

Unit - IV

ABRASIVE PROCESS AND BROACHING

①

Introduction:-

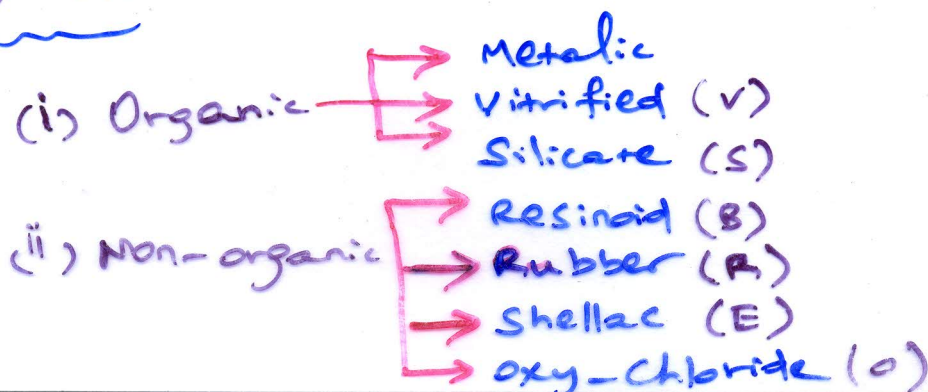
- * Grinding
- * Self-sharpening of grinding wheel.
- * for what purpose?

Types of Abrasives:-

- (i) natural Abrasives (ii) Artificial Abrasives.
- (a) Sand Stone (a) Aluminium oxide
- (b) Emery (b) Silicon Carbide
- (c) Corundum (c) Artificial Diamond
- (d) Diamond (d) Boron Carbide

Types of bond:-

- * Adhesive substance used to hold abrasive grains together to form the grinding wheel.
- * Sufficiently strong to withstand stresses.
- * Their choice - Grinding speed, cutting pressure, heat formation etc.
- * Types:-



Grit (or) Grain Size:-

(2)

- Indicates the size of the abrasive grains (or) size of the cutting teeth of the grinding wheel.
- Denoted by the number indicating the number of meshes per linear inch (25.4mm) of the sieve through which the grains can pass through.
- Larger is the grit number, smaller will be the Grit (or) Grain size (or) vice-versa.

Grinding operation	Grit (or) Grain Size						
	10	12	14	16	20	24	
Coarse							
Medium	30	36	46	54	60		
Fine	80	100	120	150	180		
Very fine	220	240	280	320	400	500	600

Grade:-

- Grade (or) Hardness indicates the strength with which the bonding material holds the abrasive grains in the grinding wheel.

Soft	A	B	C	D	E	F	G	H		
Medium	I	J	K	L	M	N	O	P		
Hard	Q	R	S	T	U	V	W	X	Y	Z

STRUCTURE OF WHEELS!

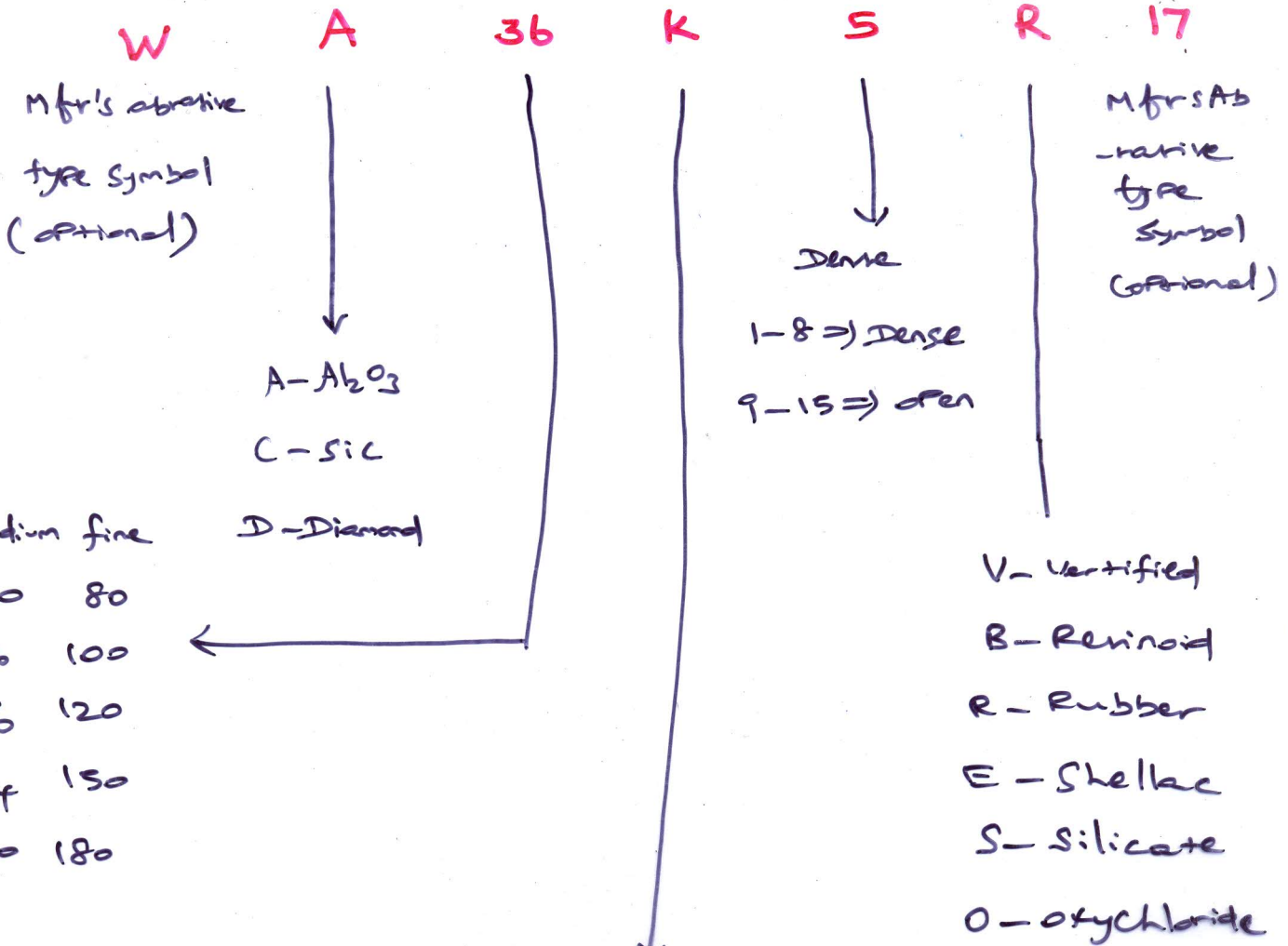
(3)

* Denotes the spacing b/w abrasive grains (or) the density of the wheel.

Structure	Symbol							
Dense	1	2	3	4	5	6	7	8
Open	9	10	11	12	13	14	15	or more

Designation of Grinding wheel!

Sequence ⇒ Prefix Abrasive Grain Grade Structure Bond Suffix



Coarse	medium	fine
10	30	80
12	36	100
14	46	120
16	54	150
20	60	180
24		

Grade } A-H ⇒ soft; I-P ⇒ medium; Q-Z - Hard
 scale }

Selection of Grinding wheel:-

(4)

* Quick stock removal, high-class surface finish, close dimensional tolerances.

* Parameters (1) Constant factors
(2) Variable factors.

Constant factors:-

- (1) Physical properties of the material to be ground
- (2) Amount and rate of stock to be removed
- (3) Area of contact
- (4) Type of Grinding wheel.

Variable factors:-

- (1) Work speed (2) wheel speed
- (3) condition of the grinding wheel (4) Personal factors.

Reconditioning of Grinding wheel:-

* wear } ⇒ wheel loses its cutting capacity
Loading }
Glazing }

* Avoid ⇒ Dressing, Truing.

SHAPES OF GRINDING WHEEL:-

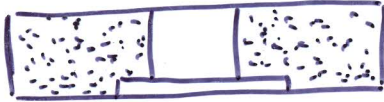
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(i) Straight



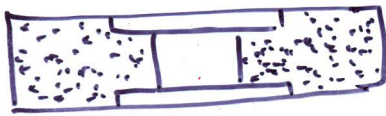
(ii) Straight cup



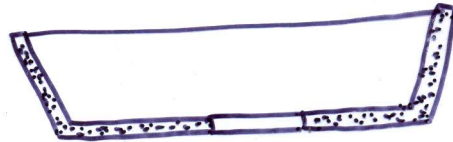
(iii) Recessed on one side



(iv) Cylindrical



(v) Recessed on both sides



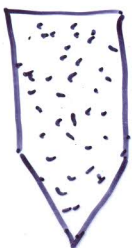
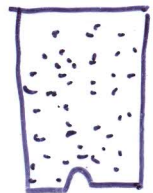
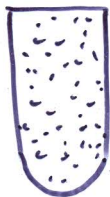
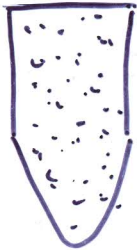
(vi) Flaring cup



(vii) Tapered



(viii) SAUCER type.



Standard Shapes of Straight Grinding wheel faces

Glazing of Grinding wheel:-

(6)

* Glazing of wheel is a condition in which the face of the grinding wheel takes a glass-like appearance. That is, the cutting points of the abrasives have become dull & smooth due to its wear.

* Continued work with the glazed wheel increases the smoothness of the face & decreases its cutting capacity.

* Glazing of wheel takes place when a wheel

① is too hard

② revolves at high speed.

* Remedy for Glazing is to

① to give optimum speed for the wheel.

② to use a softer wheel.

Loading of the Grinding wheel:-

* The grinding wheel may become loaded if the particles of the metal being ground will adhere to the face of the grinding wheel & fill up the pores of the wheel face. The adhered particles of the metal being ground with the face of the

Grinding wheel Prevent the Grinding wheel to cut freely.

* Loading may be caused by

(7)

(1) Grinding softer material

(2) using a wheel of too hard a bond and running it too slowly

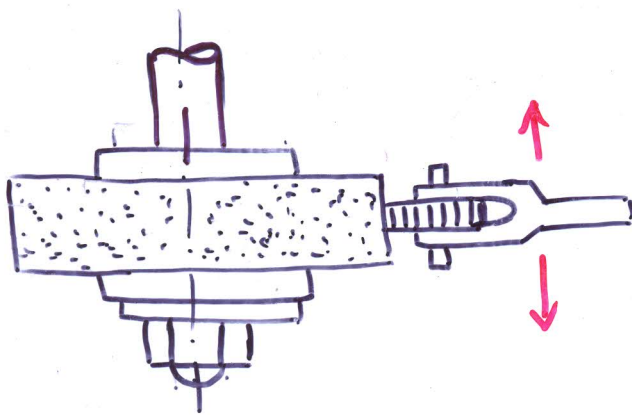
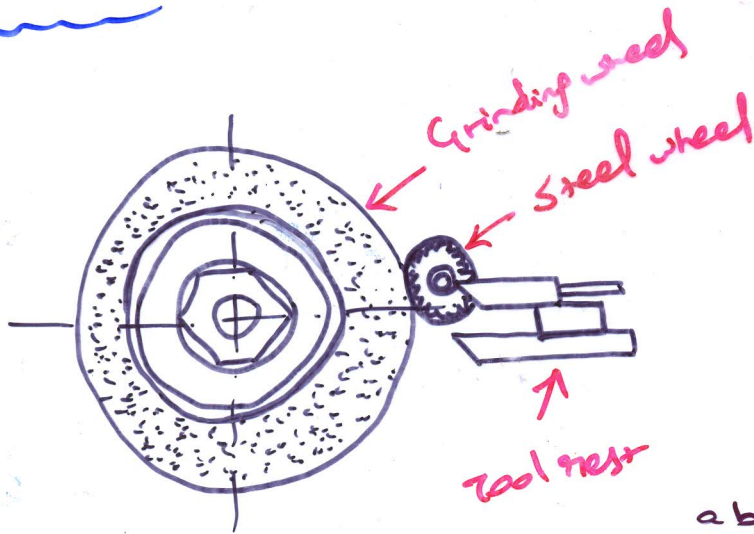
(3) taking cuts that are too deep & by not using the right cutting fluid.

* The remedy for loading is

(1) to run the wheel at optimum speed

(2) to use a softer wheel.

Dressing:-



⑧

* Process of removing loaded particles and breaking away the glazed surface by the tool called

"dresser" so that the abrasive particles are again presented to the work surface.

Tool types

- Star dressing tool
- Round abrasive stick
- Diamond dressing tool.

Truing:-

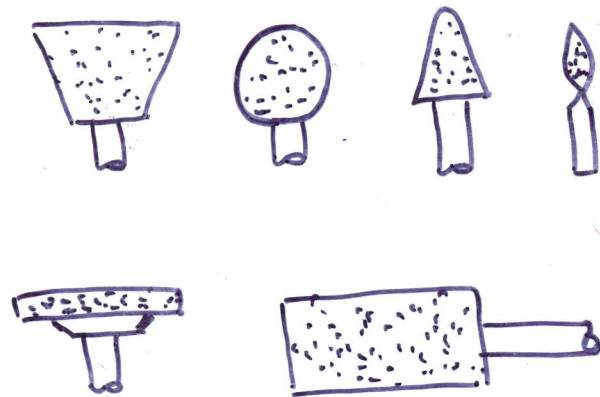
* Truing is the process of changing the shape of the grinding wheel as it becomes worn from an original shape owing to the breaking away of the abrasive particles & bond.

* This is done to make the wheel rotate true with its axis.

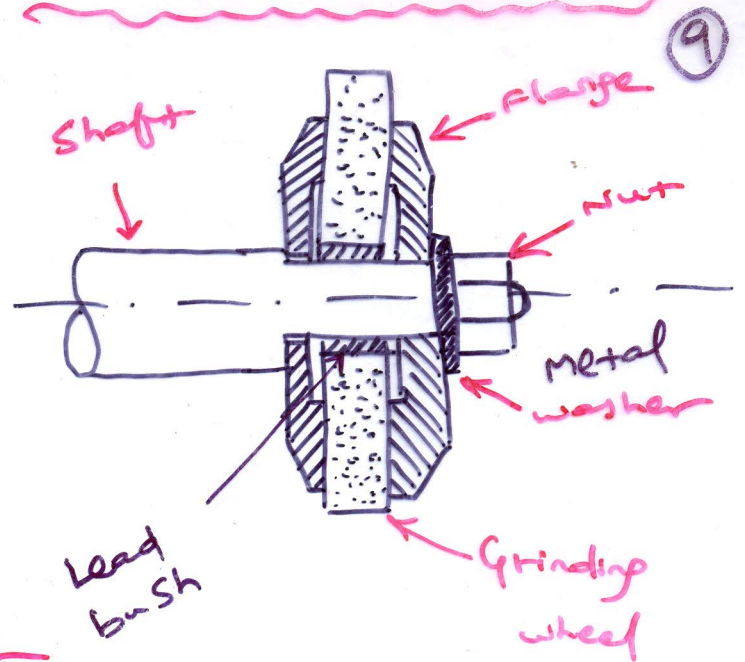
* It is also done to change the face contour for form grinding.

* Truing & dressing are done with the same tools but not for the same purpose.

Mounted wheels & Points:-

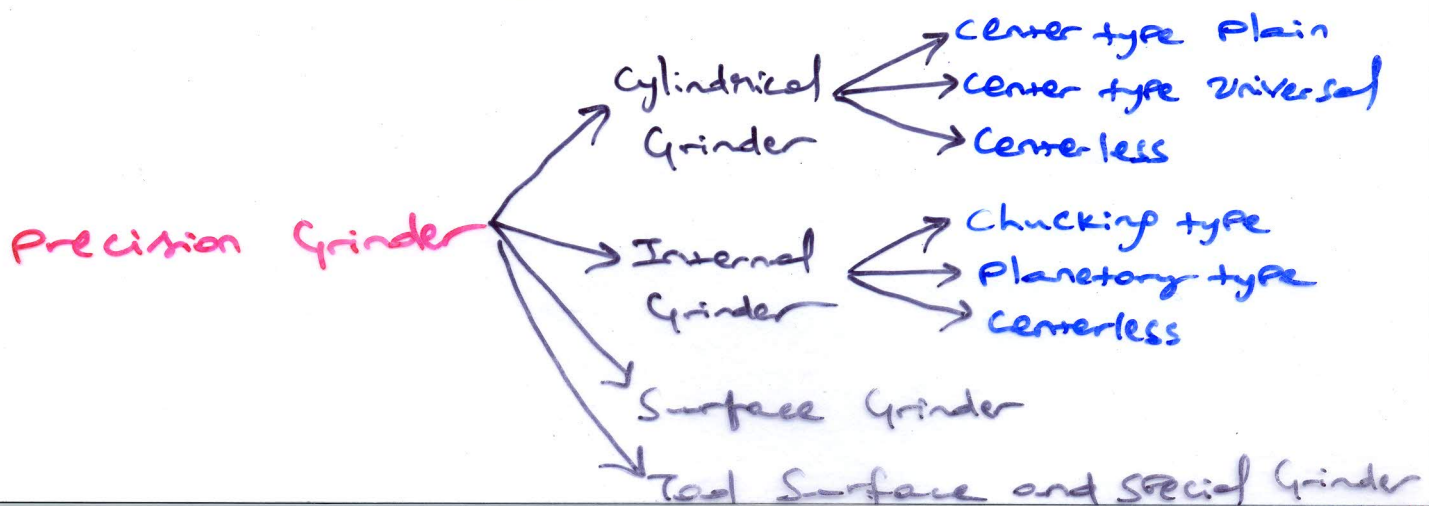
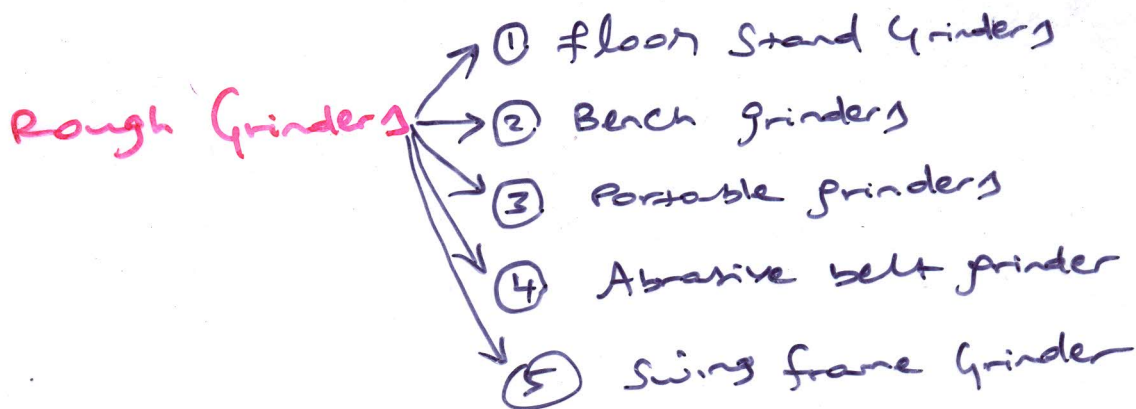


Mounting of Grinding wheel:-

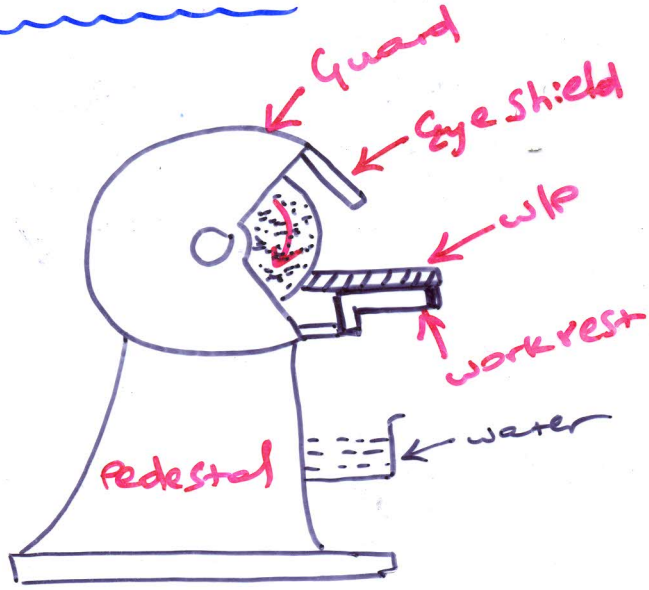


Types of Grinding Machines:-

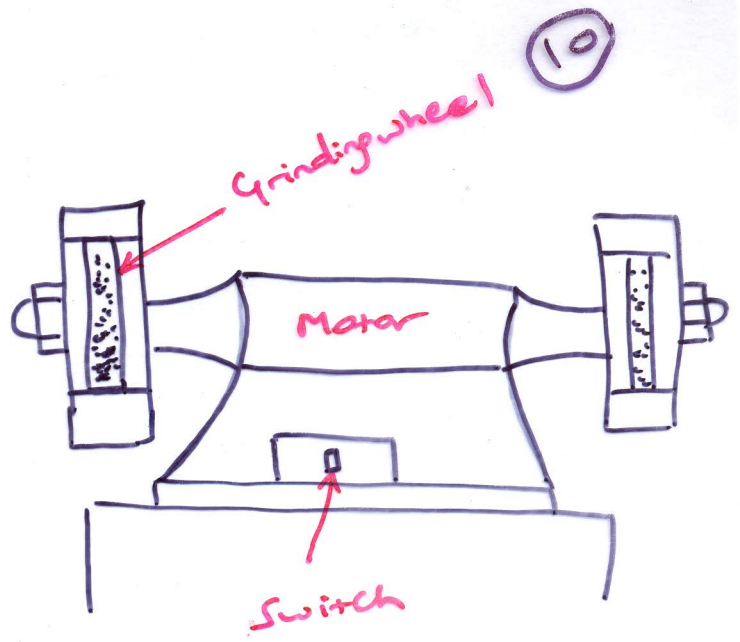
1. Type of operation — (a) Tool (b) cut-off grinder
2. Quality of finish — (a) Rough (b) Precision grinder
3. Type of surface — (a) cylindrical (b) Internal (c) surface (d) special purpose etc.,



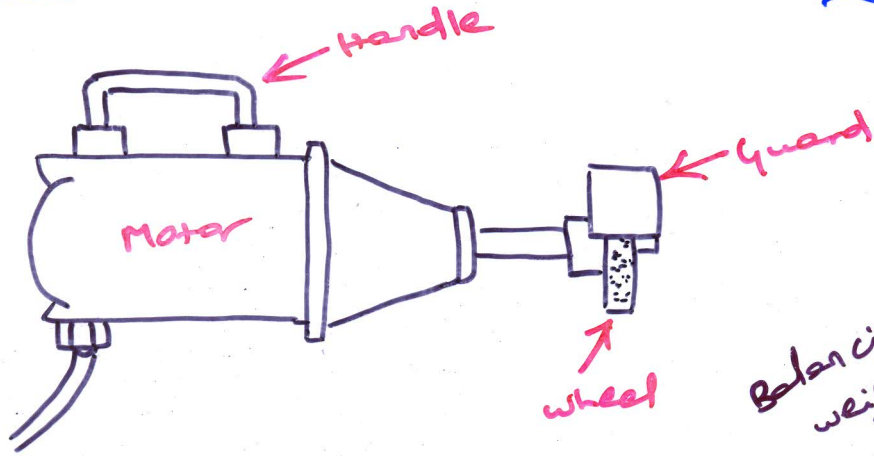
Rough Grinders!—



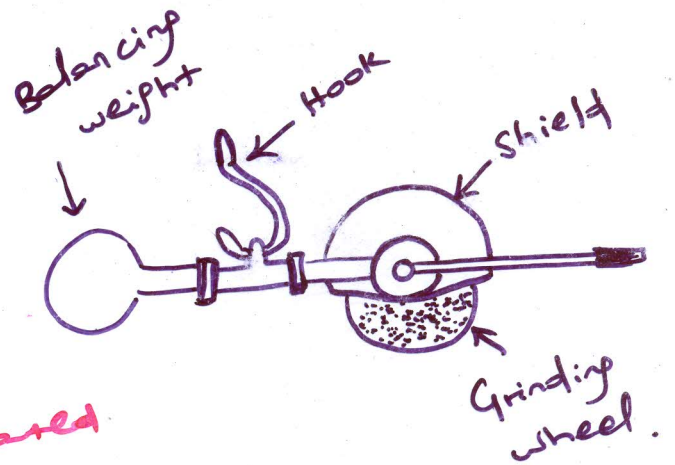
Floor Stand Grinder



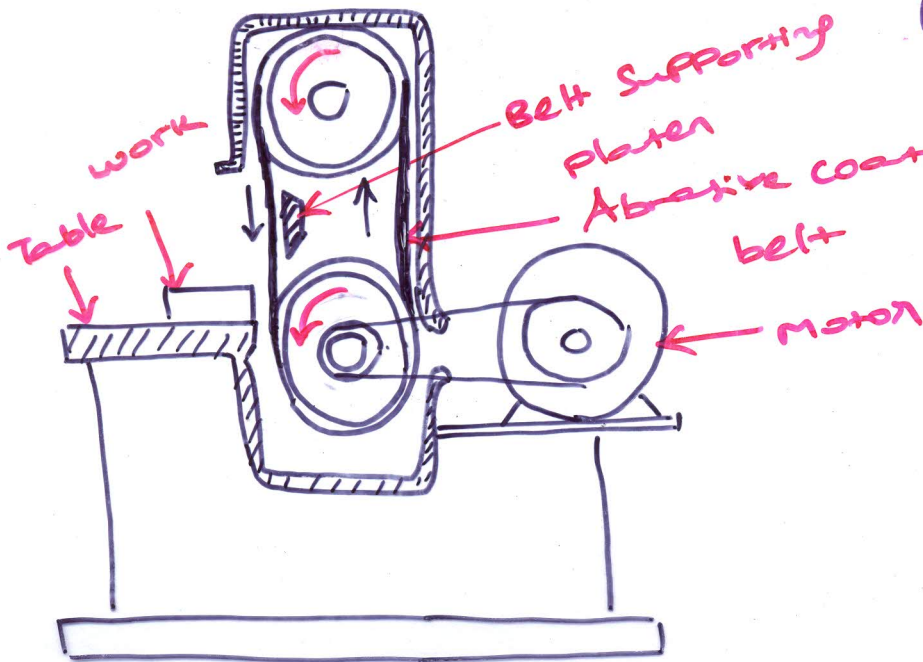
Bench Grinder



Portable Grinder



Swing frame
Grinder



Abrasive Belt Grinder

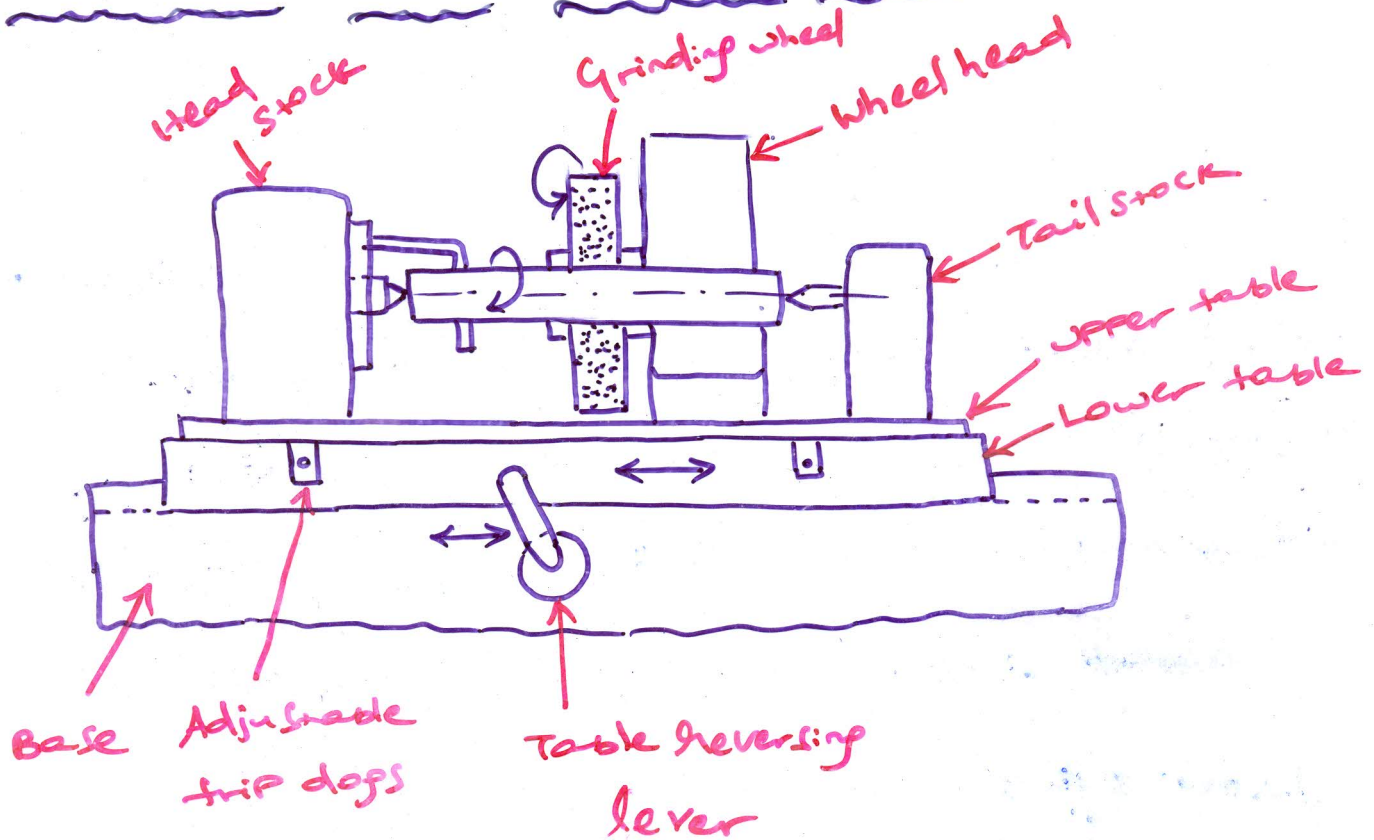
Precision Grinders:-

(11)

Cylindrical Grinders:-

- (i) Center type Grinders
 - Plain type
 - Universal type
- (ii) Centerless type Grinders.

Center type Plain Cylindrical Grinder

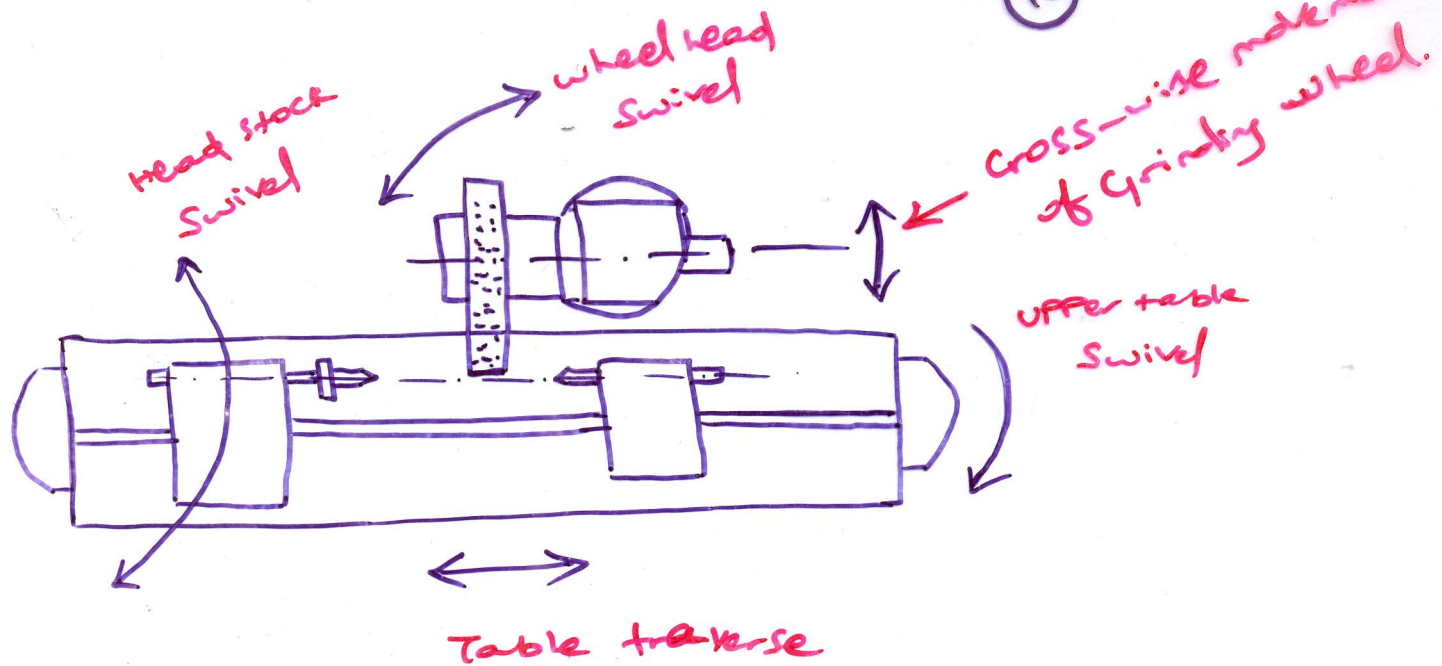


Various movements:-

- ① Longitudinal feed along guideways of the bed. [Hand (or) Power]
- ② Swivelling of upper table on the lower table [10° on either side]
- ③ Rotation of a Grinding wheel.
- ④ The movement of the wheel perpendicular to the table ways. by hand (or) power. [cross feed]

Center type Universal Grinder:-

(12)



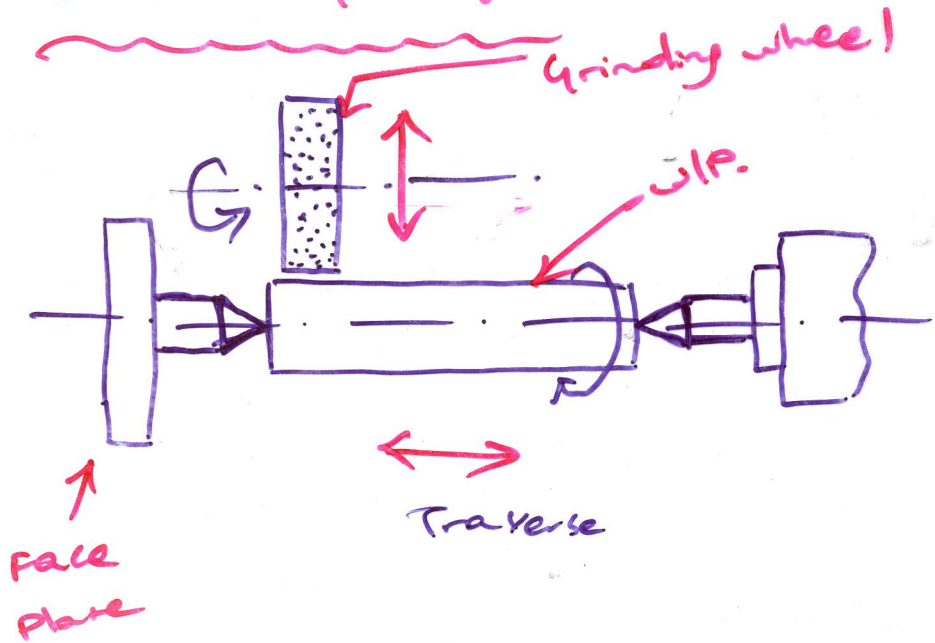
- * Revolution of workpiece b/w the centers
- * Swivelling of Head stock in a horizontal plane
- * Swivelling of upper table in a horizontal plane
- * Swivelling of wheel head in a horizontal plane.
- * Longitudinal feed of the table
- * Cross-wise movement of the grinding wheel.

Types of operations in cylindrical grinding machine:-

- (i) Traverse Grinding
- (ii) Plunge Grinding

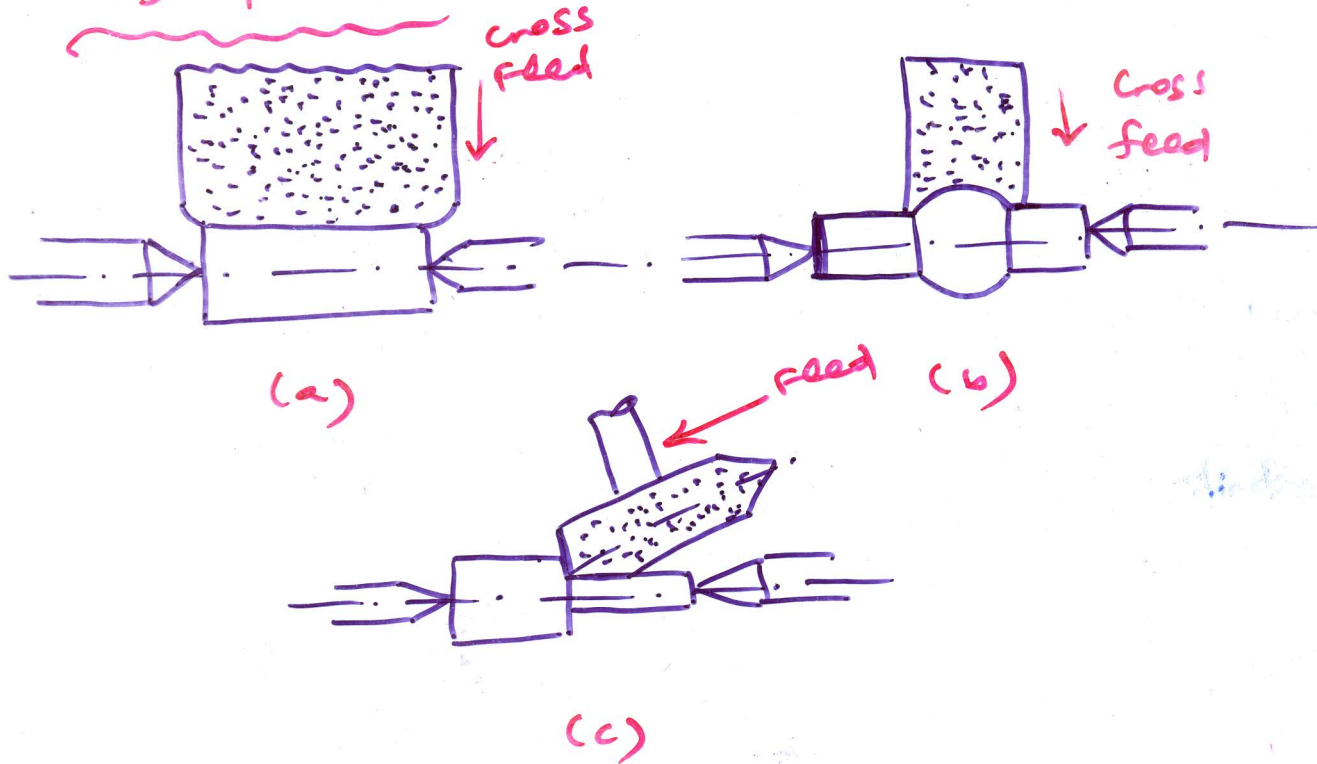
Traverse Grinding:-

(13)

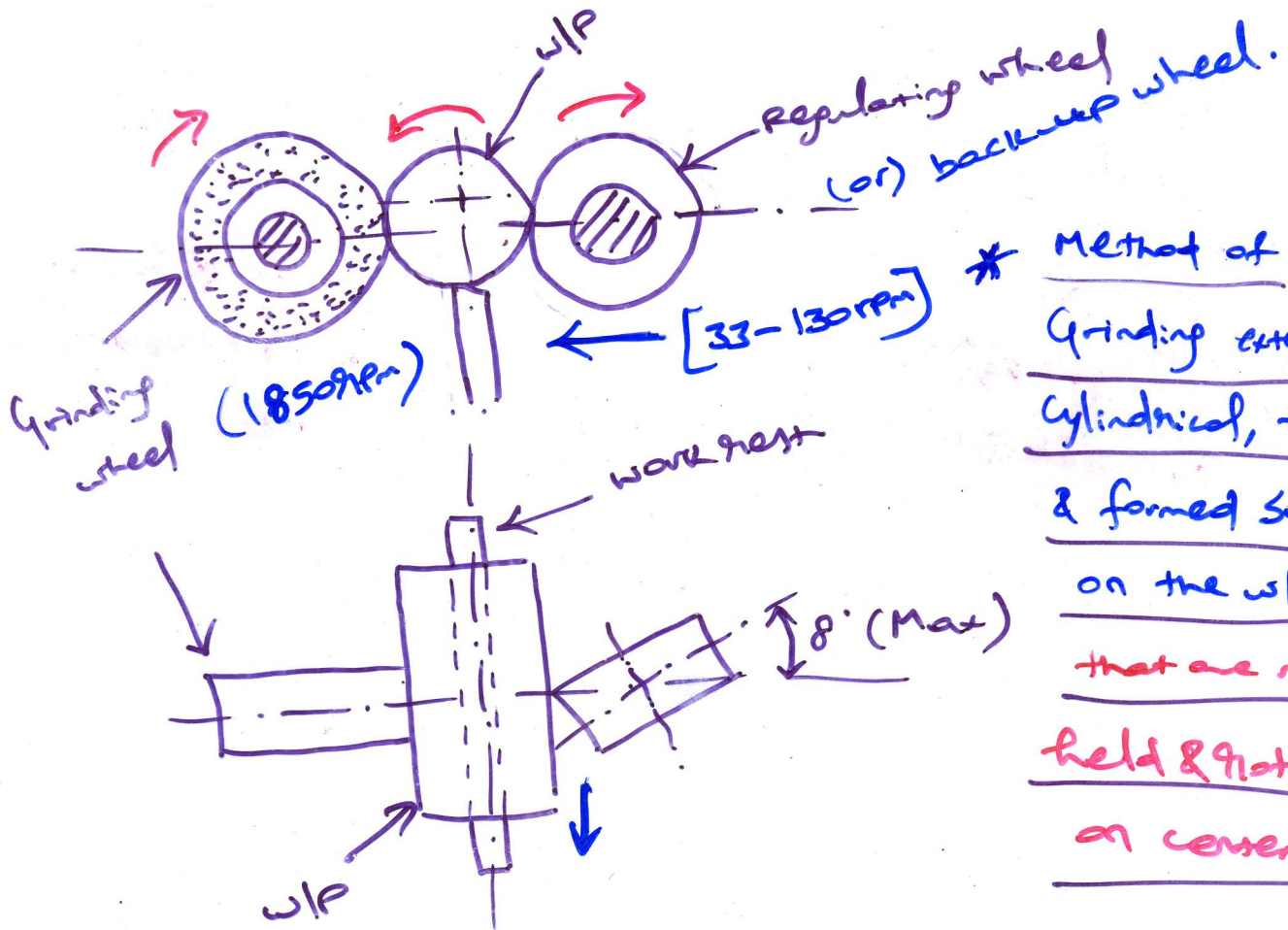
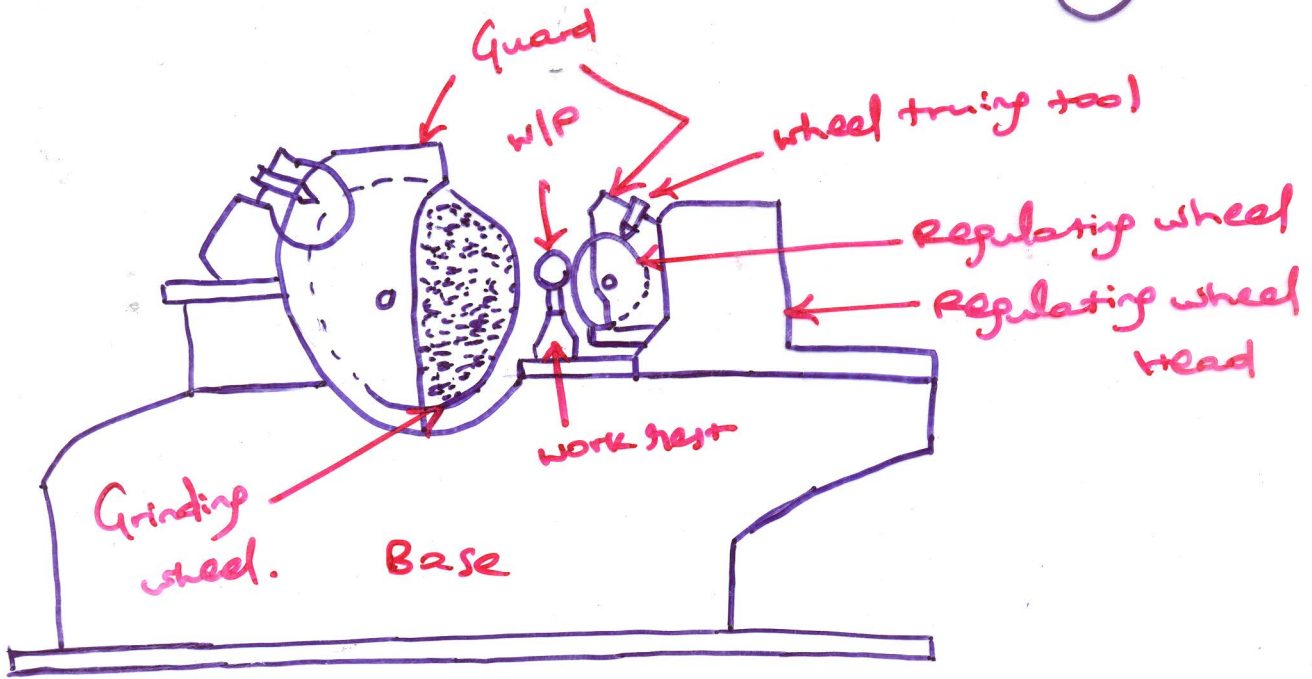


* used when the job length is more than the width of the grinding wheel.

Plunge Grinding:-



Centerless Grinders:-



* Method of Grinding exterior cylindrical, taper & formed surfaces on the W/P that are not held & rotated on centers.

* The regulating wheel is inclined at an angle of 8° to permit the axial movement of the workpiece in between the wheels.

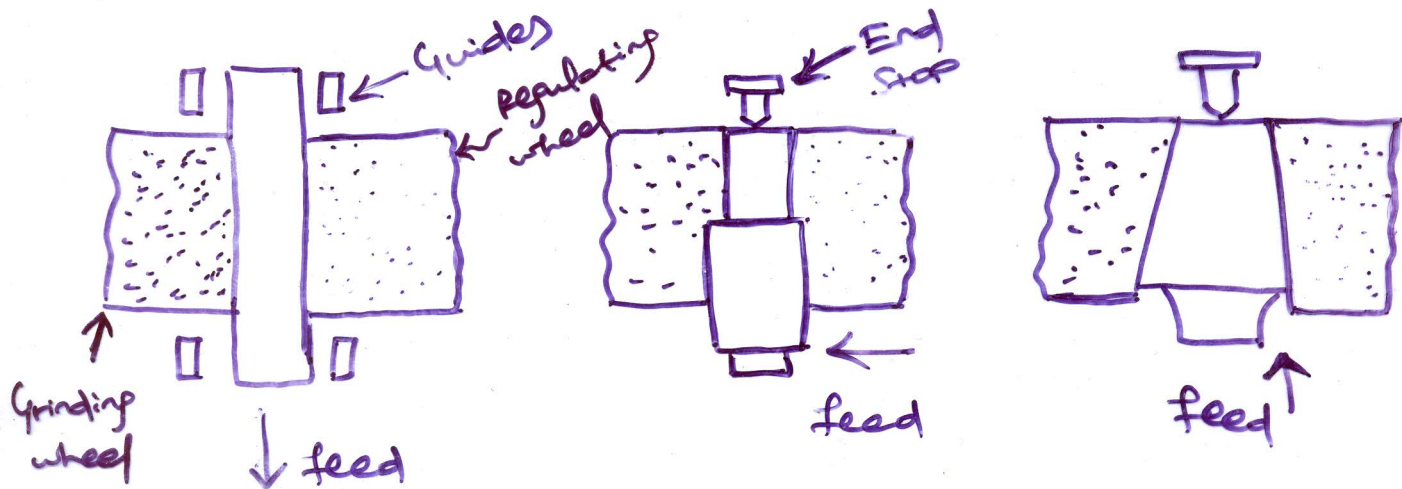
$$S = \pi d n \sin \alpha$$

Methods of Centerless Grinding:-

(19)

(i) through feed

(ii) In-feed (iii) End feed.



(a) through feed

(b) In feed

(c) End feed Grinding

* long shafts, bars, roller pins etc.

* for 1 pass, 0.2mm

* similar to plunge grinding

* used for grinding formed surfaces

* used for grinding tapered surfaces.

* End Stop prevents the axial move of the w.p.

Internal Grinders:-

* used to finish straight, tapered (or) formed holes.

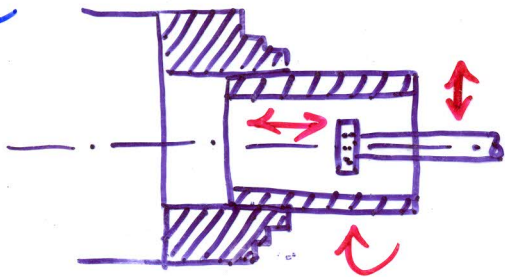
- (a) Chucking type
- (b) Planetary type
- (c) Centerless type

chucking type Internal Grinders:-

(16)

Type-I

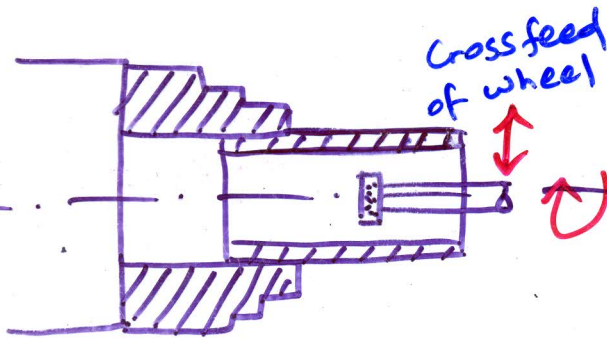
According to General construction, there are 2 types.



W/P → rotation

Grinding wheel } ⇒ Rotation,
longitudinal feed,
cross-feed.

Type-II



W/P → rotation, longitudinal feed.

Grinding wheel } ⇒ rotation,
cross-feed.

Rotation of chuck

Longitudinal feed of chuck.

Plain Internal Grinder:- The work head can be swivelled to 45°.

Universal Internal Grinder:-

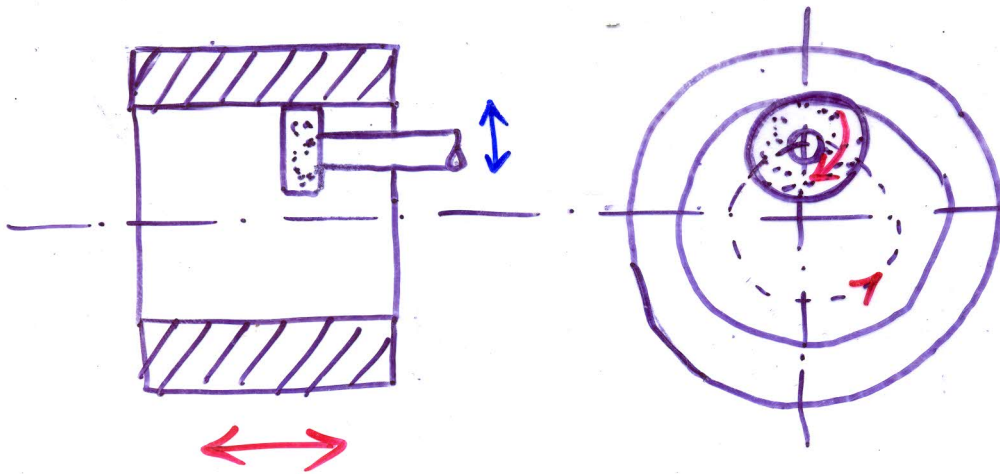
* work head — cross feed can be given & it is swivelled upto 90°.

Planetary type Internal Grinders:-

(17)

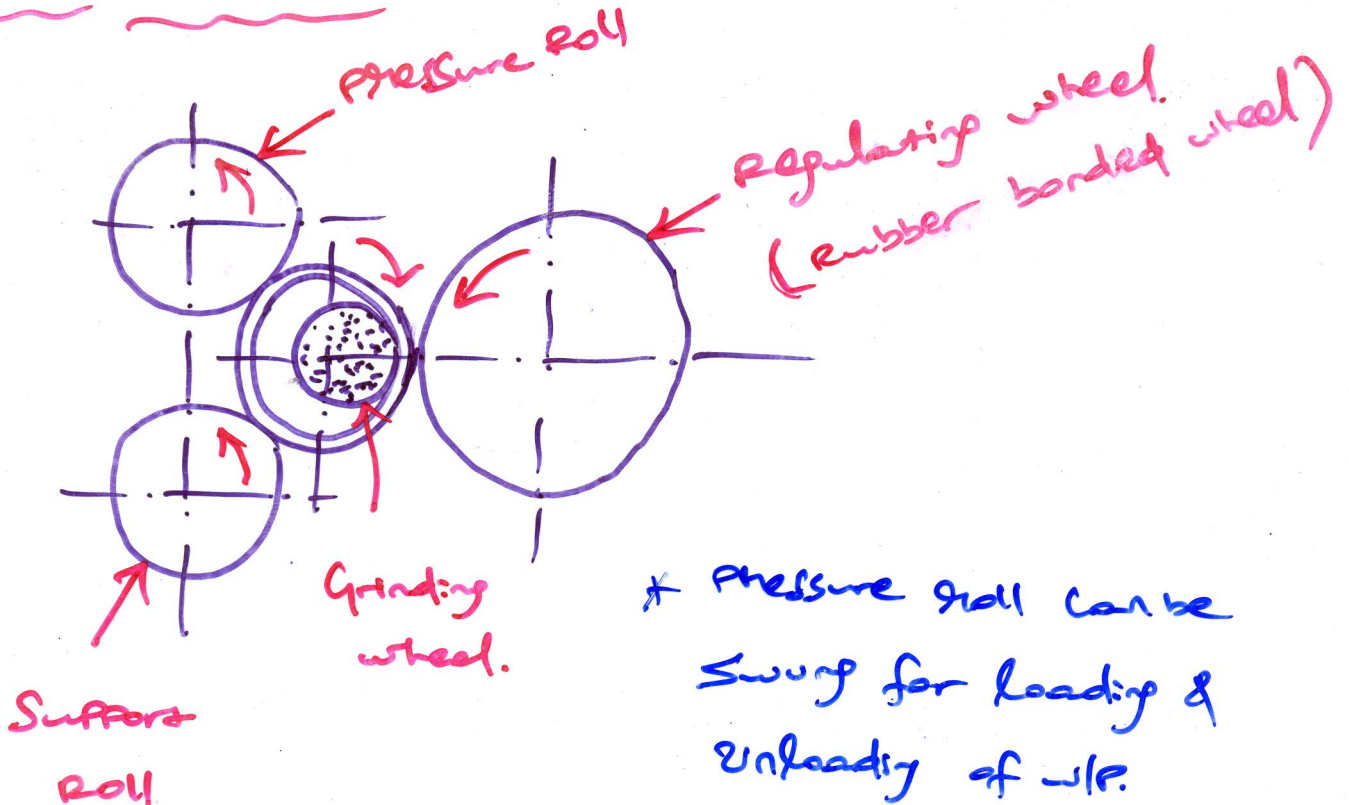
Movements

- ① Longitudinal (or) Reciprocating movement of Chuck.
- ② Planetary motion & cross-feed of wheel.



used for finishing holes for heavy jobs that can't be conveniently rotated by a chuck

Centerless Grinding:-



Movements

Grinding wheel \Rightarrow Reciprocation, Rotation, Cross-feed.

Advantages of centerless Grinding:-

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- ① As the W/P is supported throughout its entire length when grinding takes place, there is no tendency for chatter (or) deflection of the work.
- ② Small, fragile (or) slender workpieces can be ground easily.
- ③ The process is continuous & is adopted for production work.
- ④ Less metal is removed due to floating condition.
- ⑤ No center holes, no chucking (or) mounting of work on mandrels (or) other work holding devices are required.

Disadvantages:-

- ① In hollow workpiece, there is no certainty that the outside diameter will be concentric with the inside diameter.
- ② Work having multiple diameter is not easily handled.

Surface Grinding M/c:-

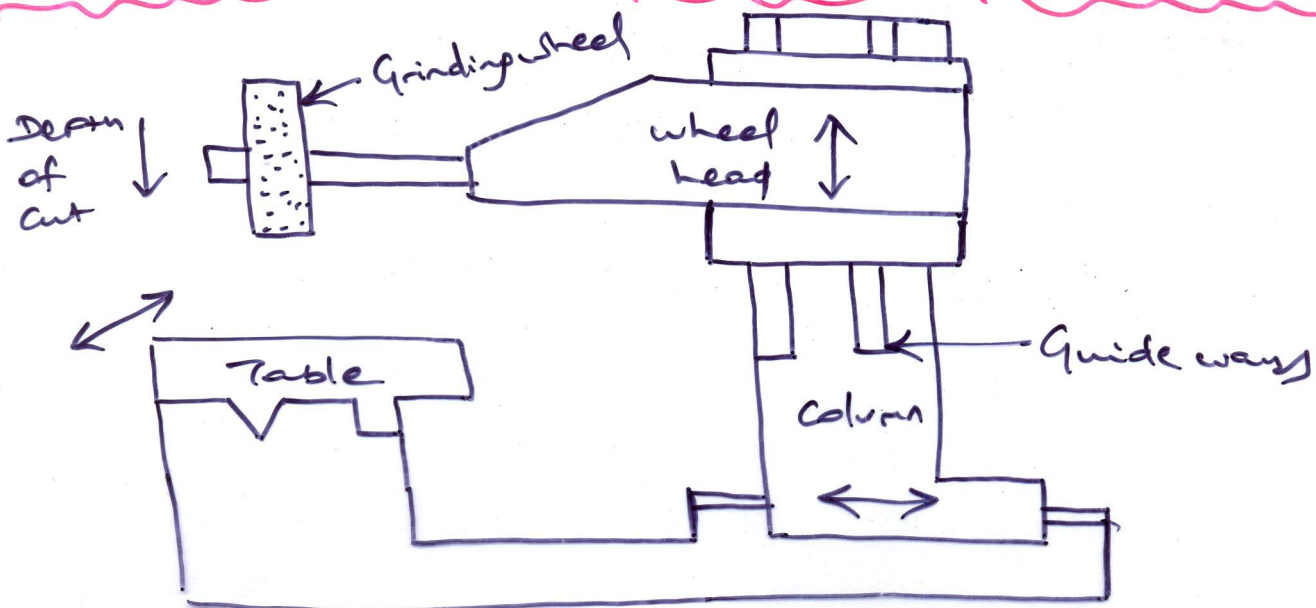
(19)

- * Used to produce & finish flat & plane surfaces
- * Angular & formed surfaces
- * Heavy work pieces - fixture
Small work piece - Magnetic chuck

Types

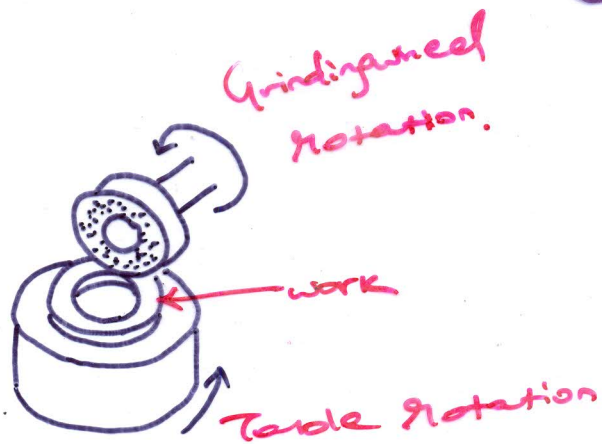
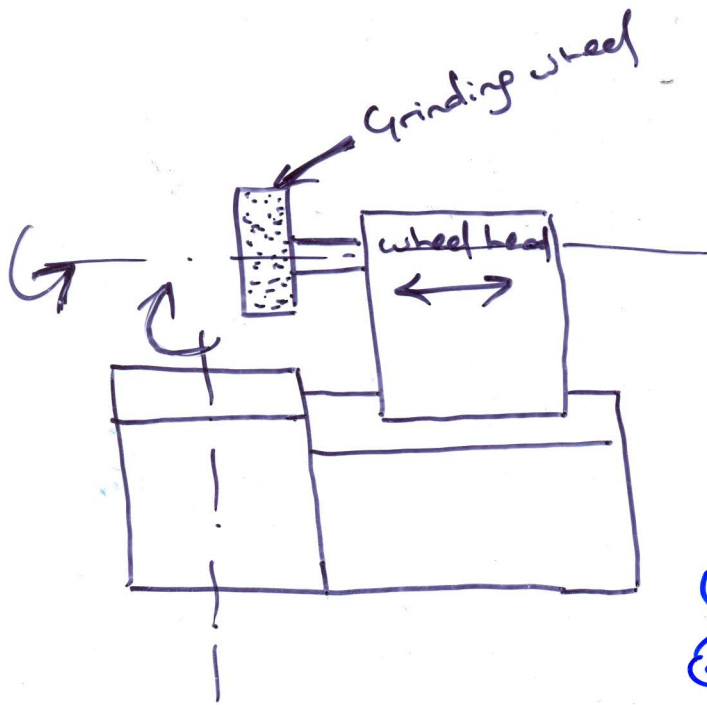
- ① Horizontal Spindle Reciprocating table Surface Grinder
- ② Horizontal Spindle Rotary table Surface Grinder
- ③ Vertical Spindle Reciprocating table Surface Grinder
- ④ Vertical Spindle Rotary table Surface Grinder

① Horizontal Spindle Reciprocating table Surface Grinder



Horizontal Spindle Rotary table Surface Grinder:-

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- ① Rotation of wheel & cross-feed of wheel
- ② Rotation of the table

Vertical Spindle Reciprocating table Surface Grinder

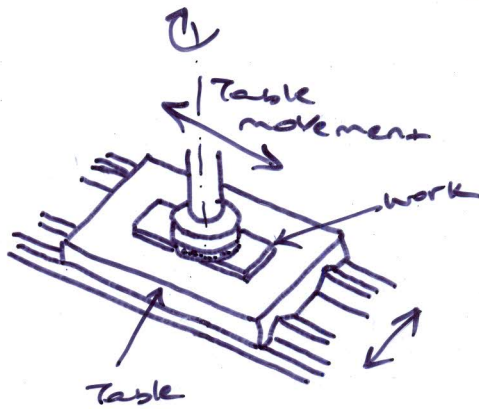
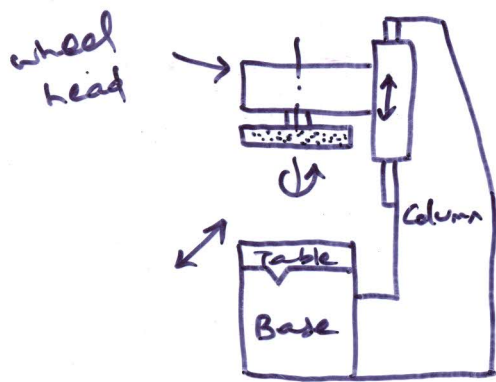
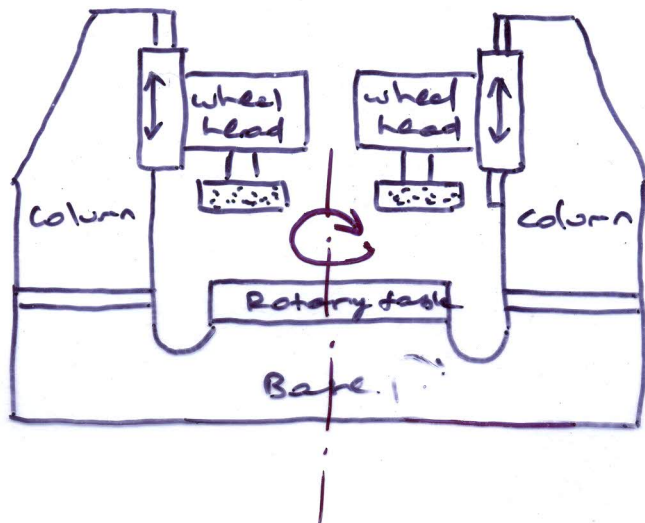


Table - C. feed & L. feed
 wheel - Vertical & rotation.

Vertical Spindle Rotary Table Surface Grinder:-



used to grind large quantity of workpieces.