

WORKSHOP TECHNOLOGY

<p>Unit-4</p> <p>Drilling, Reaming and Boring machines</p>	<p>Drilling Machine: Introduction, tools for drilling, its classification, twist drills, twist drill parts and terminology, some important drill dimensions and important angles of drill, drill size and specifications, straight flute drills,</p> <p><i>Drilling machine types;</i> Portable, Bench, Radial, Universal, Multiple spindle, Gang, Horizontal and automatic drilling machines.</p> <p><i>Drilling machine operation;</i> Drilling, Spot facing, Reaming, Boring, Counter boring, Counter Sinking, tap drill size</p> <p>Reaming Machine; Introduction, Reamer terminology, Types of reamers-hand reamers, machine reamers, adjustable and taper reamers.</p> <p>Boring Machines: Introduction, Horizontal boring machines, Vertical boring machines.</p>
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DRILLING MACHINE

Introduction

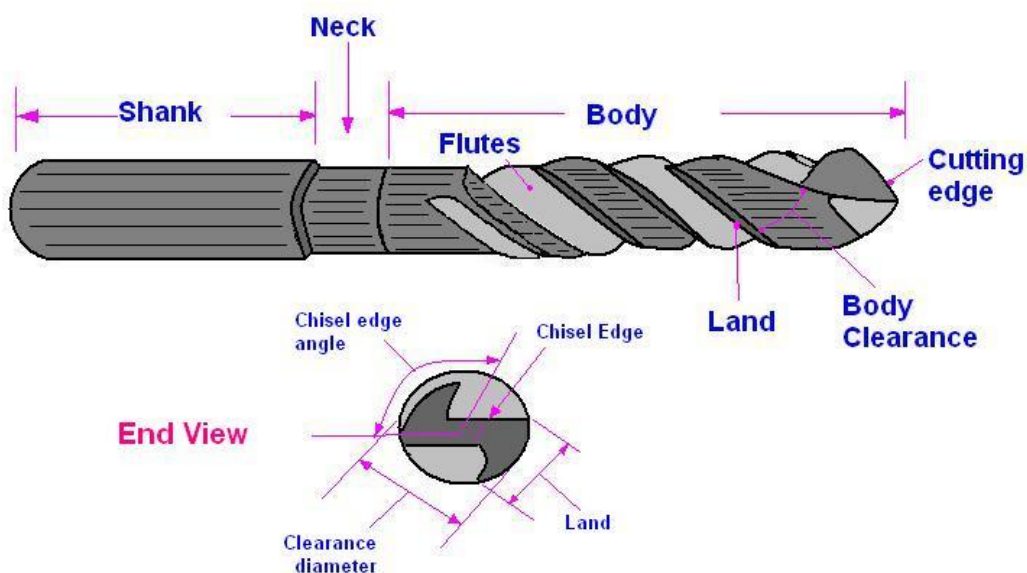
A drilling machine is one of the important machine tools in the workshop. A drilling machine is used to form a hole of different sizes on a job, drilling is a metal removing process, by a drilling machine you can do drilling operation, reaming operation and boring operation.

Drilling is a material-removing or cutting process in which the tool uses a drill bit to cut a hole of circular cross-section in solid materials.

Twist drill parts and terminology

There are many ways of classifying drills. The tool(drill) and not the work piece is revolved and is fed into the material along its axis.

Parts of Twist Drill



For example, according to material, number and types of flutes, drill size, type of shank (straight or taper) and cutting point geometry etc. However, the most common type of drill is the fluted drill shown in figure.

It is made from a round bar of tool material, and has three principal parts: the point, the body and the shank. The drill is held and rotated by its shank. The point comprises the cutting elements while the body guides the drill in the operation. The body of the drill has two helical grooves called “flutes”. The flutes form the cutting surface and also assist in removing chips out of the drilled hole. The parts of twist drill are:

1: Point:

The point is the cone shaped end and it does the cutting. It consists of the following:

(A) dead center: It is the sharp edge at the extreme tip of the drill. This should always be the exact center of the drill.

(B) Lips: these are the cutting edges of the drill.

(C) Heel : It is the portion of the point back from the cutting edge.

2: Shank :

It is the portion of the drill by which it is clamped in the spindle. The shank may be either straight or tapered. Straight shank drills are used with a chuck. Tapered shank drills have self-holding tapers that fit directly into the drill press spindle. On the taper shank is the another term is used which is called tang. This fits into a slot in the spindle's sleeve.

3: Body :

It is the portion between the point and the shank. The body consists of the following parts:

(A) Flutes :

Two or more spiral grooves that run the length of the drill body are called flutes. The flutes do four things.

- Help form the cutting edge of the drill point.
- Curl the chip tightly for easier removal.
- Form channels through which chips can escape from the hole being drilled.
- Allow the coolant and lubricant to get down to the cutting edge.

(B) Margin

It is the narrow strip extending back the entire length of the flute. It is the full diameter of the drill.

(C) Body Clearance:

It is the part of the drill body that has been reduced in order to cut down friction between the drill and the wall of the hole.

Point angle

The point angle is located on the head of the twist drill. The angle is measured between the two main cutting edges at the top. A point angle is necessary to **center the twist drill in the material**.



The smaller the point angle, the easier the centering in the material. This also reduces the risk of slipping on curved surfaces.

The larger the point angle, the shorter the tapping time. However, a higher contact pressure is required and centering in the material is harder.

Geometrically conditioned, a small point angle means long main cutting edges, whereas a large point angle means short main cutting edges.

Straight fluted drill

When drilling soft and ductile, nonferrous material, such as copper and aluminum, its ductility and softness causes the material to make constant prolonged contact with the rake face, or cutting edges, of a drill.



To prevent the drill bit from "digging in" or grabbing the material, and to maintain proper hole diameter and sidewall surface finish, straight fluted drill bits are used.

When drilling a tough nonferrous material, such as titanium, you will need helical twist drill bits -- made of tungsten carbide.

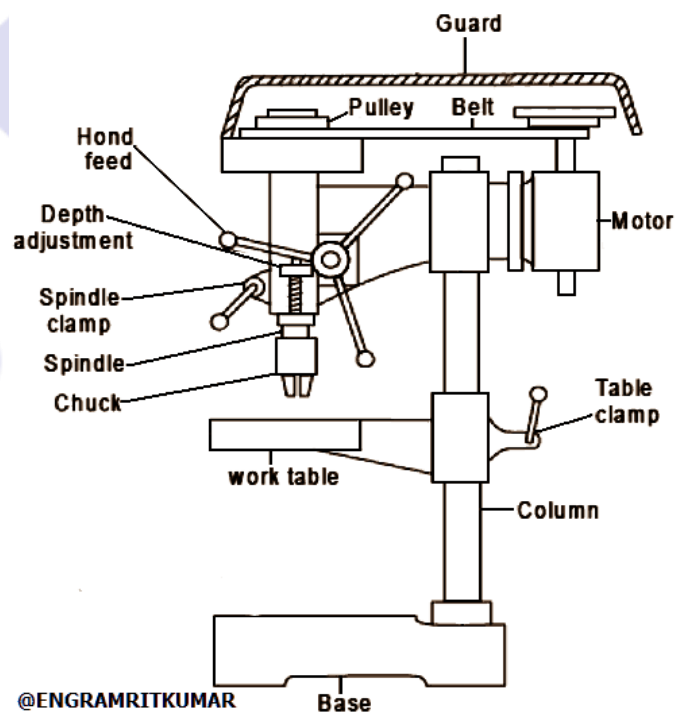
Drilling Machine Types:

In the market there are various **types of Drilling machine** available, here mention **some of the popular types of drilling machines**.

- Sensitive Drilling Machine
- Vertical or Pillar
- Radial Arm
- Gang Type
- Multi-Spindle
- Numerically control
- Special Purpose Drilling Machine
- Sensitive Drilling Machine:

Sensitive drilling machine

The Sensitive drilling machine has only a hand-feed mechanism for feeding the tool into the workpiece. This enables the operator to feel how the drill is cutting and accordingly he can control the down feed pressure.



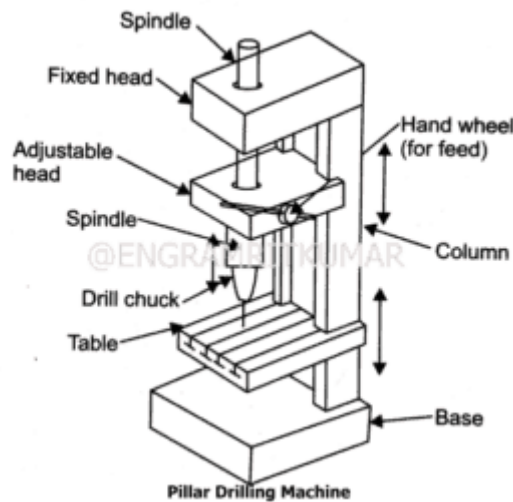
Vertical or Pillar Drilling Machine:

Vertical or Pillar Drilling Machine is free standing and is of a far heavier construction able to take larger drills.

It has a heavy frame to support a wider range of work.

The table height is adjustable and power speed and feeds are available.

The larger drills normally have a taper shank located within taper bore in the spindle end. These tapers are standardized as Morse tapers.



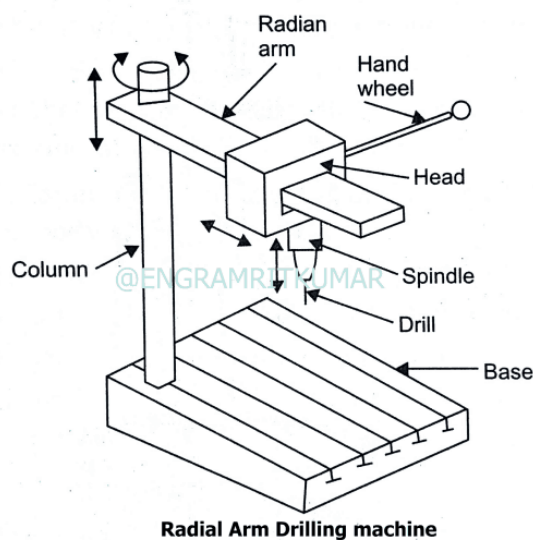
Radial Arm Drilling Machine:

The radial drill machine is free-standing and the workpiece is clamped in the position on the base. It is used for heavy large and heavy work.

The arm is power-driven for the height location. The drill head is positioned using motorized drives and it transverse the swinging arm.

The workpiece remains stationary on the machine base or worktable.

The machine spindle is moved to the location required.



Gang Type Drilling Machine:

In the Gang type Drilling Machine, several spindles/ or stations are mounted on one long table as shown in the figure.



Multi-spindle Drilling Machine:

In the Multi-spindle drilling machine, there are many spindles mounted on one head to allow many holes to be drilled simultaneously.



Numerical Control Drilling Machine:

Numerical control drilling machine can automatically change tooling with a turret or automatic tool changer. Speeds, feeds, and table position is controlled using a computer program.



Numerical Control Drilling Mchine

Drilling Machine Operation:

These are the following operations that can be performed in the Drilling machine.

- Core drilling operation
- Step drilling operation
- Boring operation
- Counter boring operation
- Reaming operation
- Countersinking operation
- Spot facing operation

Drilling operation:

When we need a **circular hole in a workpiece of any size** there, we can use drilling operation, by a drilling operation you can form any size of holes in a workpiece. Although you can use a lathe for drilling operation too, drill machine is an appropriate machine to do holes in a workpiece.

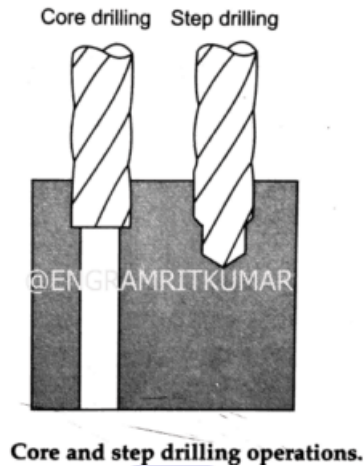
The cutting tool we used for this type of operation is drill bit. A drill bit is a multipoint rotary cutting tool which helps to remove material from a workpiece.

Core Drilling:

When sand castings are made, cores are used to displace the metal where holes are desired. When cast the molten metal flows around the core. After the metal solidifies the casting is removed from the mold and the core disintegrates leaving the desired holes. the holes are usually quite rough and require heavy body drill to clean up the sidewall of the whole.

Step Drilling:

More than one diameter can be ground on the drill body which saves an extra operation.



Boring:

When you need to enlarge the diameter of the existing hole you need to perform the boring operation, but the accuracy is not greater than reaming operation. The boring tool is generally a single-point cutting tool.

Reaming:

It is an operation of finishing a drilled hole. A finished hole has the specified diameter size, is perfectly round, the diameter is the same size from end to end, and it has a smoothly finished surface. A drill hole is seldom accurate enough in size or sufficiently smooth to be called a precision hole. When greater accuracy is required the whole must be drilled undersize by a certain amount and finished by the reaming.

In short, when we need to enlarge the size of an existing hole with great accuracy in a workpiece, we have to performed reaming operation. In this type of operation, we need a reamer to perform the operation. A reamer is a rotary cutting tool that removes the material from the existing hole which has several parallel and helical cutting edge throughout its cylindrical body.

Counter Boring:

It is the operation of boring a second hole, a larger diameter than the first but concentric with it. When this operation is done on a drilling machine a tool known as counterbore is used.

The small diameter on the end of the tool known as the pilot keeps the counterbore concentric with the original hole. Pilots are interchangeable with others of different sizes to fit the various size of holes.

Counter Sinking:

It is the operation of producing an angular surface at the end of a hole. A countersink is used. The countersink is made in many diameters size and several angles. The angle size depends upon the reason for countersinking.

Flathead screws require a countersink with an 82 included angle, where is a Centre hole must be 60. Various types of rivet heads have included angles of from 90 to 145 degree.

Spot Facing:

It is the operation of machining a flat, circular surface around a whole to provide a seat for a Bolt head, nut or washer.

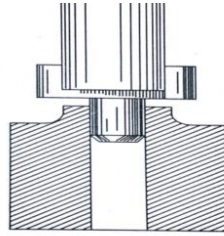


Figure: Spot-facing tool.

It is usually performed on casting. A Counterbore may be used for spot facing. The Surface machined should be a square with the hole.

Reamer:

A reamer is a rotating cutting tool generally of cylindrical shape which is used to enlarge and finish holes to accurate dimensions to previously formed hole. It is a multiple edge cutting tool having the cutting edge on its periphery.

Parts of Reamer:

A reamer consists of three main parts:

1. Fluted section
2. Neck
3. Shank

The fluted part consists of chamfer, starting taper, sizing section and back taper length. Chamfer length or bevel lead insures proper and easy entry of the reamer into the hole. The main cutting action of reamer is done by starting taper, the sizing section and to guide the reamers and also smooth or size the hole. The back taper reduces friction between reamers and the whole surface.

Types of Reamers:

There are following types of reamers:

- Hand Reamer
- Machine Reamer
- Tapered Reamers:
- Adjustable Reamer



1: Hand Reamer:

These reamers are operated by hand with a tap wrench fitted on the sequence of the reamer. The work is hold in a vice. The flutes may be straight or helical. Shank is straight with a square tang for the wrench.

2: Machine Reamer;

These are similar to hand reamer, except that the shank is tapered.

3: Adjustable Reamers:

In these reamers separate blades are inserted in the grooves provided in the body of the reamer. The blades can be moved up or down of the reamer.

4: Tapered Reamers:

These reamers are used to finish the taper holes for cutting the taper things used to secure the collars, pulleys etc to the shaft.

Boring Machine

A boring machine is a machine which is used for boring large holes on the articles or work items which are not possible to move or rotate on the machine. It is one of the most useful machines which is used on heavy articles like engines, frames, cylinders, land etc. on which the operation of lathe and drilling machine is not possible.

Types of Boring machines

Horizontal: The rotational axis of w/p is horizontal

Vertical - The rotational axis of w/p is vertical

Horizontal Boring Machine

Horizontal boring machine is basically used when boring operation is to be performed on larger parts. In this machine, the spindle is positioned in horizontally and the spindle is placed in the parallel position to the table and ground both.

Uses- Horizontal boring machine is used in boring, shaping, facing, milling and drilling. One of the major uses is when parts are larger in size and crane is to be placed overhead.

Working of Horizontal Boring Machine

Horizontal Boring Machine remains static and the boring tool is rotated. Holes are bored by using boring bars and tools. To bore a hole, the boring tool is affixed on the spindle and the cutter is adjusted on the bar in a specifically required dimension. The major factor in boring is its required measure of the bore in length and sphere.

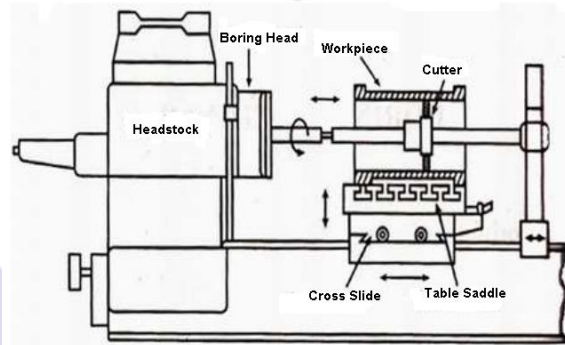
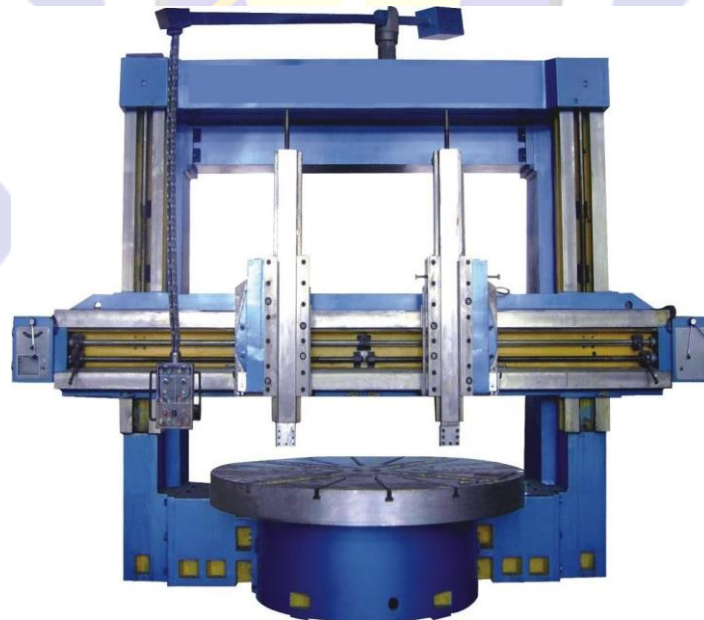


Table Type Horizontal Boring Machine

Vertical Boring Machine

In the vertical type of boring machine configuration, the operational tool is placed like normal lathe machinery and performs all the normal lathe machinery functions like cutting, turning, boring, threading etc.



Uses- Vertical boring machines are used in turbines, tires, pipelines, large frames, machine tables etc.