Grinding

*Grinding* is an operation performed by a rotating *abrasive wheel*, which removes metal from the surface of an object. It is usually a *finishing operation* which gives a good *surface finish* and high *dimensional accuracy* to workpieces which have already been machined by other methods. Very little metal is removed in this operation. Grinding is also used to machine materials which are too hard to be machined by other methods. The different types of grinding processes are:

- (1) *External cylindrical grinding*, including *centreless grinding*
- (2) *Internal cylindrical grinding*
- (3) *Surface grinding*
- (4) *Form grinding*.

*External cylindrical grinding* is used to produce a *cylindrical* or *tapered surface* on the outside of a workpiece. The workpiece is rotated about its own axis as it moves lengthwise while in contact with a revolving grinding wheel.

*Internal cylindrical grinding* is used to produce *cylindrical holes* or *internal tapers* on a workpiece. The workpieces are rotated about their own axis, while the grinding wheel rotates against the direction of rotation of the workpiece.

*Surface grinding* is used to produce *flat surfaces*. The work may be ground by using either the *periphery* or the *end face* of a grinding wheel. *Form grinding* uses *specially shaped* grinding wheels to accurately finish surfaces previously machined to a special shape like *threads*, *gear teeth* and *spline shafts*. Complex forms like *punches* and *dies* can be ground by using special machines called *jig grinders*.

*Centreless grinding* is a method of grinding in which the workpieces are not held between centres (Fig 18.1). The work lies on a *work rest* between the wheels. Both grinding and regulating wheels rotate in the same direction. The work and the regulating wheel are fed forward, forcing the work against the grinding wheel. The axial movement of the work is obtained by tilting the regulating wheel.

**Abrasive wheels**

The abrasives used in grinding wheels are small particles of *silicon carbide* or *aluminium oxide*. Grinding wheels are made by using a suitable material to *bond*
the abrasive particles together. Different particle sizes and different kinds of bonding materials are used to make a whole range of grinding wheels, each suitable for a different type of work and finish. Silicon carbide wheels are used to grind low tensile strength materials, such as the tips of cutting tools, ceramics, cast iron, brass, etc. Aluminium oxide wheels are better suited for materials of higher tensile strength, such as most types of steel, wrought iron, tough bronzes, etc.

Lapping

Lapping is an abrading process that is used to produce geometrically true surfaces, achieve high dimensional accuracy, secure a fine surface finish, and obtain a close fit between two contact surfaces. In the lapping process, fine particles of an abrasive material are mixed with oil to form a paste. Lapping is done by rubbing the surface of the work with an object called a lap in an ever changing path. The lap is made of a relatively soft porous material like cast iron or copper. The paste is rubbed into the lap, an action which causes the abrasive particles to become imbedded in it. Laps are operated by machine or by hand.

Honing

Honing is usually used to finish internal or external cylindrical surfaces which have been previously machined or ground. The abrasive is in the form of a flat stone or stick called a hone. A few of these stones are mounted round a metal cylinder to form a honing tool which is reciprocated axially, while being in contact with the rotating work piece.

Superfinishing

Superfinishing is a process which uses large bonded abrasive stones to produce a surface finish of extremely high quality. A reciprocating motion is given to a large stone which presses lightly on the work piece. The work piece itself is rotated or reciprocated depending on its shape.

Polishing and buffing

Polishing is used to remove scratches and small defects from a surface. This is done by the cutting action of fine abrasive particles applied to wheels made of cloth, leather, felt, etc. The wheel is rotated while the workpiece is held against it.