GRINDING:

It is an act of dressing, shaping or finishing metal surfaces using a rotating abrasive wheel and point at which together act as a cutting tool. Generally 25 microns to 0.5mm metal can be removed in the process with an accuracy of about 25 microns. In such cases it is a surface grinding process. It is also used to remove excess material from the castings, forgings welds etc. in such cases it is a rough machining process.

Abrasives: abrasive is any material which can wear away the other substance which is softer than it. These are crushed into grains and used in grinding wheels, discs, belts, points, lapping compounds etc.

Classification of abrasives:

Natural abrasives: these are available in the earth crust as mineral deposits. These contain impurities. Hence they are not only too difficult to extract but also to process. E.g. emery, sand, flint, garnet, corundum etc.

Artificial abrasives: these are produced by artificial means. E.g. silicon carbide, aluminum oxide etc. these are better than natural ones because the desired purity and grain size can be derived.

Application of abrasives:

Emery and corundum: To sharpen the tool edges.
Sic: to grind cast iron, ceramics, tungsten carbide, non ferrous metals etc.
Aluminum oxide: to grind steels, wrought iron, bronzes etc.
Carborundum: to grind carbides, marbles, gems, stones etc.

Grinding machines and its types:

Grinding machines are the machines which perform the abrasive machining. They may be portable or stationary. They are classified as follows:

Based on the quality of surface finish:

1. Rough grinding machines
2. Precision grinding machines.

To produce and finish mainly flat surfaces

1. Surface grinding machines.

To produce and finish plain cylindrical surfaces

1. Cylindrical grinding machines.

To finish straight and tapered and formed holes:

1. Internal grinding machines.

To sharpen and recondition the cutting tools:

1. Tool and cutter grinders.

To finish special contours:

1. Special grinding machines.

HORIZONTAL SURFACE GRINDING MACHINES:

These are mainly used for grinding flat surfaces. But using formed wheels, irregular surfaces can also be grinded on some machines.

Principle: Here the work piece is mounted on the work table which has reciprocating motion. A grinding wheel is supported on a horizontal spindle. It has adjustments to move up and down as well as to and fro along with the spindle.

Its downward motion result in a cut of depth't'. It's to and fro motion result in a horizontal surface finish. If the work or the table is moved parallel to the direction of rotation of wheel, it is called down grinding. If it is moved in the opposite direction to the direction of rotation of the wheel, it is called up grinding.

Construction:

It is made of rigid hollow base, supporting a column. The motor and the necessary driving mechanism is housed in the base. The control push buttons to start and stop the machine are fixed over it. A working table is mounted on a saddle which in turn is assembled over the base so as to move them in both longitudinal and cross wise directions using hand wheels. The working table may be either magnetic or designed to hold the suitable fixtures. The grinding wheel which is supported on the horizontal spindle is partially housed in a wheel head which in turn is mounted on the column so as to raise or lower it with the help of another hand wheel.

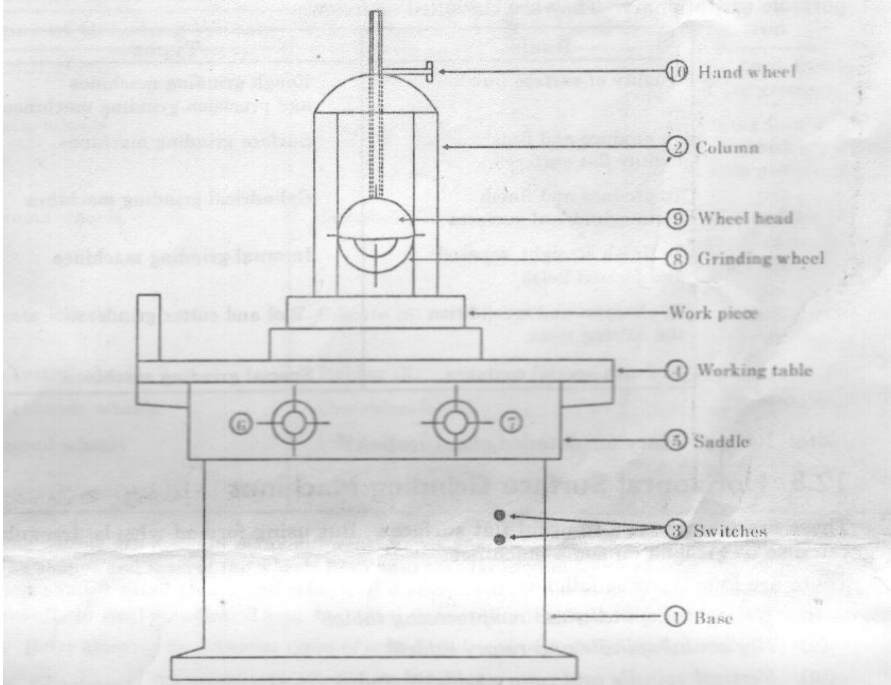

Fig 12.2 *Horizontal Surface Grinding Machine*
(Horizontal Spindle and Reciprocating Table Type)

Operation:

The work piece is mounted on the work table. A suitable grinding wheel is selected and fixed to the wheel head over the horizontal spindle. The necessary in feed is calculated and adjusted with the help of hand wheel. The machine is started. By operating the hand wheels the work piece is moved for the required longitudinal and cross traverse under the wheel. By counting the process the desired surface finish is obtained. The machine is then switched off.

CYLINDRICAL GRINDING MACHINES:

These are mainly used to grind the cylindrical surfaces so as to reduce their outside diameters and to leave a fine finish. However they can also be used to grind the cams, fillets, eccentrics etc. there are mainly three types:
Plain center type.
Universal center type
Centre less grinding machines.

Plain center type cylindrical grinding machines:

Principle:

Here the work piece is held between two centers and made to revolve on its axis. A grinding wheel is positioned behind the work piece, is made to rotate at higher speeds than the job in the direction opposite to that of the job. Grinding takes place as the wheel is made to move parallel to the axis of the job. To grind or to form fillets, the wheel is to be positioned above the job, providing necessary down feed.

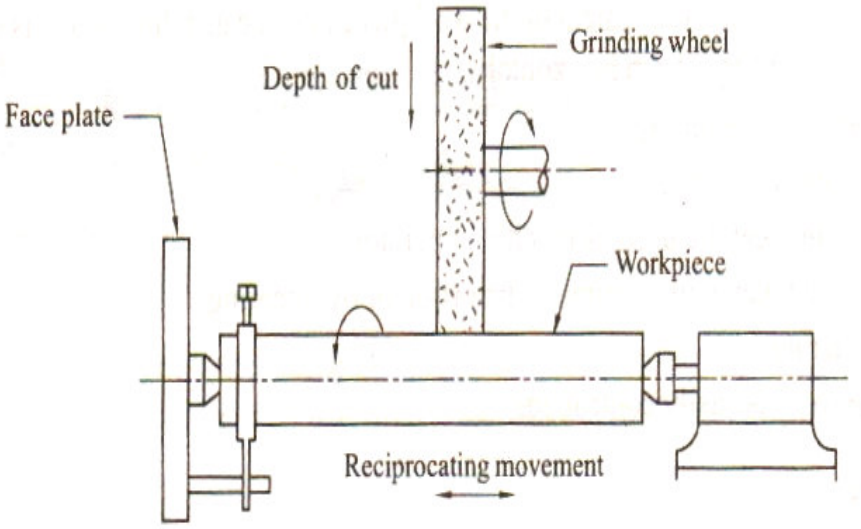

Fig. 12.2 Cylindrical grinder

Construction:

It resembles a lathe. The base of the machine is a rigid hollow casting. It rests on the floor and supports the other parts. The motor and the necessary drive mechanism is housed in the base. A slide table is mounted on the bed to provide longitudinal motion to the grinding wheel. A working table is pivoted at the center of the sliding table so as to swivel the grinding wheel a desired angle. A head stock is fixed at one side of the bed. It supports one end of the work piece using a face plate as chuck. A tail stock is positioned on the other side of the bed. It is made to slide over the bed longitudinally so as to support the other end of the work piece. A hand wheel helps to slide the tailstock. A wheel head carries a grinding wheel and its driving motor is mounted on the slide table at the rear end of the base.

CENTERLESS CYLINDRICAL GRINDING:

PRINCIPLE:

Here the work piece is held over the work rest in between two wheels. The larger one is the grinding wheel.
It is to do actual grinding at the specified speed. The smaller wheel is regulating wheel made of plastic or rubber bounded material. Its purpose is to control the speed of rotation, longitudinal motion of the work and rate of feed. It is mounted at an angle to the plane of the grinding wheel revolving at slower surface speed. The work piece rotates at a speed approximately equal to the speed of the regulating wheel. Both the wheels rotate in the same direction.

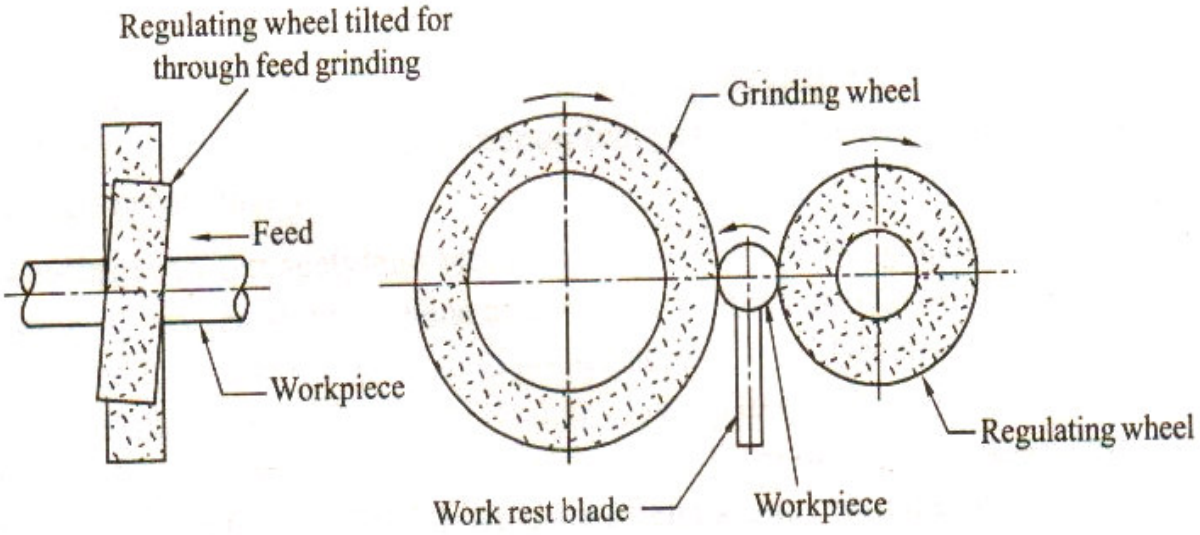

Fig. 12.3 Centerless grinder

Applications:

1. to grind the exterior cylindrical surfaces
2. to grind long slender bars
3. To produce and finish taper surfaces.

Advantages:

1. Production is very rapid since the process is continuous.
2. Accurate size control since there is no distortion.
3. Less wheel wear since large wheels are used.