

DRILLING MACHINES

Definitions and introductions:

1. **Drilling:** It is an operation-producing hole in solid materials using drill- a rotating cutting tool.
2. **Drills:** these are the ends cutting tools designed for drilling. Mainly there are two types- flat drills and twist drills.
3. **Twist drills:** These are manufactured by twisting and grounding the tool longitudinally. These help not only for easy drilling but also to remove chips automatically during drilling. These are made from carbon steels and high-speed steels. The size of the drill is standardized. Mainly there are two types- straight or parallel shank twist drill and Tapered shank twist drill.
4. **Straight shank twist drill:** These are also used on portable hand or electric drilling machines. These are held in machines using a chuck and a key.
5. **Tapered shank twist drills:** these are used to drill holes from 3 to 100mm diameters. These could be directly inserted into the spindle of the machine by simple thrust with a soft tap.

Terminology:

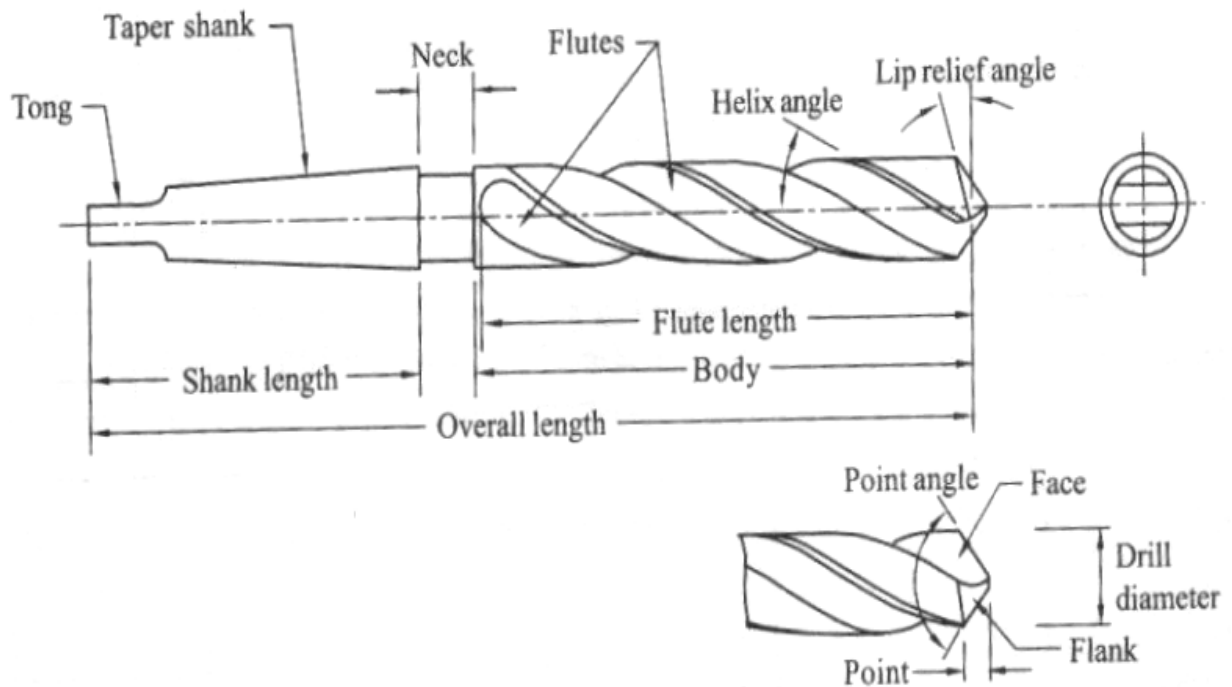


Fig. 10.4 Twist drill

Feed: It is the axial distance moved by the drill into the work piece during one revolution of the spindle. It is expressed in mm per revolution.

Cutting speed: it is the distance that a drill would roll for one minute at the given speed of the spindle. It is the speed of its circumference. It is expressed in m/min.

Classification for drilling machines:

Drilling machines are broadly classified as follows-

1. portable drilling machines
2. Sensitive drilling machines.
3. Up right drilling machines
4. Radial drilling machine.
5. Gang drilling machines.
6. Multiple drill head-drilling machines.
7. Automatic drilling machine.

Sensitive drilling machines:

Bench drilling machine:

Construction: it consists of a base, which is bolted on to a bench. It supports a column and other parts of the machine. A worktable is clamped to the down side of the column, so that it can slide up and down as well as radially about the column axis. A head carrying a driving motor and a V- belt drive unit of a stepped cone pulley is mounted on the upper side of the column. The driving mechanism consists of a sleeve. A vertical spindle is housed in it, which can be moved up and down with the help of a hand wheel. A drill chuck is fitted into the spindle.

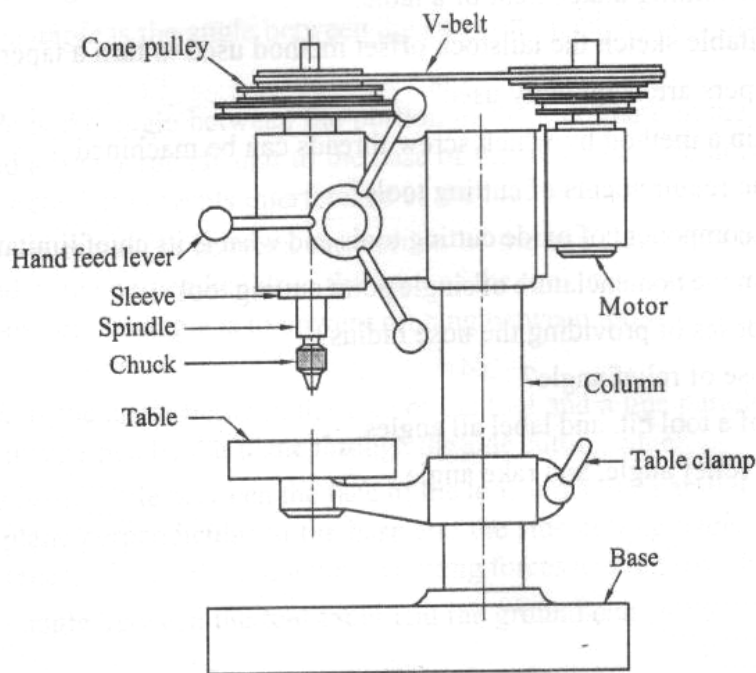


Fig. 10.1 Sensitive drilling machine

Operation: The hole location on the job is made with a center punch. It is then made deeper using a combined drill counter sink. It helps to guide the drill smoothly without any walk off the punch mark.

Suitable drill and coolant are selected for the specific job. The drill is fixed in the chuck using the key. The work piece is clamped on to the worktable over a wooden piece with a suitable fixture. It is raised and clamped at the required height, so that the drill can penetrate the job. The machine is started. The drill is slowly fed on to the center mark. Suitable pressure is applied on the job for the right feed. Feeling the cutting action, the operation should be completed. The drill is withdrawn carefully later.

Disadvantages:

1. A skilled worker is a must.
2. Only small size holes can be drilled.

Radial drilling machine

It is a heavy-duty precision machine, designed for universal movements of the arm with a tool head over a stationary work piece.

Construction: it consists of a large heavy base with a stationary worktable. A heavy cylindrical column is mounted over it. It support a heavy large radial arm which can be raised, lowered or swung around its axis to any position and clamps automatically in that position. It receives power from a motor, which is mounted over it.

It can slide vertically over the elevating screw. A drill head contains the sleeve and spindle unit. A gearbox is housed inside the drill head to obtain required feed and speed. These receive power from another motor, which is mounted over the head. The head can be moved horizontally over the arm on the guide ways and clamped at any desired position. A hand wheel helps in giving a manual or automatic down feed for drill. The operative switches are fixed over the head.

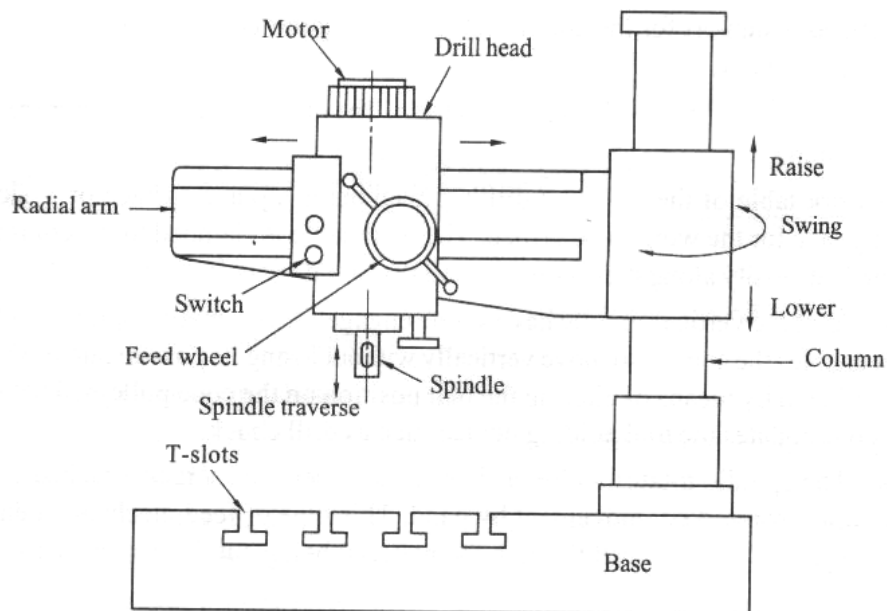


Fig. 10.3 Radial drilling machine

Operation: after locating the hole positions, the work piece is mounted on the worktable using suitable fixtures. Suitable drill and coolant are selected. The drill is fitted into the spindle. The tool head is brought over the work piece by swinging and moving the arm in the necessary up, down, left, or right directions.

The necessary feed and speed are given. The machine is started and drilling may then be performed as usual.

Advantages:

1. The universal movements of the tool head permit the drill tool located at any desired position over the stationary work piece.
2. Possible to work on odd shaped jobs and to drill larger diameter holes.
3. Accurate precision drilling is possible.

Drilling machine operations:

Reaming: It is a finishing operation of a predrilled hole using a reamer, which has multi longitudinal straight flutes. To obtain a smoothly finished accurate size hole, a slightly under size hole will be drilled first.

It is then finished with a reamer. In such a case the amount of material to be removed should not exceed 0.125mm.

Boring: it is an enlarging operation of a pre-drilled hole using a boring tool, which has a single cutting point. In order to produce a non-standard size hole the nearest size hole is drilled first using the standard drill. Later it can be enlarged using a boring tool.

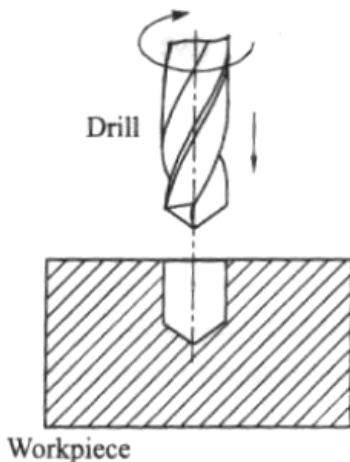


Fig. 10.5 Drilling

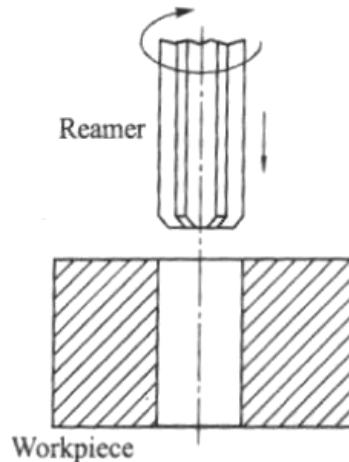


Fig. 10.6 Reaming

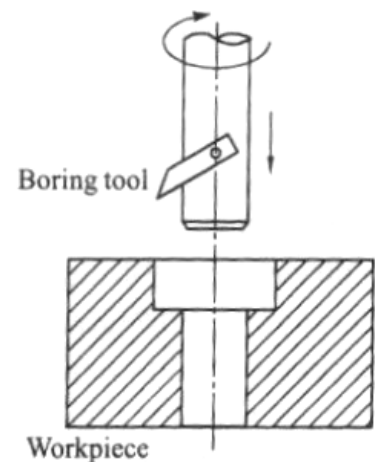


Fig. 10.7 Boring

Tapping: it is an internal thread generating operation in a predrilled hole, using a set of 3 taps, used one after the another in succession. To generate a specific size thread, a nearest drill size is calculated and drilled first. Then using standard size taps, slowly and gradually the threads are generated.

Counter sinking: it is an operation to produce a conical surface at the end of a predrilled hole, using a counter sink. A conical shaped cutting tool. The angle size of the hole depends on the angle size of the screw thread, whichever is to be seated in it. A countersink hole avoids unwanted projection over the top surface of the work piece. E.g. furniture, joints in doors, windows etc.

Counter boring: it is an operation to enlarge one end of the pre drilled hole concentrically to the required depth, using a counter bore tool, to form a square shoulder. The counter bore is used to drive in the socket head screw, bolts, bolts, and pins etc. the pilot of the tool helps to maintain concentricity with the original hole. It is replaceable depending on the required size.

Spot facing: it is an operation to produce a smooth flat seating at the top of the hole surface for bolt heads, washers, nuts etc. it may be done using counter bores or special spot facing tools.

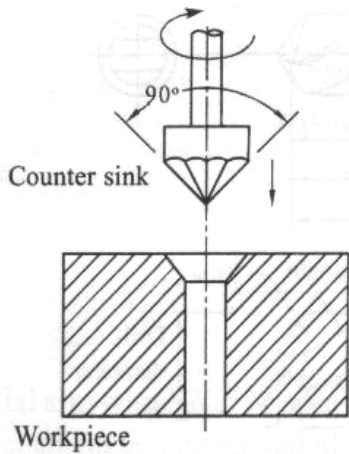


Fig. 10.8 Counter sinking

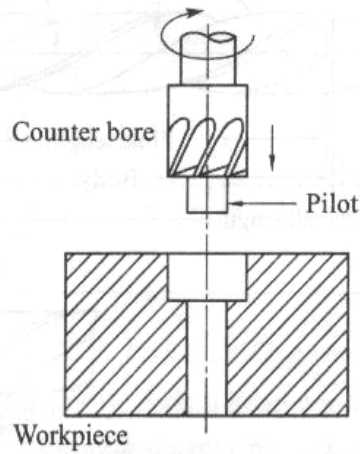


Fig. 10.9 Counter boring

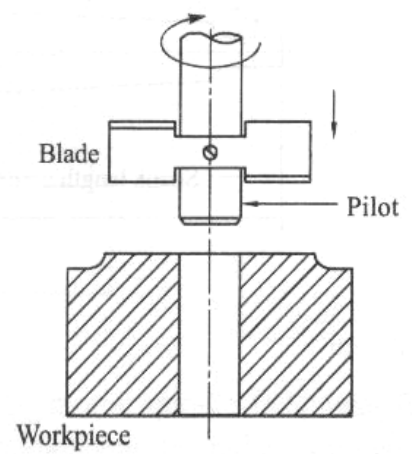


Fig. 10.10 Spot facing

Specification of drilling machines:

1. The maximum diameter of the drill that can be used in that machine.
2. The maximum size of the work piece that can be worked on in that machine.
3. Size of the working table.
4. Number of spindles in that machine.
5. Power capacity of the machine.
6. For radial drilling machines, diameter of the column and the length of the arm have to be specified.