

INTRODUCTION: DRILLING MACHINE.

Drilling is an operation of making a circular hole by removing a volume of metal from the job by cutting tool called drill. A drill is a rotary end-cutting tool with one or more cutting lips and usually one or more flutes for the passage of chips and the admission of cutting fluid. A drilling machine is a machine tool designed for drilling holes in metals. It is one of the most important and versatile machine tools in a workshop. Besides drilling round holes, many other operations can also be performed on the drilling machine such as counter- boring, countersinking, honing, reaming, lapping, sanding etc.

CONSTRUCTION OF DRILLING MACHINE

In drilling machine the drill is rotated and fed along its axis of rotation in the stationary work piece. Different parts of a drilling machine are discussed below:

(i) the head containing electric motor, V-pulleys and V-belt which transmit rotary motion to the drill spindle at a number of speeds.

(ii) Spindle is made up of alloy steel. It rotates as well as moves up and down in a sleeve. A pinion engages a rack fixed onto the sleeve to provide vertical up and down motion of the spindle and hence the drill so that the same can be fed into the work piece or withdrawn from it while drilling. Spindle speed or the drill speed is changed with the help of V-belt and V-step-pulleys. Larger drilling machines are having gear boxes for the said purpose.

(iii) Drill chuck is held at the end of the drill spindle and in turn it holds the drill bit.

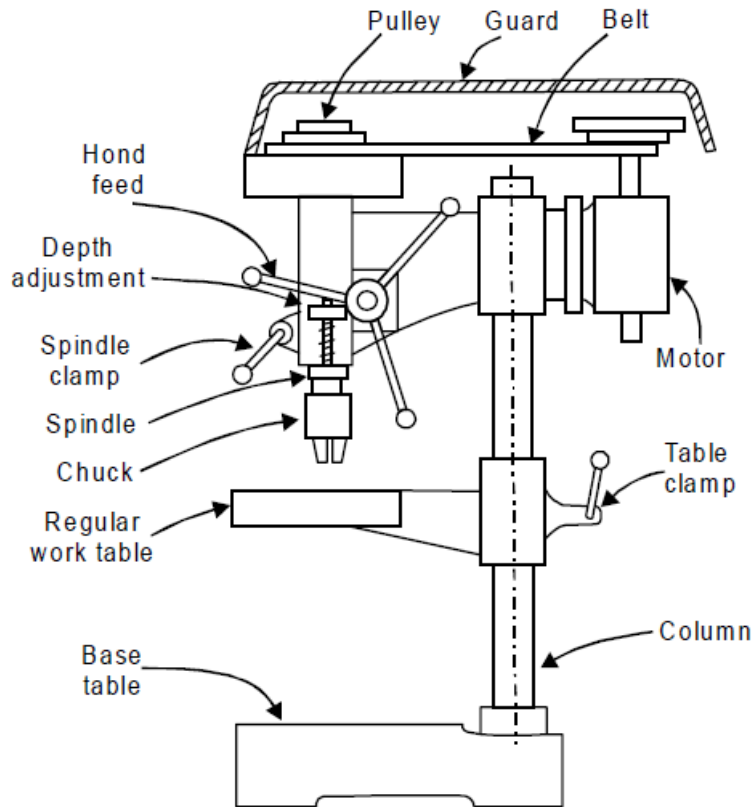
(iv) Adjustable work piece table is supported on the column of the drilling machine. It can be moved both vertically and horizontally. Tables are generally having slots so that the vise or the work piece can be securely held on it.

(v) Base table is a heavy casting and it supports the drill press structure. The base supports the column, which in turn, supports the table, head etc.

(vi) Column is a vertical round or box section which rests on the base and supports the head and the table. The round column may have rack teeth cut on it so that the table can be raised or lowered depending upon the work piece requirements.

This machine consists of following parts

- 1. Base**
- 2. Pillar**
- 3. Main drive**
- 4. Drill spindle**
- 5. Feed handle**
- 6. Work table**



TYPES OF DRILLING MACHINE

Drilling machines are classified on the basis of their constructional features, or the type of work they can handle. The various types of drilling machines are:

- (1) Portable drilling machine
- (2) Sensitive drilling machine
 - (a) Bench mounting
 - (b) Floor mounting
- (3) Upright drilling machine
 - (a) Round column section
 - (b) Box column section machine
- (4) Radial drilling machine
 - (a) Plain
 - (b) Semi universal
 - (c) Universal
- (5) Gang drilling machine.
- (6) Multiple spindle drilling machine.
- (7) Automatic drilling machine.
- (8) Deep hole drilling machine.
 - (a) Vertical (b) Horizontal.

Portable Drilling Machine

A portable drilling machine is a small compact unit and used for drilling holes in work pieces in any position, which cannot be drilled in a standard drilling machine. It may be used for drilling small diameter holes in large castings or weldments at that place itself where they are lying. Portable drilling machines are fitted with small electric motors, which may be driven by both A.C. and D.C. power supply. These drilling machines operate at fairly high speeds and accommodate drills up to 12 mm in diameter.

Sensitive Drilling Machine

It is a small machine used for drilling small holes in light jobs. In this drilling machine, the work piece is mounted on the table and drill is fed into the work by purely hand control. High rotating speed of the drill and hand feed are the major features of sensitive drilling machine. As the operator senses the drilling action in the work piece, at any instant, it is called sensitive drilling machine. A sensitive drilling machine consists of a horizontal table, a vertical column, a head supporting the motor and driving mechanism, and a vertical spindle. Drills of diameter from 1.5 to 15.5 mm can be rotated in the spindle of sensitive drilling machine. Depending on the mounting of base of the machine, it may be classified into

Following types:

1. Bench mounted drilling machine, and
2. Floor mounted drilling machine.

Upright Drilling Machine

The upright drilling machine is larger and heavier than a sensitive drilling machine. It is designed for handling medium sized work pieces and is supplied with power feed arrangement. In this machine a large number of spindle speeds and feeds may be available for drilling different types of work. Upright drilling machines are available in various sizes and with various drilling capacities (ranging up to 75 mm diameter drills). The table of the machine also has different types of adjustments. Based on the construction, there are two general types of upright drilling machine:

- (1) Round column section or pillar drilling machine.
- (2) Box column section.

The round column section upright drilling machine consists of a round column whereas the upright drilling machine has box column section. The other constructional features of both are same. Box column machines possess more machine strength and rigidity as compared to those having round section column.

Radial Drilling Machine

The radial drilling machine consists of a heavy, round vertical column supporting a horizontal arm that carries the drill head. Arm can be raised or lowered on the column and can also be swung around to any position over the work and can be locked in any position. The drill head containing mechanism for rotating and feeding the drill is mounted on a radial arm and can be moved horizontally on the guide-ways and clamped at any desired position. These adjustments of arm and drilling head permit the operator to locate the drill quickly over any point on the work. The table of radial drilling machine may also be rotated through 360 deg. The maximum size of hole that the machine can drill is not more than 50 mm. Powerful drive motors are geared directly. In-to the head of the machine and a wide range of power feeds are available as well as sensitive and geared manual feeds. The radial drilling machine is used primarily for drilling medium to large and heavy work pieces.

Depending on the different movements of horizontal arm, table and drill head, the upright drilling machine may be classified into following types-

1. Plain radial drilling machine
2. Semi universal drilling machine, and
3. Universal drilling machine.

In a **plain radial drilling machine**, provisions are made for following three movements -

1. Vertical movement of the arm on the column,
2. Horizontal movement of the drill head along the arm, and
3. Circular movement of the arm in horizontal plane about the vertical column.

In a **semi universal drilling machine**, in addition to the above three movements, the drill head can be swung about a horizontal axis perpendicular to the arm. In universal machine, an additional rotatory movement of the arm holding the drill head on a horizontal axis is also provided for enabling it to drill on a job at any angle.

Gang Drilling Machine

In gang drilling machine, a number of single spindle drilling machine columns are placed side by side on a common base and have a common worktable. A series of operation may be performed on the job by shifting the work from one position to the other on the worktable. This type of machine is mainly used for production work.

Multiple-Spindle Drilling Machine

The multiple-spindle drilling machine is used to drill a number of holes in a job simultaneously and to reproduce the same pattern of holes in a number of identical pieces in a mass production work. This machine has several spindles and all the spindles holding drills are fed into the work simultaneously. Feeding motion is usually obtained by raising the worktable.

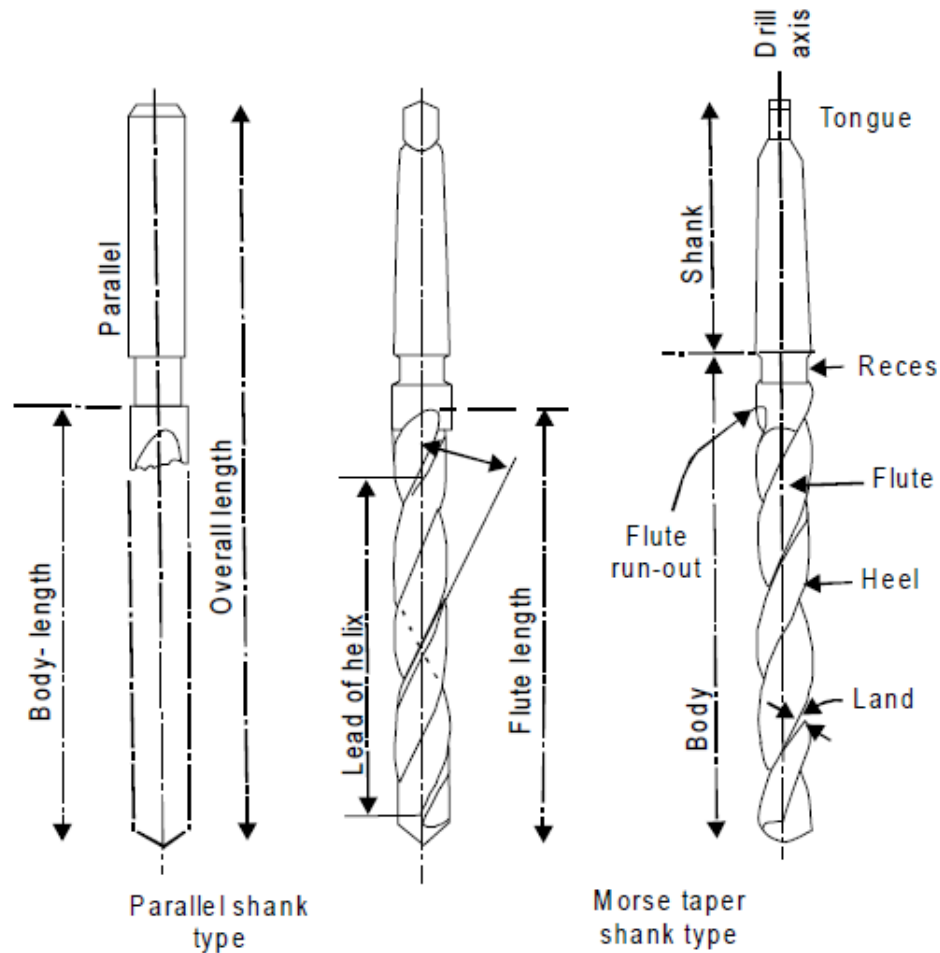
TYPES OF DRILLS

A drill is a multi - point cutting tool used to produce or enlarge a hole in the workpiece. It usually consists of two cutting edges set an angle with the axis. Broadly there are three types of drills:

1. Flat drill,
2. Straight-fluted drill, and
3. Twist drill

Flat drill is usually made from a piece of round steel which is forged to shape and ground to size, then hardened and tempered. The cutting angle is usually 90 deg. and the relief or clearance at the cutting edge is 3 to 8 deg. **The disadvantage** of this type of drill is that Each time the drill is ground the diameter is reduced.

Twist drill is the most common type of drill in use today. The various types of twist drills (parallel shank type and Morse taper shank -type) are shown in Fig....



Drill Material

Drills are made up of high speed steel. High speed steel is used for about 90 per cent of all twist drills. For metals more difficult to cut, HSS alloys of high cobalt series are used.

OPERATIONS PERFORMED ON DRILLING MACHINE

A drill machine is versatile machine tool. A number of operations can be performed on it. Some of the operations that can be performed on drilling machines are:

1. Drilling
2. Reaming
3. Boring
4. Counter boring
5. Countersinking
6. Spot facing
7. Tapping
8. Lapping
9. Grinding
10. Trepanning.

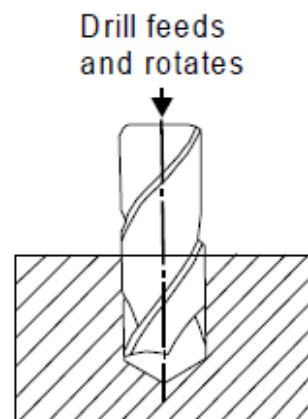
The operations that are commonly performed on drilling machines are drilling, reaming, lapping, boring, counter-boring, counter-sinking, Spot facing, and tapping.

Drilling

This is the operation of making a circular hole by removing a volume of metal from the job by a rotating, cutting tool called drill. Drilling removes solid metal from the job to produce a circular hole. Before drilling, the hole is located by drawing two lines at right angle and a center punch is used to make an indentation for the drill point at the center to help the drill in getting started. A suitable drill is held in the drill machine and the drill machine is adjusted to operate at the correct cutting speed. The drill machine is started and the drill starts rotating. Cutting fluid is made to flow liberally and the cut is started. The rotating drill is made to feed into the job. The hole, depending upon its length, may be drilled in one or more steps. After the drilling operation is complete, the drill is removed from the hole and the power is turned off.

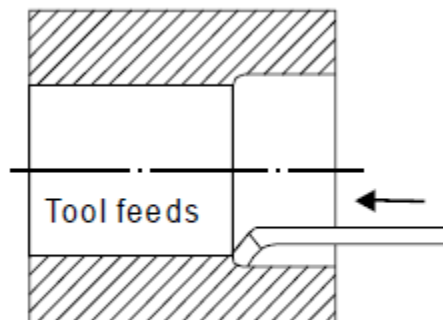
Boring

The boring operation is that where enlarging a hole by means of adjustable cutting tools with only one cutting edge is accomplished. A boring tool is employed for this purpose. Work stationary.



Work stationary

(Drilling)



Work rotates

(Boring)

