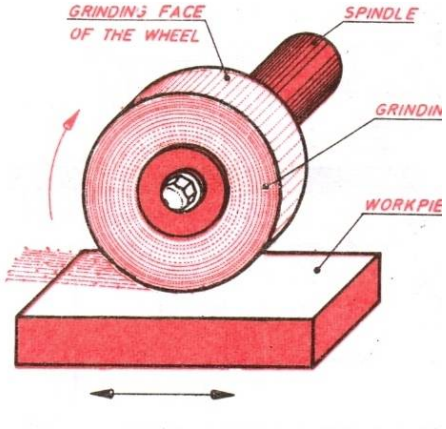
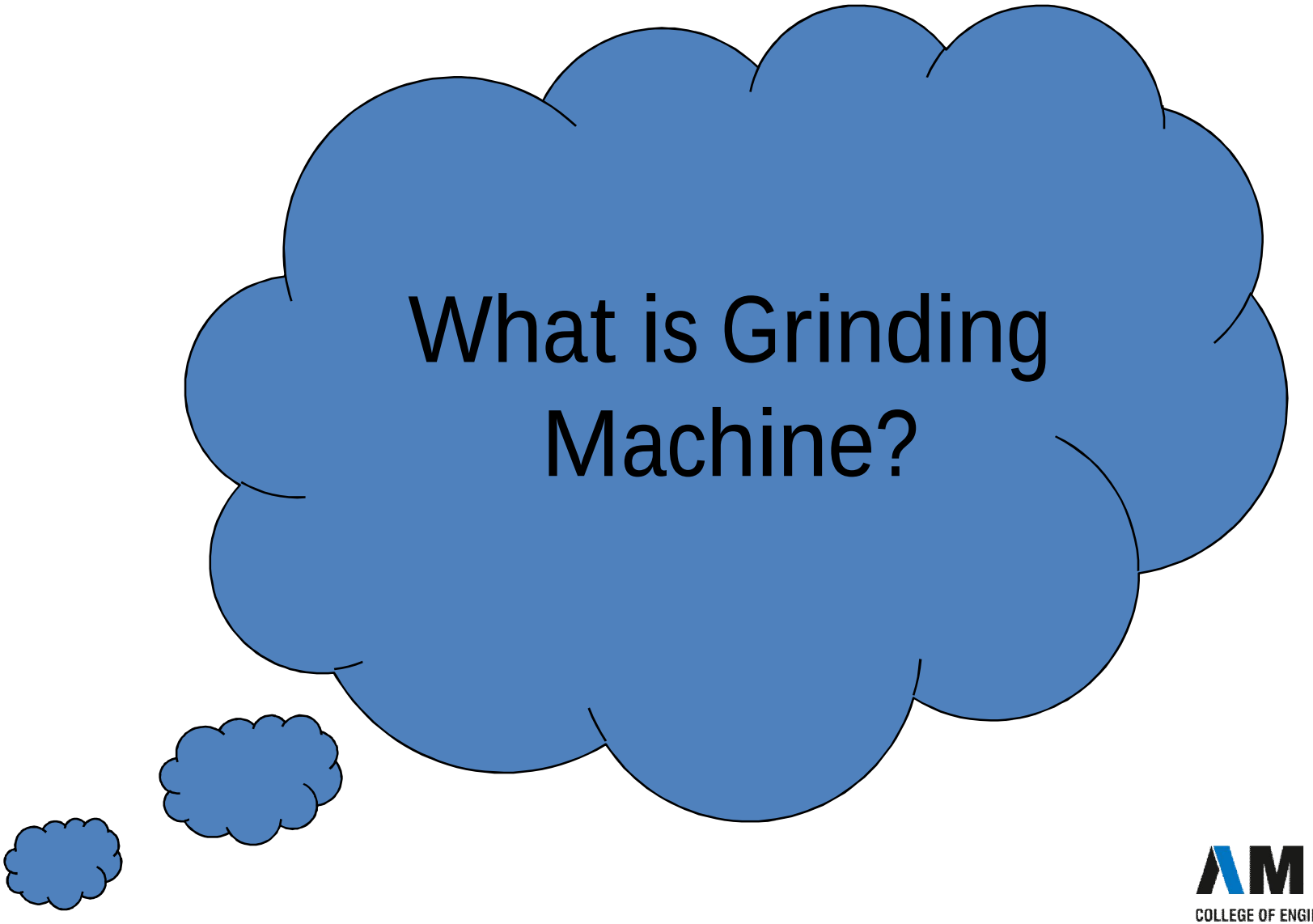
AMIRAJ

COLLEGE OF ENGINEERING & TECHNOLOGY

Ch-8
Grinding Machine & Abrasives



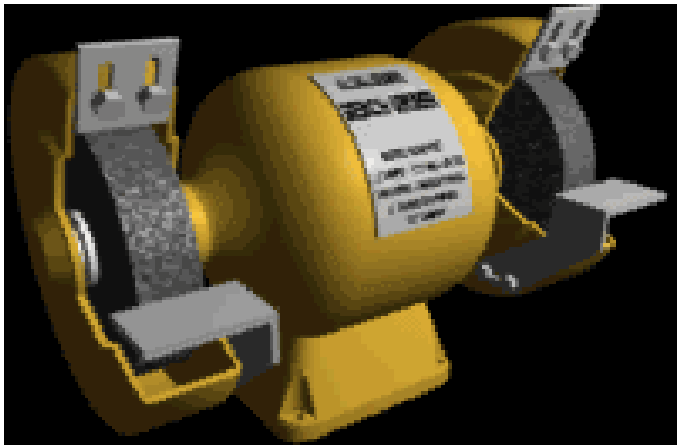
Subject:- MP **Code:-3141908**	**Prepared by:** **Asst.Prof.Harin Prajapati** **(Mechanical Department,ACET)**	AMIRAJ COLLEGE OF ENGINEERING & TECHNOLOGY

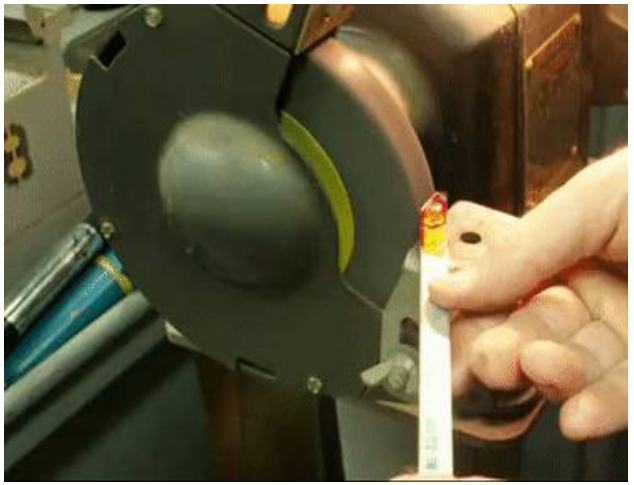


AMIRAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

GRINDING MACHINES

- Grinding Machines are also regarded as machine tools. A distinguishing feature of grinding machines is the rotating abrasive tool.
- Grinding machine is employed to obtain high accuracy along with very high class of surface finish on the work-piece.

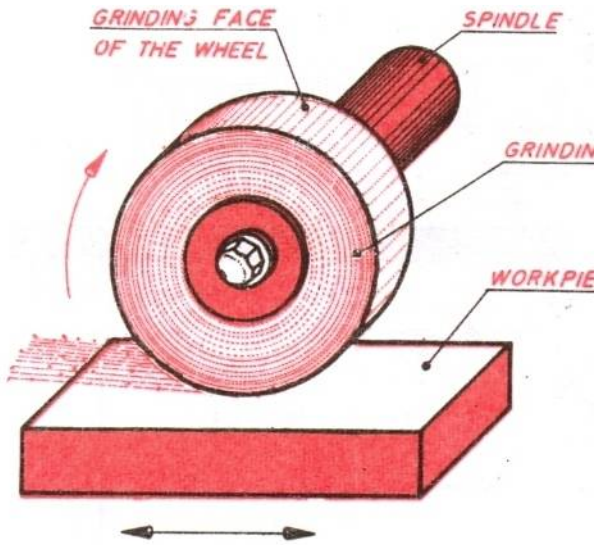




AMIRAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

Principle of grinding machines

- Work piece is fed against the rotating abrasive wheel.
- Due to action of rubbing or friction between the abrasive particles and work piece material is removed.



AMIRAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

Classification Of Grinding Machine

- Conventional grinding machines can be broadly classified as:

(a) Surface grinding machine

(i) Horizontal spindle and reciprocating table
(ii) Vertical spindle and reciprocating table
(iii) Horizontal spindle and rotary table
(iv) Vertical spindle and rotary table

(b) Cylindrical grinding machine

(i) Plain centre type cylindrical grinder
(ii) Universal cylindrical surface grinder

(c) Internal grinding machine

(i) Chucking type internal grinder
(ii) Planetary internal grinder
(iii) Centreless internal grinder

(d) Tool and cutter grinding machine

(a) Surface grinding machine:

- Basically there are four different types of surface grinding machines characterized by the movement of their tables and the orientation of grinding wheel spindles as follows:

  (i) Horizontal spindle and reciprocating table
  (ii) Vertical spindle and reciprocating table
  (iii) Horizontal spindle and rotary table
  (iv) Vertical spindle and rotary table

(i) Horizontal spindle and reciprocating table

- Figure 1 illustrates this machine with various motions required for grinding action. A disc type grinding wheel performs the grinding action with its peripheral surface.

A: rotation of grinding wheel

B: reciprocation of worktable

C: transverse feed

D: down feed

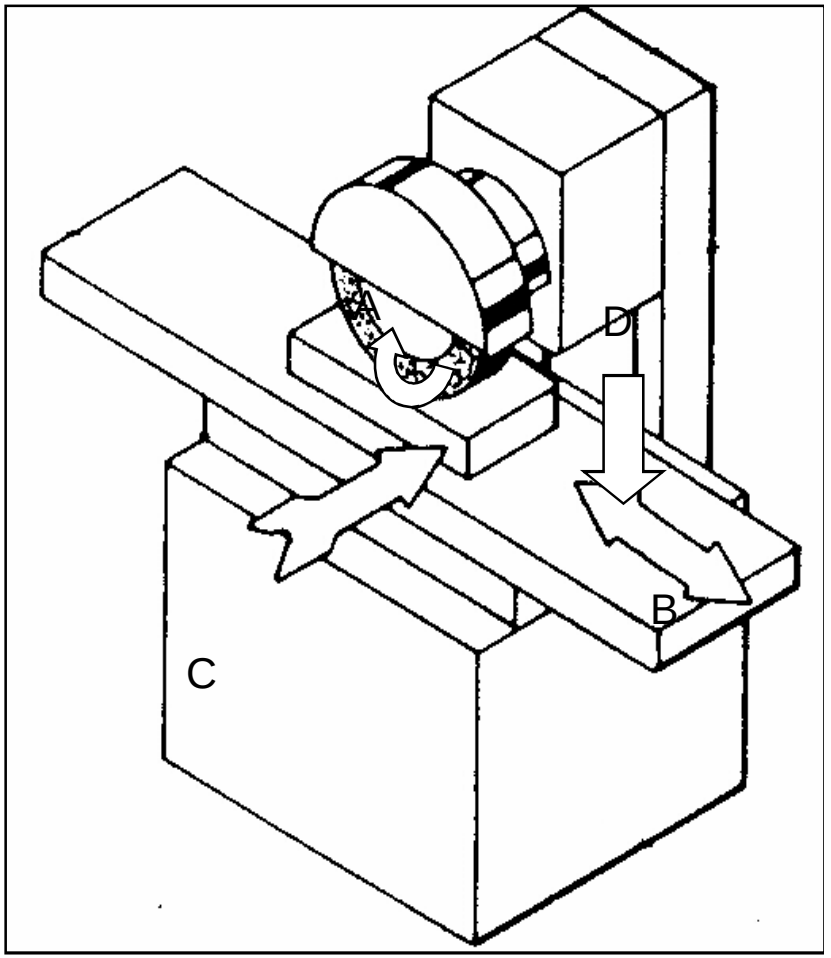


Fig.1 Horizontal spindle reciprocating table surface grinder

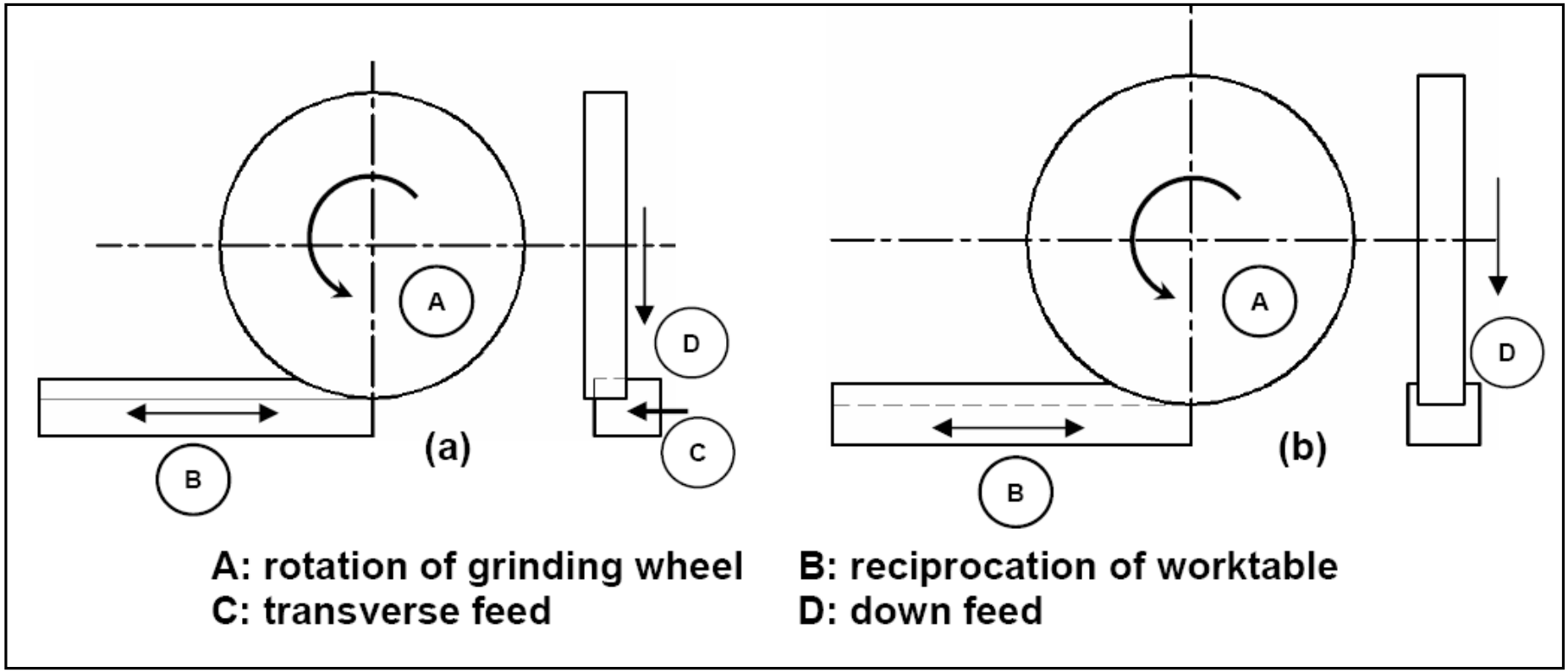


Fig.2 Surface grinding (a) traverse grinding (b) plunge grinding

➢Both traverse and plunge grinding can be carried out in this machine as shown in Fig. 2

(ii) Vertical spindle reciprocating table grinder

- This grinding machine with all working motions is shown in Fig. 3. The grinding operation is similar to that of face milling on a vertical milling machine.

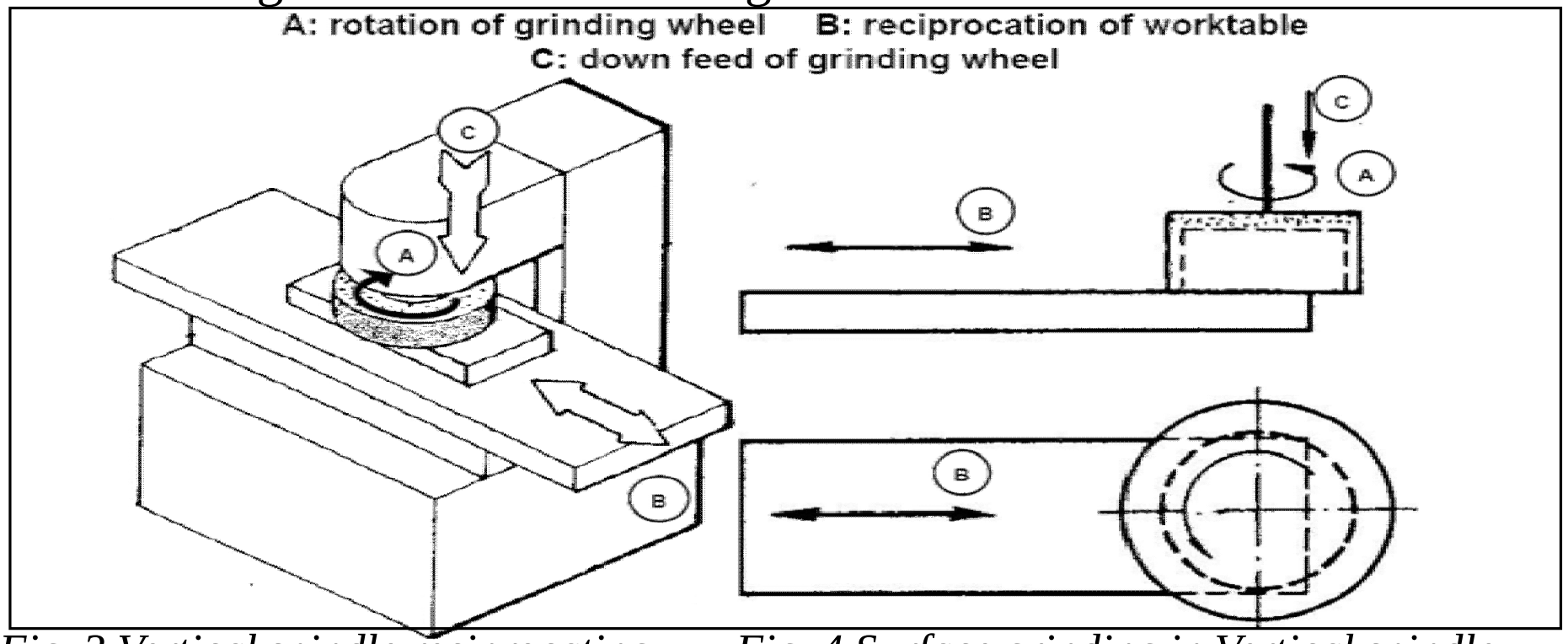


Fig. 3 Vertical spindle reciprocating table surface grinder

Fig. 4 Surface grinding in Vertical spindle reciprocating table surface grinder

(iii) Horizontal spindle rotary table grinder

- Surface grinding in this machine is shown in Fig. 5. In principle the operation is same as that for facing on the lathe.

- This machine has a limitation in accommodation of workpiece and therefore does not have wide spread use.

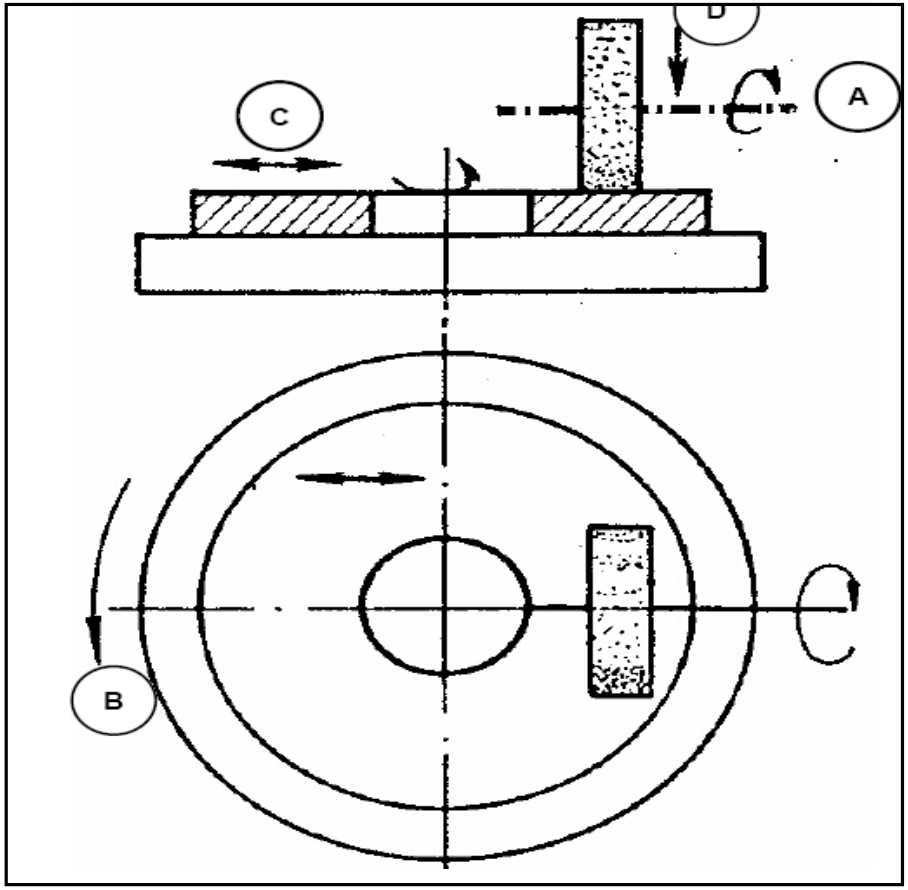


Fig. 5 Horizontal spindle rotary table grinder

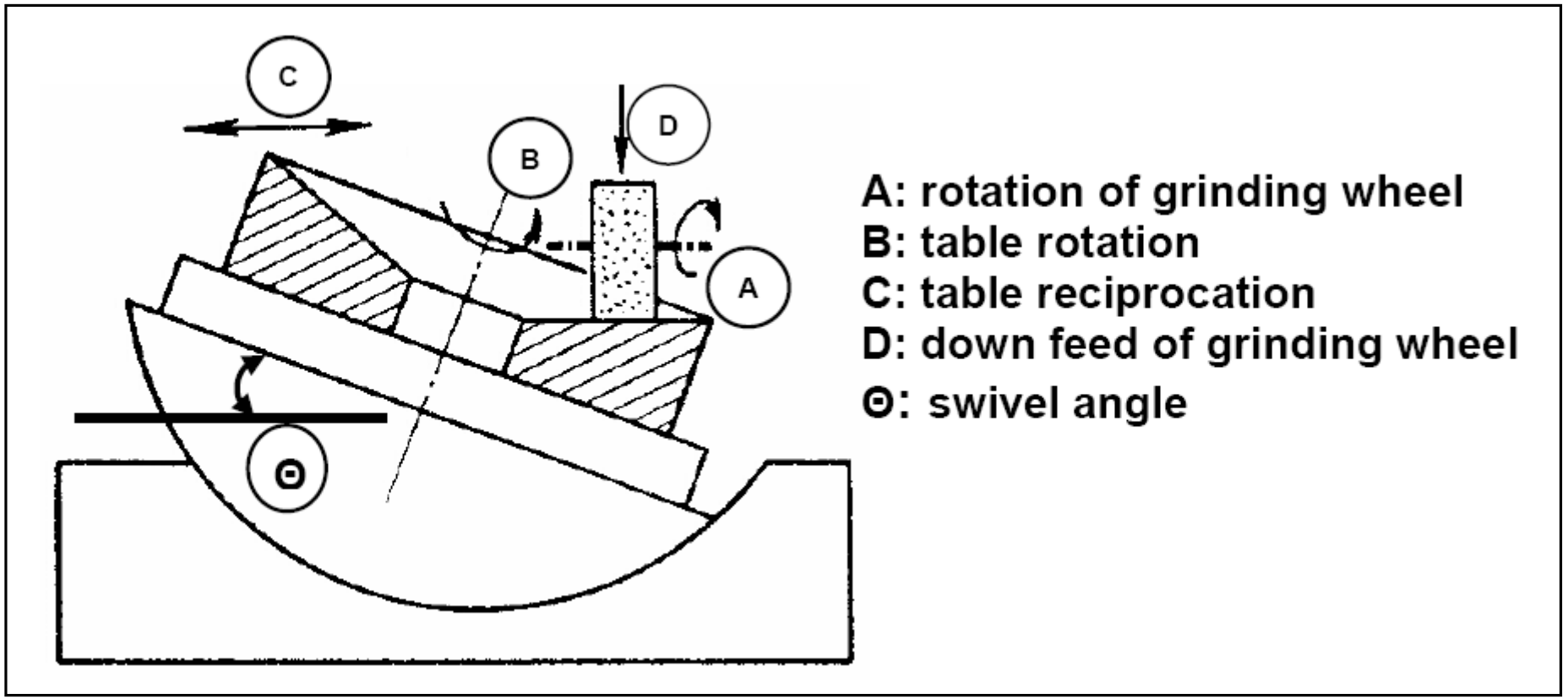
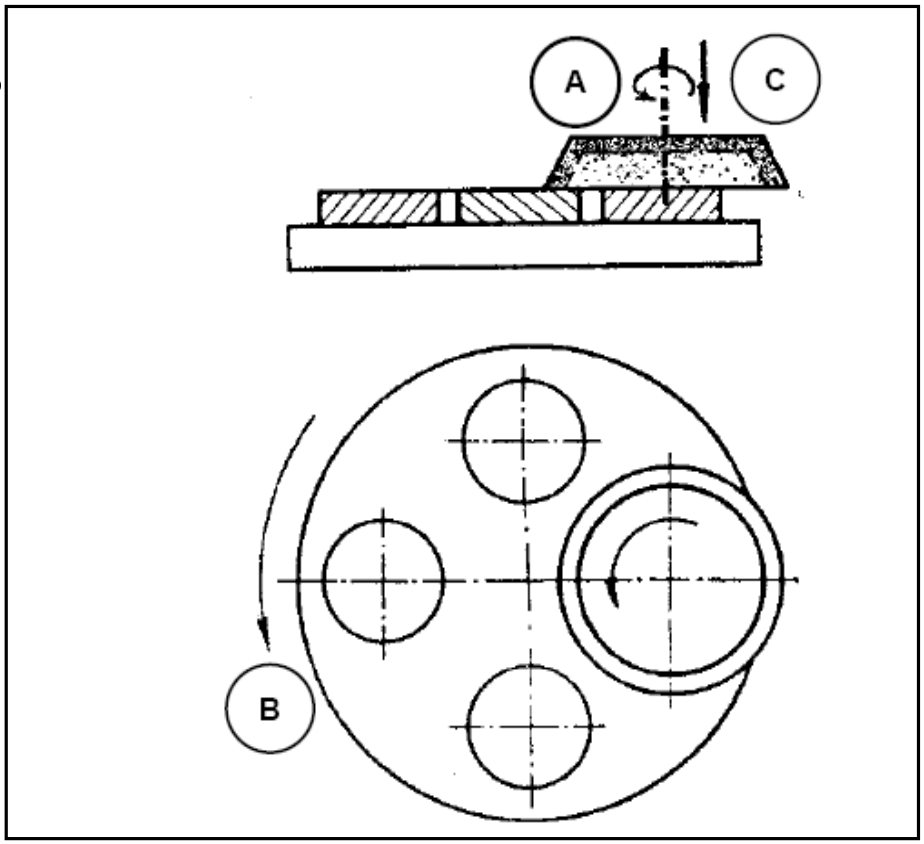


Fig. 6 *Grinding of a tapered surface in horizontal spindle rotary table surface grinder*

➢However, by swivelling the worktable, concave or convex or tapered surface can be produced on individual part as illustrated in Fig. 6.

(iv) Vertical spindle rotary table grinder

- The principle of grinding in this machine is shown in Fig. 7.
- The machine is mostly suitable for small workpieces in large quantities.
- This primarily production type machine often uses two or more grinding heads thus enabling both roughing and finishing in one rotation of the work table.



A: rotation of grinding wheel B: work table rotation C: down feed of grinding wheel

Fig. 7 Surface grinding in vertical spindle rotary table surface grinder

(b) Cylindrical grinding machine

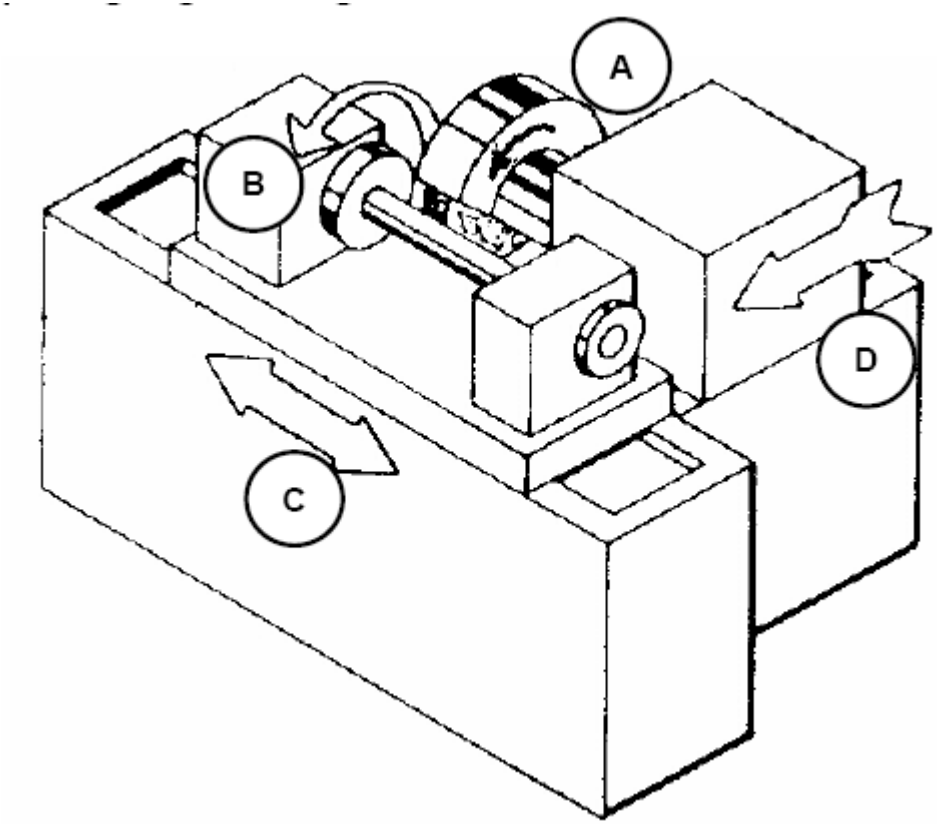
- This machine is used to produce external cylindrical surface. The surfaces may be straight, tapered, steps or profiled. Broadly there are two different types of cylindrical grinding machine as follows:

  (i) Plain centre type cylindrical grinder

  (ii) Universal cylindrical surface grinder

(i) Plain centre type cylindrical grinder

- Figure. 8 illustrates schematically this machine and various motions required for grinding action.
- The machine is similar to a centre lathe in many respects.
- The workpiece is held between head stock and tailstock centers .
- A disc type grinding wheel performs the grinding action with its peripheral surface.

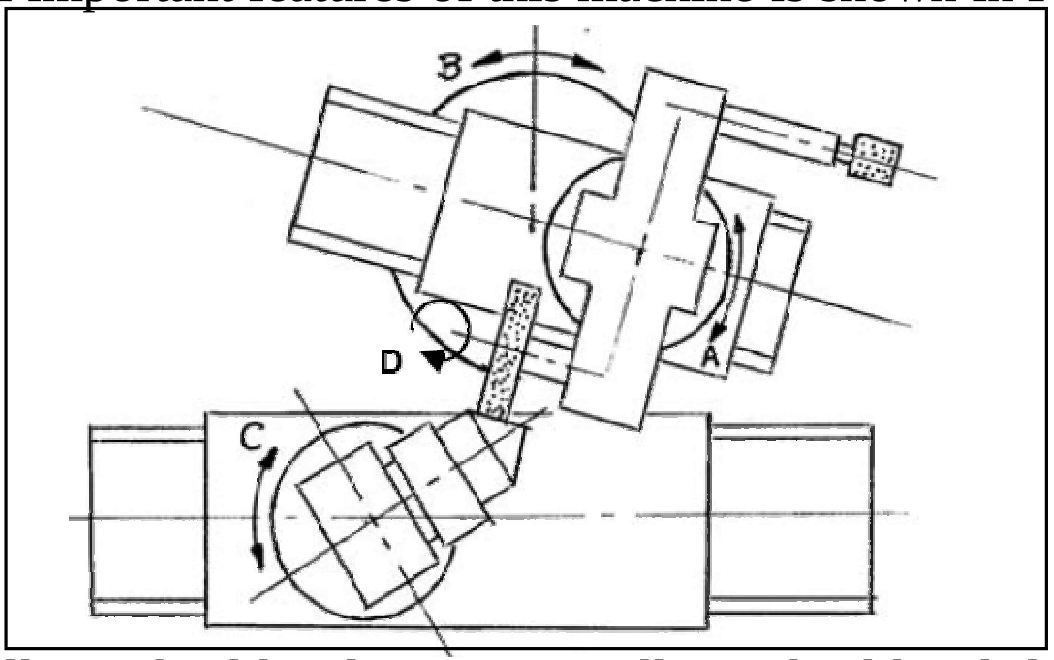


A: rotation of grinding wheel B: work table rotation C: reciprocation of worktable D: in feed

Fig. 8 *Plain centre type cylindrical grinder*

(ii) Universal cylindrical surface grinder

- This allows grinding of any taper on the workpiece. Universal grinder is also equipped with an additional head for internal grinding. Schematic illustration of important features of this machine is shown in Fig. 9.



A: swivelling wheel head B: swivelling wheel head slide

C: swivelling head stock D: rotation of grinding wheel

Fig. 9 universal cylindrical grinding machine

(c) Internal grinding machine

- This machine is used to produce internal cylindrical surface. The surface may be straight, tapered, grooved or profiled.
- Broadly there are three different types of internal grinding machine as follows:

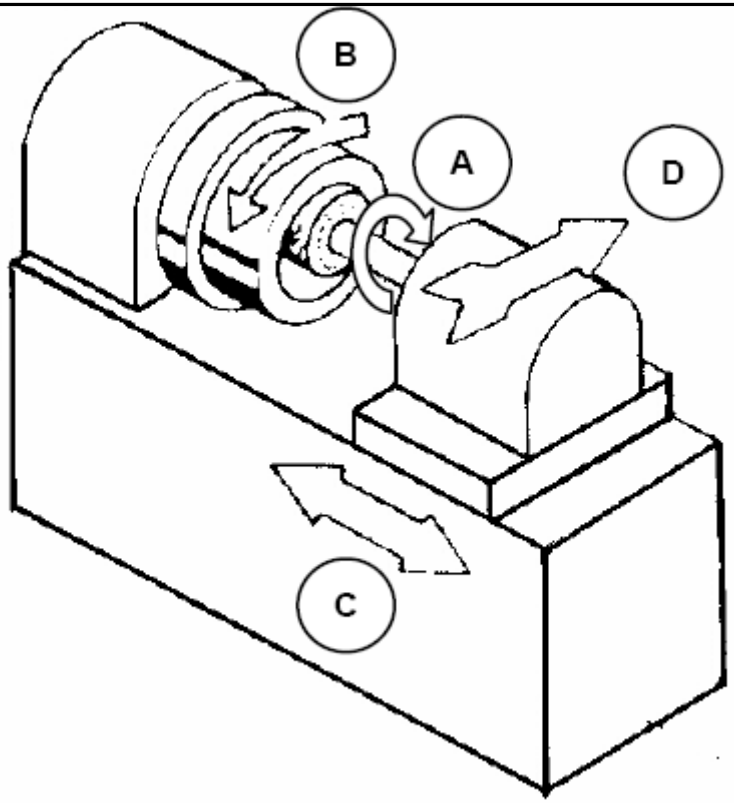
(i) Chucking type internal grinder

(ii) Planetary internal grinder

(iii) Centreless internal grinder

(i) Chucking type internal grinder

- Figure.10 Illustrates schematically this machine and various motions required for grinding action. The workpiece is usually mounted in a chuck. A magnetic face plate can also be used. A small grinding wheel performs the necessary grinding with its peripheral surface.



A: rotation of grinding wheel B: workpiece rotation

C: reciprocation of worktable D: infeed

Fig. 10 Internal centerless grinder

(ii) Planetary internal grinder

- Planetary internal grinder is used where the workpiece is of irregular shape and can not be rotated conveniently as shown in Fig.11. In this machine the workpiece does not rotate. Instead, the grinding wheel orbits the axis of the hole in the workpiece.

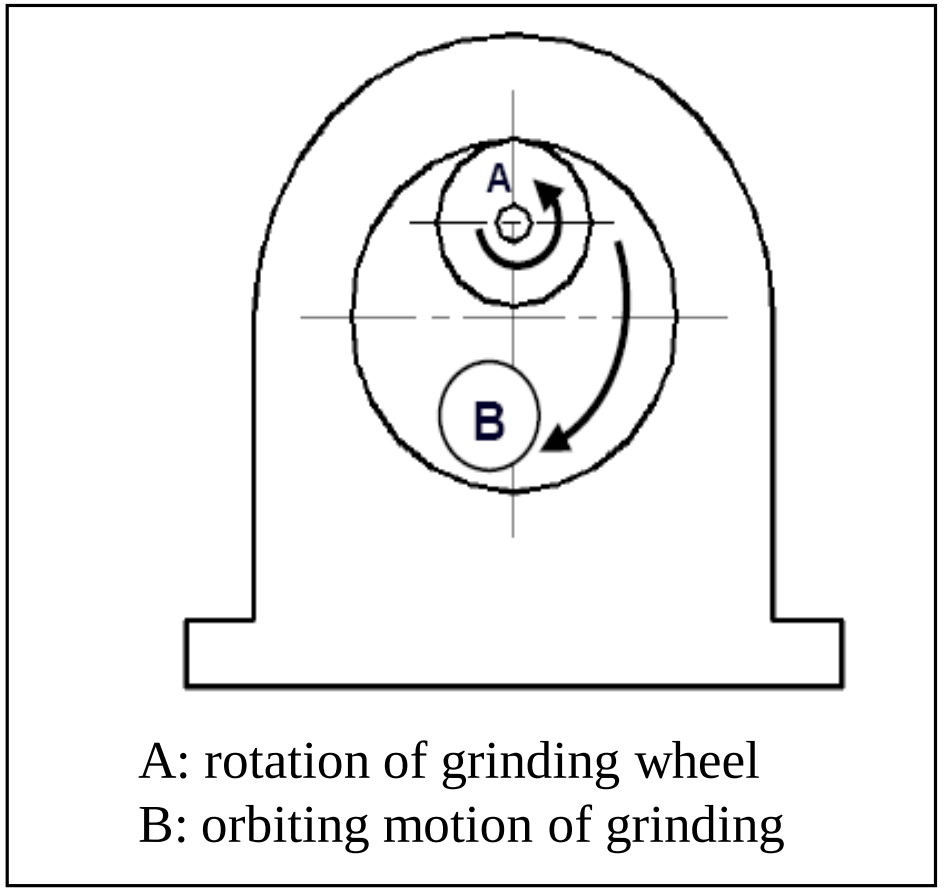
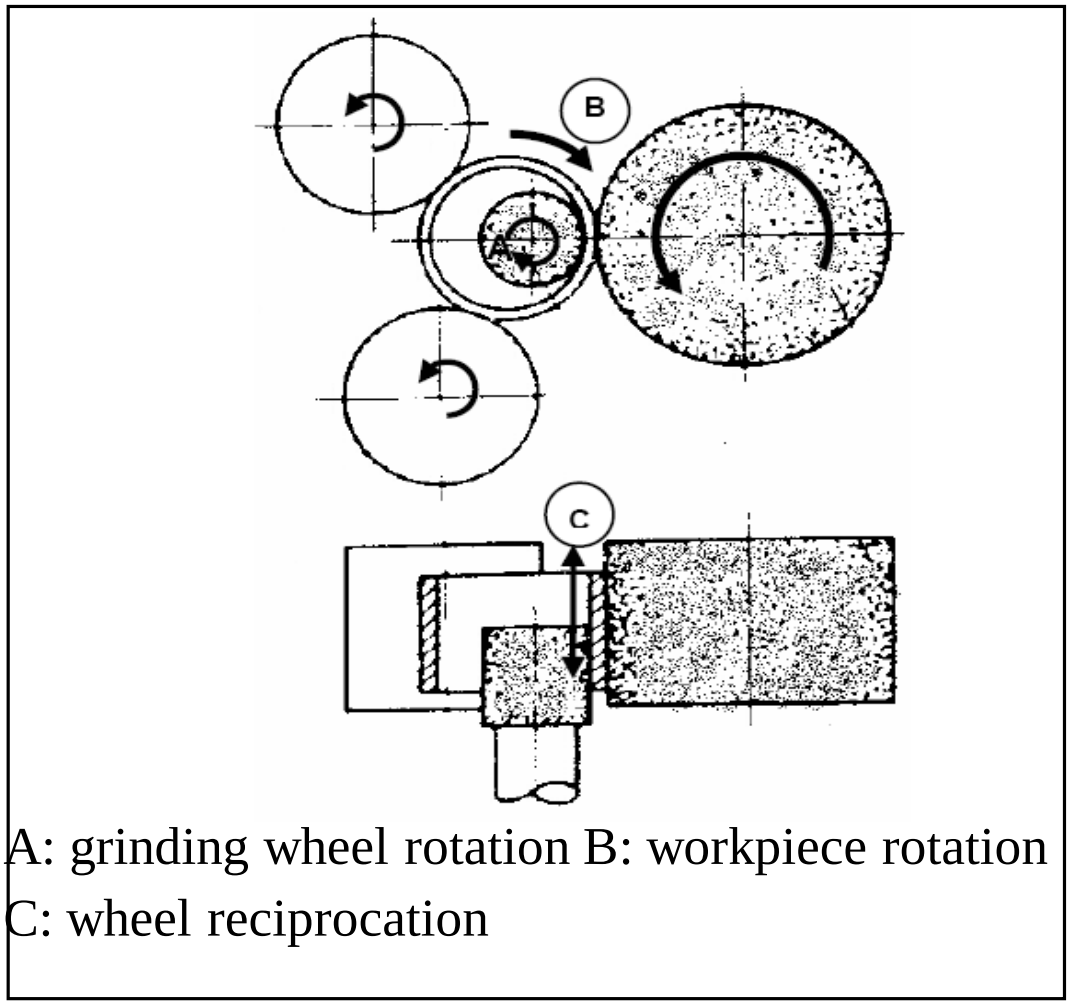


Fig. 11 Internal grinding in planetary grinder

(iii) Centreless internal grinder

- This machine is used for grinding cylindrical and tapered holes in cylindrical parts (e.g. cylindrical liners, various bushings etc). The workpiece is rotated between supporting roll, pressure roll and regulating wheel and is ground by the grinding wheel as illustrated in Fig. 12



Fig, 12 Internal centreless grinding

(d) Tool and cutter grinder machine

- Tool grinding may be divided into two subgroups: tool manufacturing and tool resharpening.

Fig. 13 universal tool and cutter grinder

Abrasives

- Abrasive is the material employed for sharpening, grinding and polishing operations.
- Natural abrasive – emery, corundum, quartz, sandstone, diamond, etc.
- Artificial abrasive – carborundum, aloxite, alundum, etc.

Applications of Abrasives

- Corundum : is a natural mineral which consists of aluminum oxide. Hardest natural substance after diamond.
  - Used for shaping, finishing and polishing other tools.
- Emery : natural abrasive consisting of aluminium oxide and little amount of iron oxide.
- Silicon carbide : synthetic abrasive harder than aluminium oxide.
  - Used to grind metals like iron, brass and soft bronze.
  - Used in non metals like wood and leather industries.

Applications of abrasives

- Zirconia aluminia : it is a mixture of zirconium oxide and aluminium oxide.
  - Used in casting and foundry industries.
- Cubic boron nitride : is made up of boron nitride with a cubic crystalline structure.
  - Used for hard coating material.
- Diamond :

Bonding materials

- These are adhesives which holds the abrasive grains together.
  - Vitrified process
  - Silicate process
  - Elastic process
  - Rubber or vulcanite process

AMIRAJ

COLLEGE OF ENGINEERING & TECHNOLOGY