A **drilling machine** is one of the important machine tools in the workshop. In today's article, I will discuss the **definition, *parts, types and operations of the drilling machine you should know about***.

We also perform drilling operation in lathe machine too, but drill machine is made for this specific drill operations, so where we need bulk of drilling operation we go for drilling machine.

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 Machine Definition:

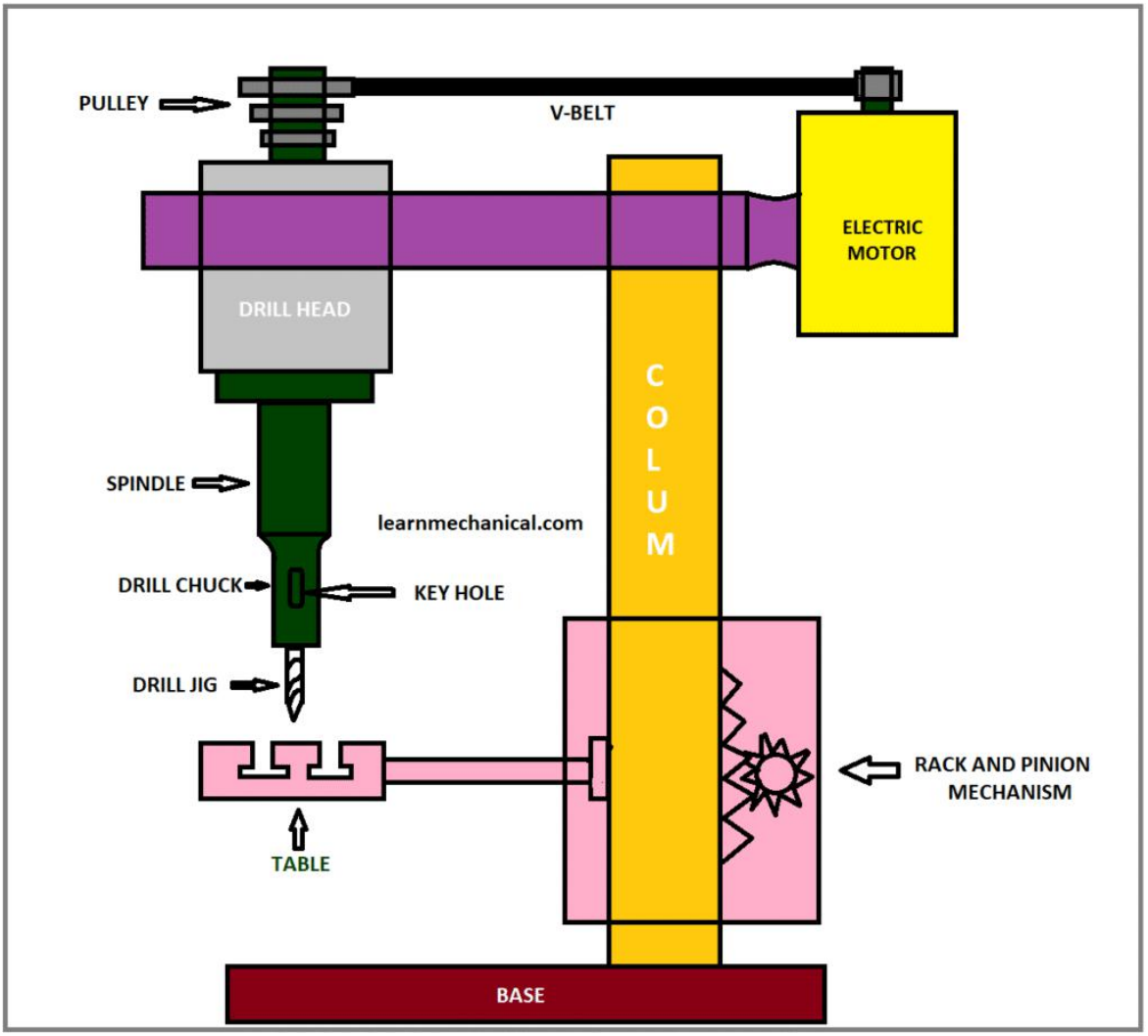
Drilling is a material-removing or cutting process in which the tool uses a drill bit to cut a hole of circular cross-section in solid materials.

This is the most common machining process, one estimate is that 75% of all metal cutting material removed comes from the drilling operation.

Drilling Machine Main Parts:

A drilling machine consists of the following parts:

- Base
- Column or Pillar
- Arm
- Worktable
- Drill head
- Feed Mechanism
- Spindle
- Drill jigs
- Chuck
- Electric Motor
- Pully or gears



Parts of drilling machine

These are the main parts of the drill machine

Let’s discuss one by one

Base:

It is one of the main parts of a drilling machine, it **carries the entire weight of the machine, and transfer the weight to the ground**.

The base of a drilling machine is generally made of cast iron or steel, and it is very rigid.

In the top of the base, there are some slots provided to support the big jobs.
And on one side of the base, a radial column or a pillar is situated.

The base is generally bolted with the ground or in some case the base is supported by two or four legs.

Column or pillar:

The column or pillar is situated on one side of the base. In general, we **use radial column so that the movement of the arm is possible in a clockwise or anti-clockwise direction**.

The column is also made of cast iron or steel and is also very rigid so that it can carry the load of the arm as well as a drill head.

A sliding table is mounted on the column so that the table can have up and down motion according to the need.

Upper arm:

At the top of the column, there is an upper arm, which carries the **drill head and also the house of the driving mechanism**. The upper arm is also made of the same material as the base. To make the structure rigid.

In some drilling machine, a guideway is provided so that the drill head can slide over this.

Worktable:

The worktable is generally made of cast iron and it is mounted on the column. **T-slots are provided at the top surface of the table may be in some table there is a vice which also helps to hold the job**.

The table can move up and down as also right or left according to the job and tool arrangement. The up and down motion of the table can be given by hand as well as by some electrical mechanism. We use a **rack and pinion mechanism** for a vertical moment of the table.

The shape of the table can be **rectangular or also circular**.

Drill head:

One side of the arm a drill head is mounted, a drill head is consist of **various feed and driving mechanism**.

A drill chuck is mounted over it. A drill head can slide up and down as per the requirement of the job.

A V-types belt is provided to transfer the power from the motor to the pulley and from pulley, the mechanical power is transferred to the drill head.

The different type of speed can be generated by **cone pully mechanism as well as a gear-train mechanism**.

Feed Mechanism:

In a drill machine, we use an **electric motor, V-belt, and pulley to transfer the power from the motor to spindle**.

For the up and down motion of the drill head, we use hand and as well as automatic feed by an electrical motor. Here also a rack and pinion are used to convert the rotational movement from electrical motor or by hand to the straight-line movement.

Spindle:

It is a **circular taper shaft which helps to hold the drill chuck**. It is made of high carbon chromium steel or stainless steel or steel alloys.

It transfers the **rotary motion from drill head to drill jigs**.

There is a **keyhole provided** on the spindle to change the drill chuck.

The spindle also can move up and down with the help of rack and pinion mechanism.

Chuck:

The chuck is mounted on the lower end of the spindle, it **holds the drill jig**. Here also a **keyhole is provided** to change the drill jigs.

Drill chucks are generally **self-centering**. In a drill machine, we use **three-jaw chuck**. And it is made of special alloy steel.

Electric Motor:

In a drilling machine, we use a single-phase ac motor. Which can run at an rpm of 600-5000, or maybe more for high duty drilling machine.

Pully or gears:

Pully or gears is used to transmit power and also for getting different speed. In a drilling machine, we use bevel gear to transmit power at an angle of 90 degrees.

So now we are going to learn how power transferred in a Drilling machine.

How does Power Transmission happen in the Drilling machine?

The power transmission in the drilling machine used to transmit the power for its working.

This power is supplied from the **electric motor**.

The process of transmission takes place with the help of the v-bolt and the pair of pulley stacks opposite to each other.

The speed of the spindle is fixed or controlled with the help of the pulley stacks.

Let’s jump to the **types of Drill machine section**.

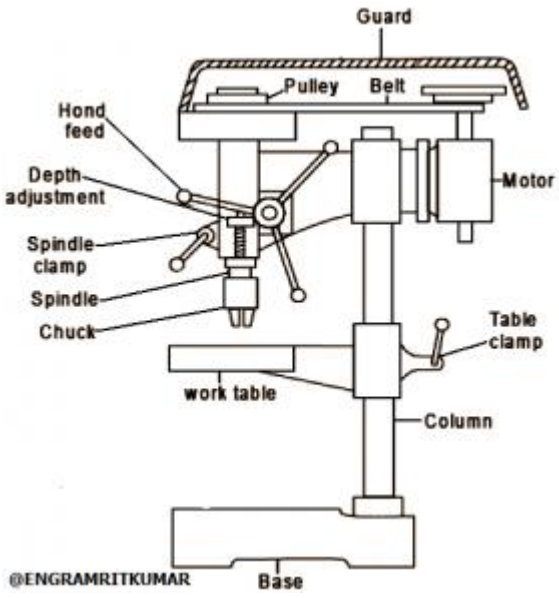
Drilling Machine Types:

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

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



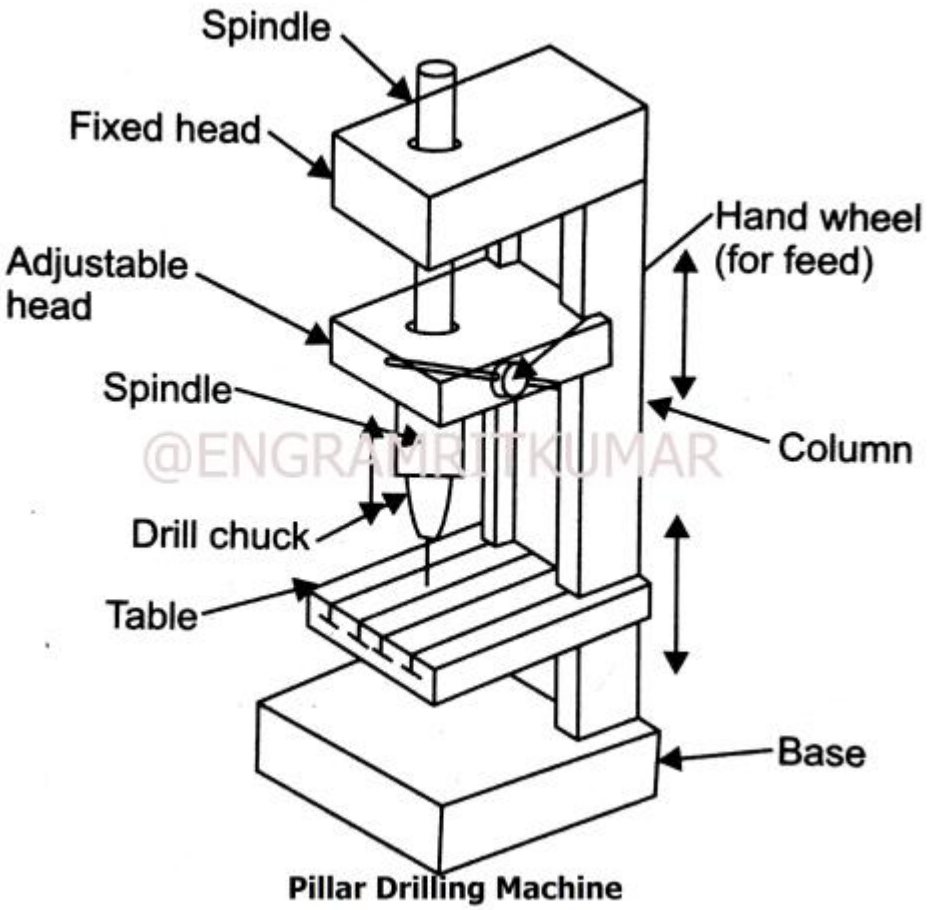
Vertical or Pillar Drilling Machine:

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 taper shank which located within taper bore in the spindle end. These tapers are standardized as Morse tapers.



Pillar Drilling Machine

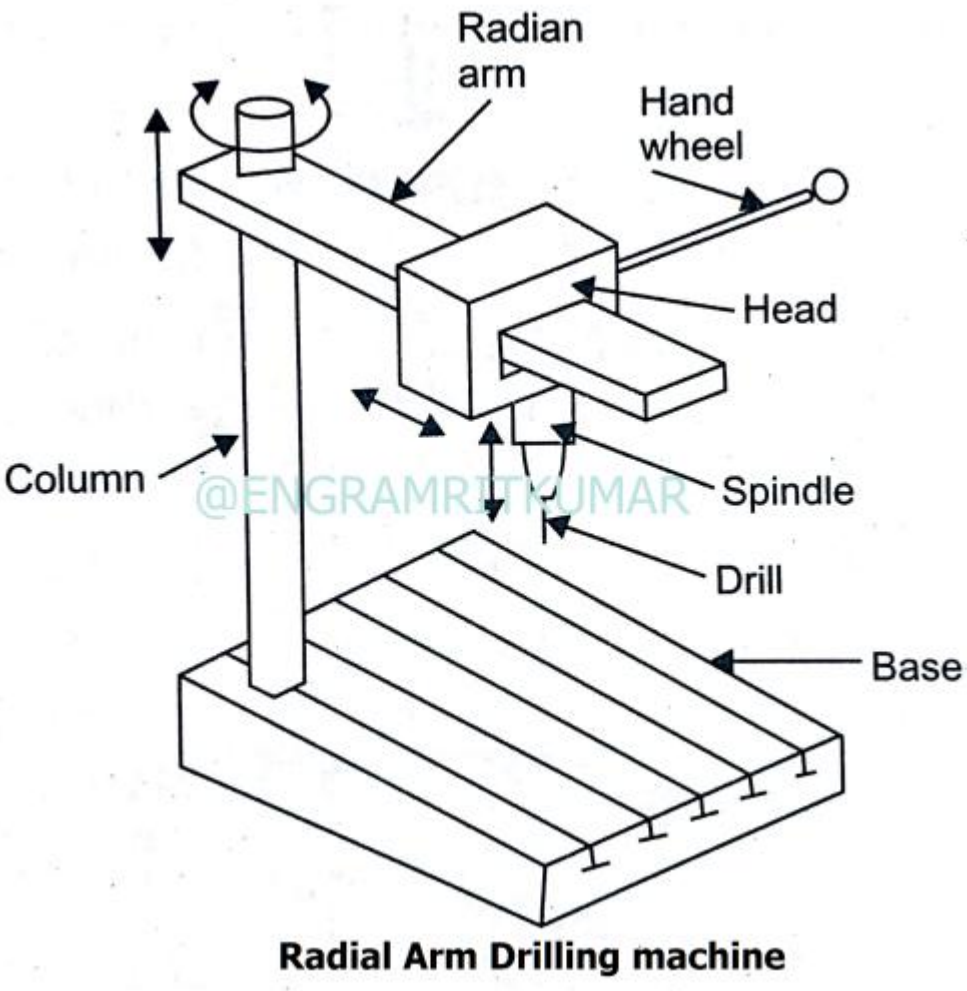
Radial Arm Drilling Machine:

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 o the machine base or worktable.

The machine spindle is moved to the location required.



Radial Arm Drilling machine

Gang Type Drilling Machine:

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

Gang drilling machine (Photo Courtesy: IndiaMart)

Multi-spindle Drilling Machine:

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

LEARN MECHANICAL

LEARNMECHANICAL.COM

Multi-spindle Drilling Machine (Photo Courtesy: IndiaMart)

Numerical Control Drilling Machine:

N**umerical control drilling machine** can automatically change tooling with a **turret or automatic tool changer**.

Speeds, feeds, and table position are controlled using a computer program.

LEARN MECHANICAL

LEARNMECHANICAL.COM

Numerical Control Drilling Mchine

Numerical control Drilling machine

Twist drill nomenclature:

It is designed with cones like internal structure, narrow at the top of the web with a gradually increasing thickness to the shank.

It is a multi-point cutting tool. I also wrote an article on the single-point cutting tool you can check that too.

These are the properties of twist drill

Axis:

The imaginary straight line which forms the longitudinal centerline of the drill.

Back taper:

A slight decrease in diameter from front to back in the body of the drill.

Body:

The portion of the drill extending from the sank or next to the outer corners of the cutting lips.

Body Diameter clearance:

That portion of the land that has been cut away so it will not rub against the wall of the hole.

Chisel Edge:

The edge at the end of the web that connects the cutting lips.

Chisel Edge Angle:

The angle included between the chisel angle and the cutting lips as viewed from the end of the drill.

Clearance Diameter:

The diameter over the cutaway portion of the drill lands.

Drill Diameter:

The diameter over the margins of the drill measured at the point.

Flutes:

Helical or Street grooves cut or formed in the body of the drill to provide cutting lips, to permit removal of chips and to allow cutting Fluids to reach the cutting lips.

Flute Length:

The length from the outer corners of the cutting lips to the extreme back and of the flutes; it includes the sweep of the tool used to generate the flutes and, therefore does not indicate the usable length of the flutes.

Helix Angle:

The angle made by the leading edge of the land with a plane containing the axis of the drill.

Land:

The peripheral portion of the body between adjacent flutes.

Land Width:

The distance between the leading edge and the hill of the land measured at the right angle to the leading edge.

Lead:

The axial advance of the leading edge of the land in one turn around the circumference.

Lips:

The cutting edge of a two-flute drill extending from the chisel edge to the periphery.

Lip Relief:

The axial relief on the drill point.

Lip Relief Angle:

The axial relief angle at the outer corner of the lip; it is measured by projection onto a plane tangent to the Periphery at the outer corner of the lip.

Margin:

The cylindrical portion of the land which is not cut away to provide clearance.

Neck:

The section of reduced diameter between the body and the shank of a drill.

Overall length:

The length from the extreme end of the shank to the outer corners of the cutting lips; it does not include the conical shank end often used on a straight shank drill, nor does it include the conical cutting point used on both straight and taper shank drills.

Point:

The cutting end of the drill made up of the end of the lands and the web; inform it resembles a cone, but departs from a true cone to furnish clearance behind the cutting lips.

Point angle:

The angle included between the cutting lips projected upon a plane parallel to the drill axis and parallel to the two cutting lips.

Shank:

The part of the drill by which it is held and driven.

Tang:

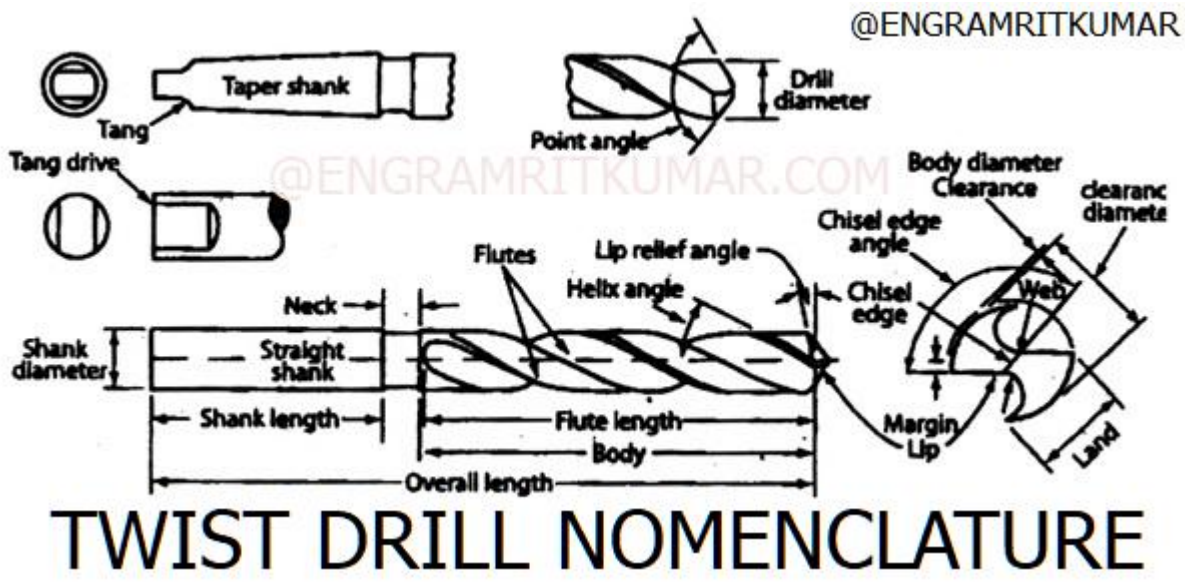
The flattened end of a tapered shank intended to fit into a driving slot in a socket.

Tang drive:

Two opposite parallel driving flats on the extreme end of a straight Shank.

Web:

The central portion of the body that joins the land; the extreme end of the web forms the chisel edge is on a two-flute drill.



Drilling Machine Operation:

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

- Plane drilling operation
- Core drilling operation
- Step drilling operation
- Boring operation
- Counter boring operation
- Reaming operation
- Countersinking operation
- Spot facing operation
- Tapping operation
- Trepanning 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.

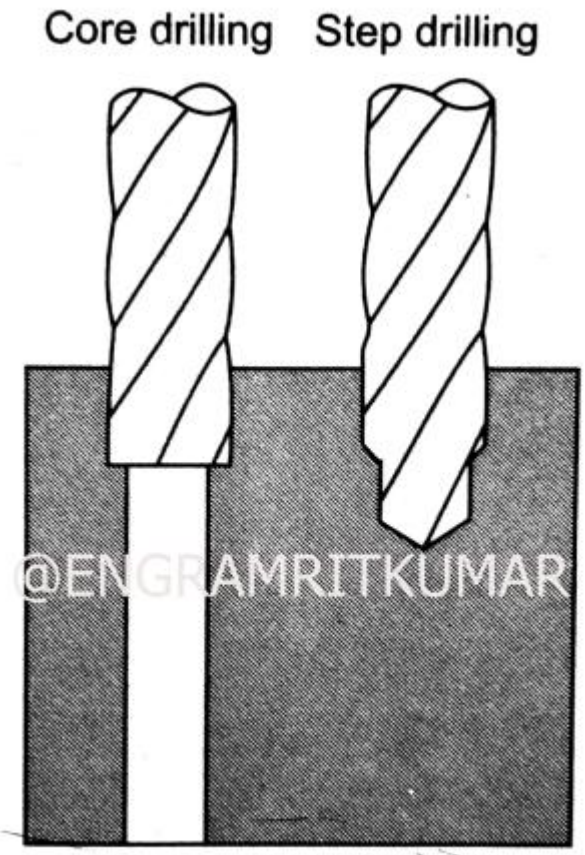
The cutting tool we used for this type of operation is drill bit. A drill bit is a multipoint rotary cutting tool which helps to remove material from a workpiece.

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.



Core and step drilling operations.

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 which 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 size 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.

It is usually performed on casting. A Counterbore may be used for spot facing.

The Surface machined should be a square with the hole.

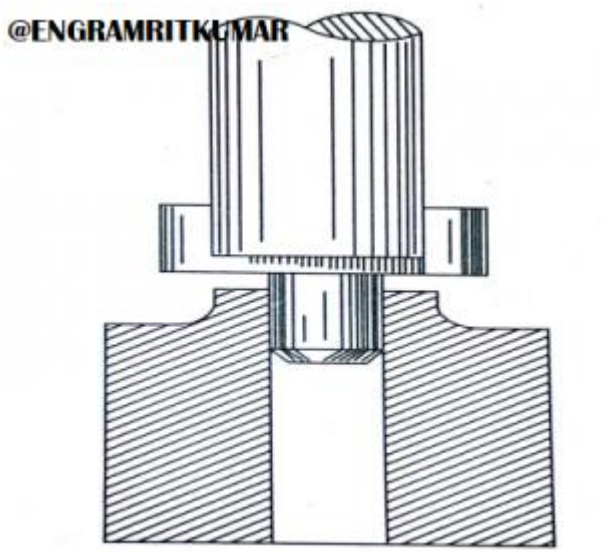


Figure: Spot-facing tool.

Tapping:

Holes that are to be tapped(threaded) are first are drilled to a specified size. In order to tap holes on a standard drilling machine, a tapping attachment must be used.

This attachment is held in the spindle of the drill press by a tapered Arbor, who drives the friction type mechanism.

The tap holding chuck accurately centers the tap on the round part of the shank and floating jaws hold the tap on its square end in a firm, rigid grip, which prevents the tap from pulling out of the chuck when reversing.

Trepanning:

It is a hole making operation where an annular groove is produced leaving a solid cylindrical core in the center.

In Trepanning a cutter consisting of One or more cutting edges placed along the circumference of a circle is used to produce the annular groove.

Trepanning is feasible if the hole has a diameter of more than 50 mm. Hole depth of 160 times the diameter can be obtained in Trepanning.

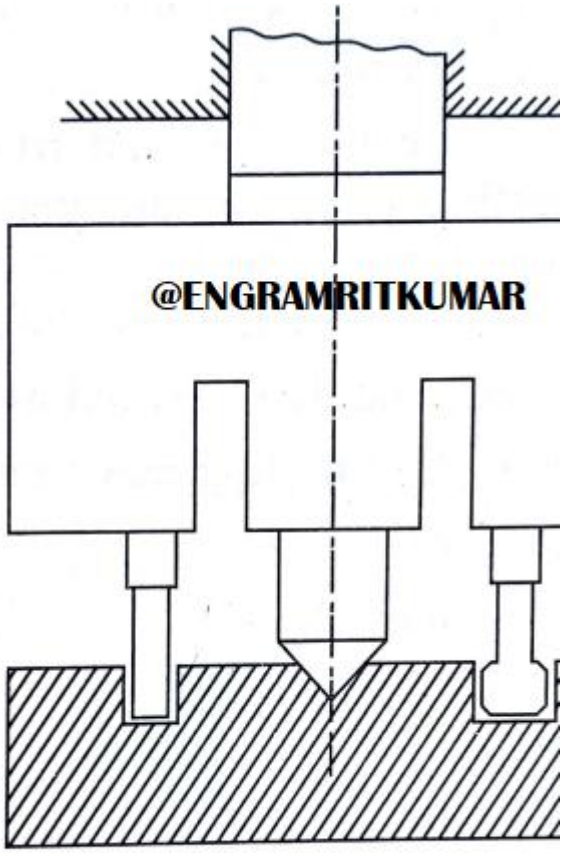


Figure:. Trepanning.

Drilling Machine Advantages:

- This machine is needed to mark on the end of components of dresses especially for setting pocket, dart & so on.
- It can make the hole permanently for a long.

Drilling Machine Dis-advantages:

- The use of a machine is limited.

Drilling Machine Application:

- It is used to make a hole in the fabric for **button attaching** and to make a reference mark for attaching different small components on the garments.

The Final thought about Parts of Drilling Machine:

So as far in this article, we see **11 types of drilling machine parts with their function**, **types, operations of drilling machine**. I hope you understand all of these, and if someone asks you this question you may able to answer.

Now I want to hear from you. If you like my article do share with your friends and also on your social handles. And **if you have any doubt you can use our Question Answer platform, where you can ask your question, also you can comment down below your doubts**, or whatever you wanna tell me. I love to hear your opinion and suggestions.

We also have **dedicated Facebook community for you guys, if you wish you can join our community, here is the link of our Facebook group**. So, Cheers, and enjoy the rest of your day.

Also, I wrote an article on parts, types, and operations Lathe Machine and also parts, types and operation of Shaper Machine you may be interested to read that too.