A & H, B & G, C & F and D & E. The cone pulley at the bottom is connected to the electric motor by a 'V' belt. So the cone pulley at the bottom rotates at a particular speed. The belt is arranged on any of the four steps to obtain different spindle speeds. The spindle speed is increased if the belt is placed on the smaller step of the driven pulley. The spindle speed will be maximum when the belt is arranged between A & H and the speed will be minimum when the belt is arranged between D & E.

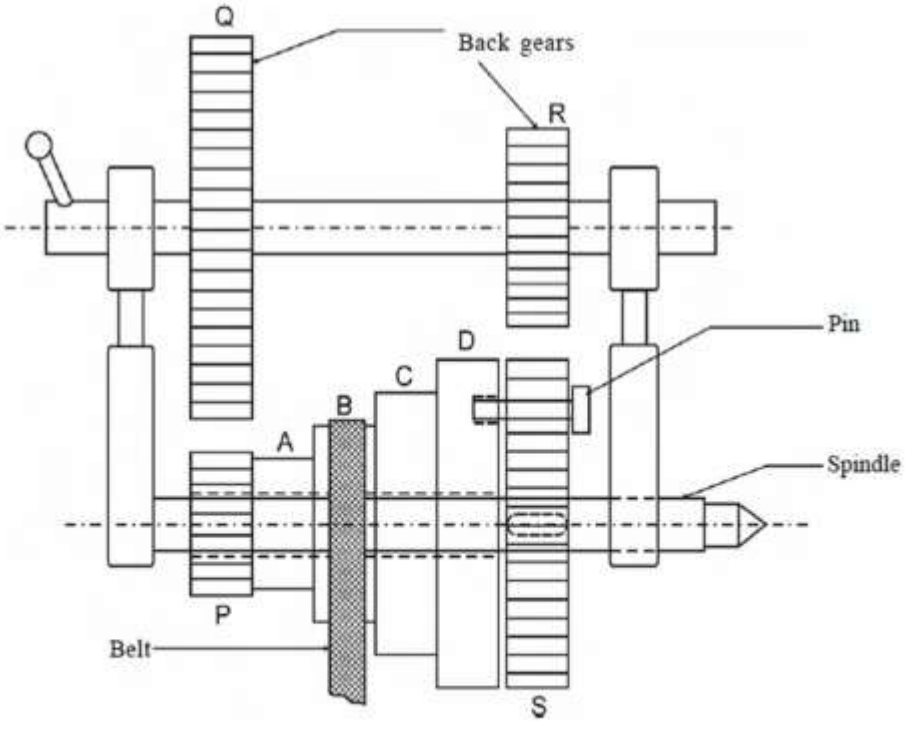
Back gear mechanism

Back gear mechanism is housed within the headstock of the lathe. A step cone pulley having steps ABCD and a small pinion 'P' are mounted on the spindle and rotate freely on it. The gear 'S' is keyed to the headstock spindle. So, the spindle will rotate only when the gear 'S' rotates. The step cone pulley ABCD and the gear 'S' can be kept separately or made as one unit with the help of a pin 'T'. When the pin is disengaged, the cone pulley along with the gear P will rotate freely on the spindle and the spindle will not rotate. There is another shaft parallel to the spindle axis having back gears Q and R mounted on it. These back gears can be made to mesh with gears P and S or kept disengaged from them. The spindle can get drive either from the cone pulley or through back gears.

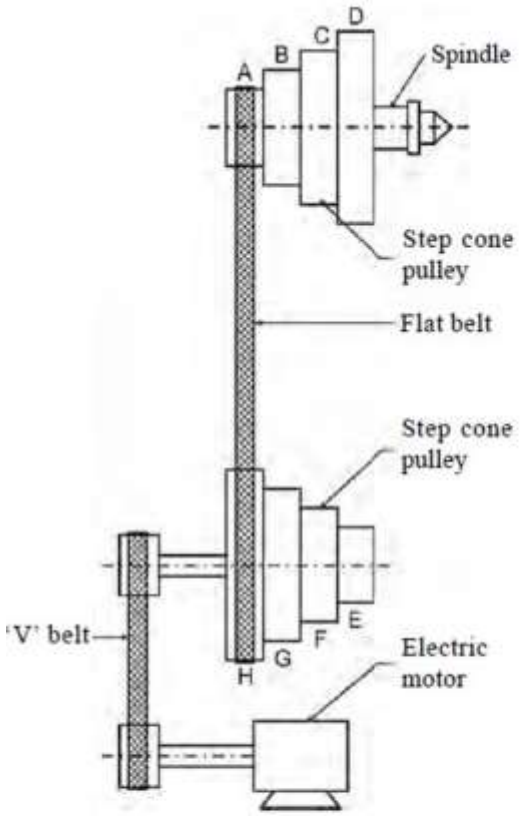


Forward position Reverse position

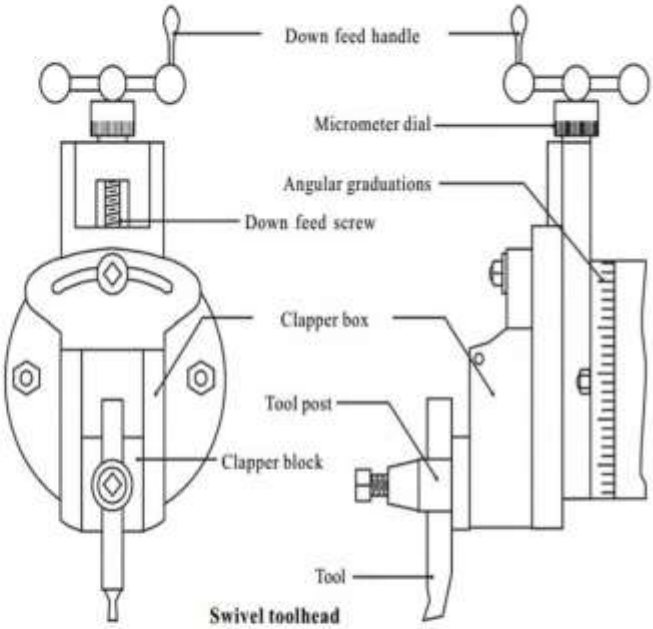
Tumbler gear arrangement



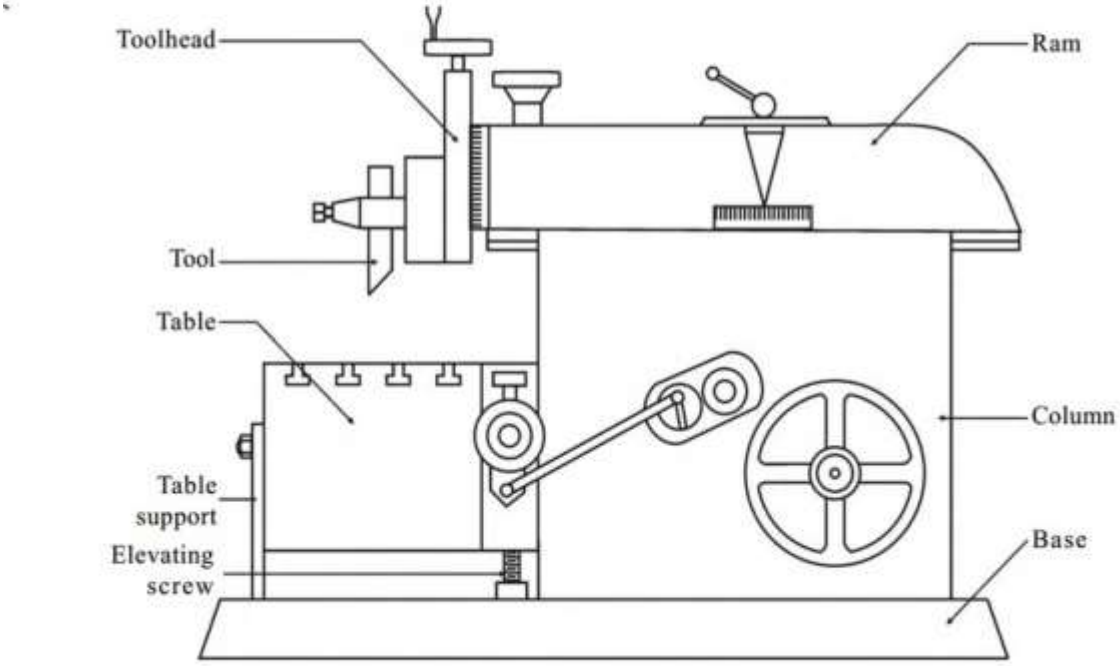
Back gear drive



Step cone pulley drive



Swivel toolhead



Shaping machine

SHAPER MACHINE

INTRODUCTION:-

The shaper is a reciprocating type of machine tool indented to produce real Surface. The Surface may be horizontal, vertical or inclined in general the shaper can produce any surface composed of straight line elements in order to shaper can general construct surface.

TYPES OF SHAPERS:-

Shapers are classified under the following headings:-

1. According to the type of mechanism used for giving reciprocating motion of the ram.
   a) Crank type, (b) Geared type, (c) Hydraulic type.
2. According to the position and travel of ram.
   a) Horizontal type, b) Vertical type, c) Travelling head type.
3. According to the type of design of table.
   a) Standard shaper, b) Universal Shaper.
4. According to the type of cutting stroke.
   a) Push type, b) Draw type.

PRINCIPLE PARTS:-

BASE:-

The base is necessary bed or support required for all machine tools. The base may be rigidly to the floor of the shape or on the bench according to size of machine. It is made of cast iron to resist vibration and take up high compressive.

COLOUMN:-

Column is a bar like casting material up on the base it encloses the ram driving mechanism. Two accurately machined guide ways are reciprocates. The front vertical face of the column serve the as guide ways or cross rail is also machined.

CROSS RAIL:-

Cross rail is mounted up on front vertical guide ways of the column. It has two parallel guide ways on the top of the vertical plane that are perpendicular to ram axis. The table may be raised or lowered to accommodate different size of the job by rotating on elevating screw which cause the cross rail to slide up and down on the vertical face of the column.

SADDLE:-

The saddle is mounted on the cross rail which holds table firmly on the top. Cross wise movement of the saddle by rotating the gross feed screw by hand or power causes the table two move side wise.

TABLE:-

The table which is bolted to the saddle receiver cross wise and vertical movement from the saddle and cross rail. It is a box like casting having T slots both on the top and sideways damping the work.

RAM:-

Ram is reciprocating member of the shaper. This is semi cylindrical in form and heavily ribbed inside to make it more rigid. It slides on the accurately machined dove tail guide ways on the top of column and is connected the reciprocating mechanism control within the column it houses a screwed shaft for altering the position of ram with respect to the work holds the tool head at the extreme forward end.

TOOL HEAD:-

The tool head of a shaper holds the tool rigidly provides vertical and angular feed movements of the tools and allows the tool to have an automotive relief during its return which is held on the circular seat on the ram.

SHAPER MECHANISM:-

In shaper the rotary movement of drive is converted reciprocating movement by the mechanism contained with the column of the machine. The ram holdings the tools get the reciprocating movement. In standard shaper the metal is removed in the forward cutting stroke while the return stroke gets idle and no metal is removed in the period to reduce the total machining time. It is necessary to reduce the time taken by return stroke.

The reciprocating movement of ram are usually obtained by on of the following methods.

i) Crank and slotted link mechanism.
ii) Whit worth quick return mechanism.
iii) Hydraulic shaper mechanism.

WORK HOLDING DEVICES:-

The top and slides of the table of a shaper have T-slots for clamping the work. The work may be supported on the table by the following methods depending on the nature of the work piece.

i) Clamped in a vice.
ii) Clamped on the table.
iii) Clamped to the engine plate.
iv) Clamped on a V-block.
v) Held between shaper …….

SHAPER OPERATION:-

A shaper is a vertical machine tool primarily designed to generate a flat surface by a single pointing cutting tool. But it may be used to perform many other operations.

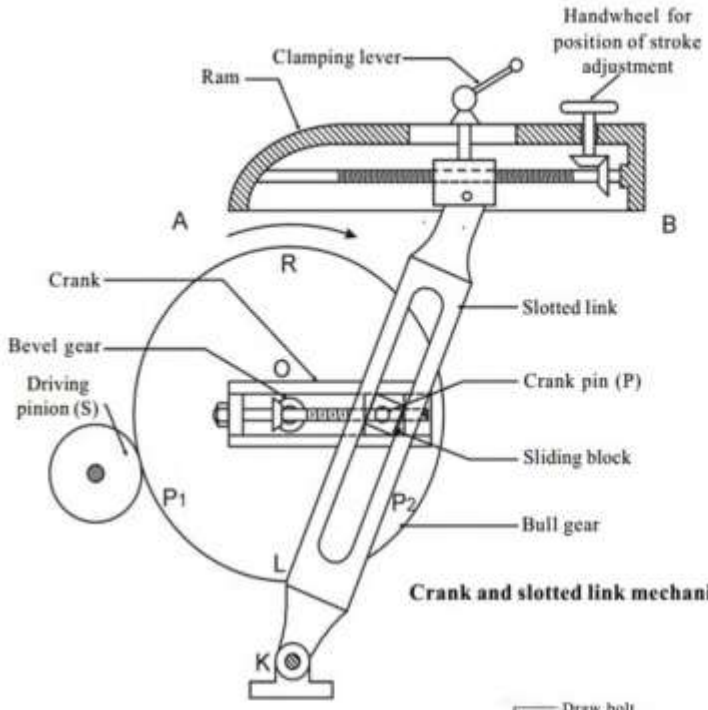
1) Machining vertical surface.
2) Machining horizontal surface.
3) Machining angular surface.
4) Cutting tools, grooves and keyways.
5) Machining irregular surface.
6) Machining splines or cutting grooves.

SHAPER SPESIFICATIONS:-

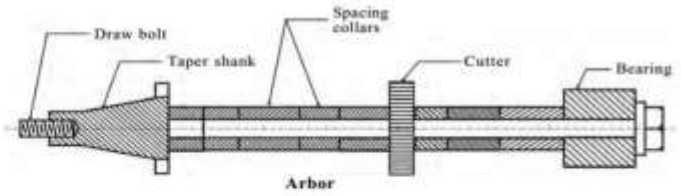
The shaper can be specified according to their .

1) Length of stroke.
2) The size of a cube that can be placed and planed in shapes.
3) Type of drive.
4) Type of cutting to return stroke ratio.
5) Amount of power input.
6) Weight of machine.
7) Number and amount of feed.

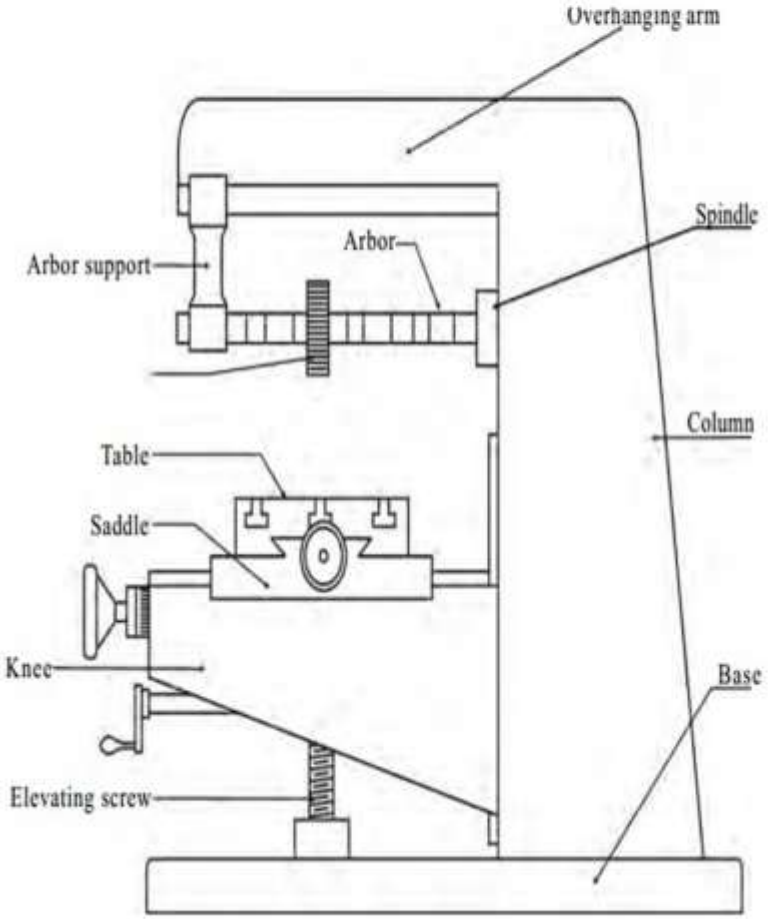
8) Floor area required.



Crank and slotted link mechanism



Arbor



Horizontal milling machine

MILLING MACHINE

INTRODUCTION:-

A milling machine is a machine tool that removes metal as the work is fed against rotating multipoint cutter. The cutter rotates at higher speeds and because of multiple cutting edges it removes metal at a fast rate. The machine can be also hold one o more no of cutter at a time. It is superior to other machines as regards to accuracy and better surface finish is designed for machining a variety of tool ram work.

TYPES OF MILLING MACHINE:-

Milling machine may be classified in several forms covering at wide range of work and capacities. The usual classification according to the general design of milling machines.

i) Column and knee type.
ii) Manufacturing of fixed bed type.
iii) Planes type.
iv) Special type.

PRINCIPLE PARTS:

The principle parts of the column and knee type milling machine are:-

The base of the machine is a gray iron casting accurately machined o its top and bottom surface and serves as a foundation member for all other parts which rests upon it carries column and it on consist of hollow base for following the cutting fluid.

COLUMN:-

The column is the main supporting member mounted vertically on the base. The column is box shaped heavily ribbed inside and houses all the driving mechanism for spindle and table feed.

KNEE:-

The knee is rigid gray iron casting that slides up and down the vertical face of column face. The adjustment of height is affected by an elevating screw mounted on base that also supports the knee. The knee houses the feed mechanism of the table and different controls of operate it.

TABLE:-

The table rest on a way on saddle and travels longitudinally the top of table is accurately finished and T-slot are provided for clamping the work and other fixtures on it. A lead screw under the table engages on a hat in the saddle to move the table horizontally by hand or power.

Over hanging arm:-

The overhanging arm is mounted on the top of the column intends up on the columns face and serves as a bearing support for other and of the arbour. The arm is adjustable so as the bearing support may be provide nearest to the cutter.

FRONT BRACE:-

The front base is extra support is fired below the knee over arm to ensure further rigidity to arbour and knee. The front brace is slotted allow for the adjustment of the height of the knee relative over arm.

SPINDLE:-

The spindle of the machine is located at the upper part of column an receives power from motor trough the belts, gears clutches and transmit it to the arbour the accuracy in metal machining by the cutter depends primarily on the accuracy strength and rigidity of the spindle.

ARBOR:-

In arbour may be considered as an extension of the machine spindle on which milling cutters are securely mounted and rotated. The arbours are made with taper shank for proper alignment with the machine spindle having taper holes of their ends.

MILLING MACHINE MECHANISM:-

The milling machine mechanism composed of spindle drive mechanism and table feed mechanism. The spindle drive is in corporate in

the column all modern machines are driven by individual motor housed within the column and spindle receives power from a combination of gears and clutch assemble multiple speed of spindle may be obtained by altering the gear ratio.

WORK HOLDING DEVICES:

It is necessary that the work should be properly used securely hold on the milling machine table for effective machine operation .

The following are the usual method of holding work on the table:

(1) T-bolts and clamps.
(2) Angle plate.
(3) V-block.
(4) Vice.
(5) Special features.

CUTTER HOLDING DEVICES:-

There are several methods of supporting and rotating milling cutter with machine spindle depending up on the different devices for holding and rotating cutter.

1. Arbor 2. Collects 3. Spring collects 4. Adaptors 5. Belted cutters. 6. Screw on cutters.

MILLING MACHINE OPERATION:-

The following are the different operation performed on milling machine.

1. Plane milling
2. Face milling
3. Side milling
4. Saddle milling
5. Angular milling
6. Gang milling
7. Find milling
8. Saw milling
9. Profile milling
10. Gear cutting
11. Helical milling

12. Cam milling
13. Milling key ways slots and grooves
14. Thread cutting
15. Form milling