Drilling, Shaping, planning & Grinding Machines Fundamentals
Drilling Machine Fundamentals
Drilling is a machine operation used to create a round hole in a work-part.

Notice the difference between *Boring* and *Drilling*.

*Boring* is used to enlarge an existing hole.

Drilling is performed with a rotating cylindrical tool (called a *drill* or *drill bit*) that has two cutting edges on its working end.

Two types of holes may be generated, Fig. 1.
Figure 1: Two hole types

Through Hole

Blind Hole

Drilling - An Introduction
Several operations are related to drilling. Most of the operations follow drilling; a hole must be made first by drilling and then followed by one of the other operations.

All of the operations use rotating tools.
Operations Related to Drilling

a) Reaming. It is used to slightly enlarge a hole, to provide a better tolerance on its diameter, and to improve its surface finish. The tool is called *reamer* and it usually has straight flutes.

b) Tapping. This operation is performed by a *tap* and is used to provide internal screw threads on an existing hole.
c) **Counterboring.** It provides a stepped hole, in which a larger diameter follow a smaller diameter partially in the hole. It is used to seat bolt heads into a hole so the head do not protrude above the surface.

d) **Countersinking.** It is similar to counterboring, except that the step in hole cone-shaped for flat head screws and bolts.
**Operations Related to Drilling**

e) *Center Drilling or Centering.* This operation drills a starting hole to accurately establish its location for subsequent drilling.

f) *Spot Drilling.* It is similar to milling. It is used to provide a flat machined surface on the workpart in a localized area.
Types of Drill Presses

- Upright Drill
- Bench Drill
- Radial Drill
- Gang Drill
- Multiple Spindles Drill
- Numerical Control Drill Press
Types of Drill Presses

Upright Drill Press

- Head (power)
- Column
- Adjustable head
- Spindle
- Table
- Base

Feed change lever
Speed change lever
Spindle
Column
Base
Types of Drill Presses

Radial Drill Press
Work Holding On Drill Presses

- **Vise.** A device possessing two jaws that grasp the work in position.

- **Fixture.** A device that is designed for a particular workpiece (higher accuracy in positioning the part relative to the machining operation, faster production rates)

- **Jig.** A device similar to the fixture but the jig provides a means of guiding the tool during the drilling operation.
Both cutting motion (CM) and feed motion (FM) comes from the rotation and linear movement of the tool respectively.
Shaping & Planning Machines Fundamentals
Shaping & Planning Machines

• Shaping and planning are similar operations.

• Cutting tools used in both operations are single-edge cutting tools to create a straight and flat surface.

• Interrupted cutting occurs in them, subjecting the tool to an impact loading upon entry into the work.

• These machines are limited to low speeds due to their start-and-stop motion.

• High-speed steel cutting tools are recommended.
Shaping Machine

Relative Motions in Shaping Operations
What are the cutting and feed motions of it?

Cutting motion is the table (workpiece)

Feed motions is the tool
Relative Motions in Shaping & Planning Machines

Note the main differences between shaping and planning machines.
Grinding Machine Fundamentals
Grinding Machine (Surface Grinding)
Grinding Machine
Grinding Operations

Applications:
- For better surface finishing
- Better accuracy or close tolerances
- For hardened materials
- Very little metal removal

Cutters:
- Grinding wheels

Machines:
- Surface grinding machines (for flat or formed profiles)
- Cylindrical Grinding machines
- Universal grinding machines