THEORY finishes

Surface finishes/metals

The purpose of applying a finish to a piece of metal is to protect it from tarnishing or corrosion (rusting). Think of a metal artefact (say a bike) was to be constructed and left outside without any protective coating (paint), how long do you think it would take before it rusted? Not very long! Therefore metals have to be protected from rain, snow, etc. There is a number of ways of doing this depending on the type of metal being protected. The following examples are just some methods of protecting metals.

Painting
Paints are applied to bikes, garden gates, bridges, washing machines, etc because these artefacts are generally made from steel. Paints applied on metals come in various types and many colours.

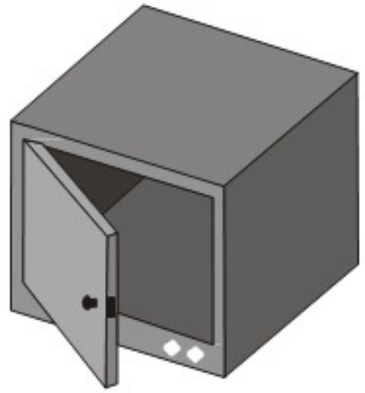
Lacquering
This is very similar to varnishing, it can be applied with a brush or can be sprayed on. The purpose of using this type of finish, is, if the base metal has a nice colour to it e.g. copper or brass, it allows this colour to be seen but at the same time protecting it.

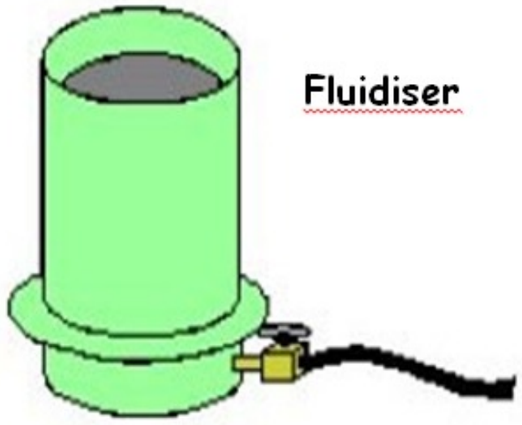
Bluing
This process involves heating the metal up and dipping it in a bath of oil, leaving it to cool and wiping dry with a cloth.

Plastic Dip Coating

A plastic coating is applied in the following way:-

1. Thoroughly clean and degrease the metal.
2. Heat the metal to 180^{O} degree C in an oven.
3. Dip the metal into the fluidised plastics powder for a few seconds.
4. Return it to the oven to fuse the coating to a smooth glass finish. Leave





Fluidiser

http://www.youtube.com/watch?v=EPqNYeQRsKY

2 THEORY machine tools

Machine Tools

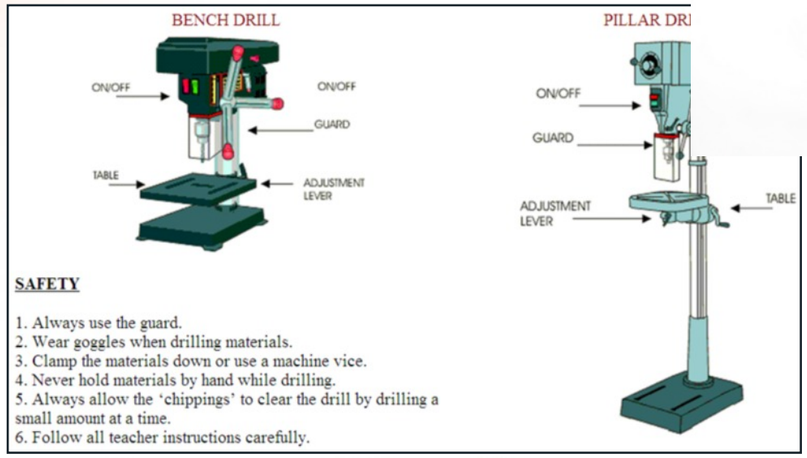
Belt Sander - You will see these in the school's workshops. They sand wood in a vertical motion.

Disc Sander – These sand in a rotational motion

Hand held Orbital Sanders – these come in many shapes and sizes. Each have a dust extractor attached to them to stop the use breathing in exes dust. They sand by moving the sanding beds in small circular motions (orbital motions).

Machine Tools - Drills

Cordless Drill This does the same as the bench and pillar drill, but because it is not attached to anything it can drill holes in more awkward areas. This can also be used as an electric screwdriver if the drill bit is changed for a screw bit.



SAFETY

1. Always use the guard.
2. Wear goggles when drilling materials.
3. Clamp the materials down or use a machine vice.
4. Never hold materials by hand while drilling.
5. Always allow the 'chippings' to clear the drill by drilling a small amount at a time.
6. Follow all teacher instructions carefully.

A mortise machine can be used to help cut out the mortise in a mortise and tennon joint. It uses a square chisel that contains a special twist drill to extract the waste wood.

Drill Bits

Twist Drill
Used for drilling holes. A normal drill set will include sizes from 1mm to 14mm.

Forstner Bit
Used for larger diameter holes. When using this bit the hole is drilled very slowly so that the bit does not 'jam' in the wood.

Hole Saw
For large diameters a 'hole saw' can be used. The advantage of this type of drill bit is that the blade can be changed to give different sizes of diameter.

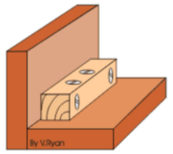
THEORY Knock down fittings

Knock Down Fittings

CAM LOCK FITTINGS The disk fits into a recess in the first side of the cabinet. It rotates by inserting a screwdriver into lot in its side. The shaft is screwed into the second side of the cabinet. The collar of the shaft is passed through the hole in the second slot in the disk. When the disk rotates the shaft is locked in position. This keeps both sides of the cabinet locked together.

SCAN FITTINGS These are strong enough to be either permanent or temporary joints. The cylinder is inserted into the first side of a cabinet in a pre-drilled hole. The screw is then pushed through the hole in the second side until it meets the cylinder. It can then be tightened with a screw driver until both sides of the cabinet pull together.

PLASTIC CORNER BLOCK (FIXIT BLOCKS) The corner block is pressed against the two pieces of material (normally wood based). Screws are used to fix the block into position. This type of joint is used to fit modern cabinets such as those found in a kitchen. It is a relatively strong joint although it has the advantage that it can be dismantled using a screwdriver.



NATURAL WOOD FITTING (SQUARE SECTION BATTEN) A piece of material such as pine can be drilled and screws can be passed through these holes. This gives a cheap and effective knock-down joint. The screws are normally countersunk into the knock-down fitting.

TWO BLOCK FITTING (LOK-JOINTS) These are made from plastic. A bolt passes through the first fitting into the thread of the second. As the bolt is tightened it draws the two fittings together. The pins help keep the fitting straight. This gives a very strong joint and it can be dismantled using a screwdriver.

RIGID JOINT These are normally moulded in plastic which makes them strong.
Screws pass through the four holes which hold the sides at each corner firmly together

THEORY manufacturing in industry

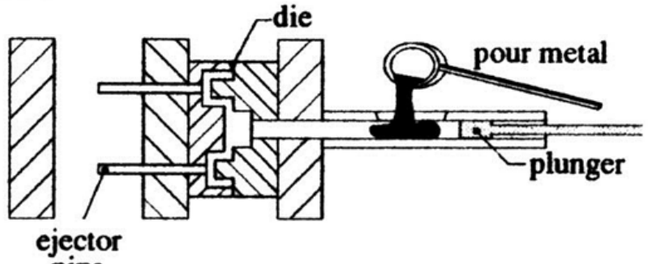
Metal)Die Casting (Moulding)

Where large numbers of identical components are required, sand casting is not appropriate because the mould has be broken up each time. Die casting is a method using a permanent mould (called a die). The moulds are made of tough alloy steel and are split into two or more parts to allow the casting to be removed.

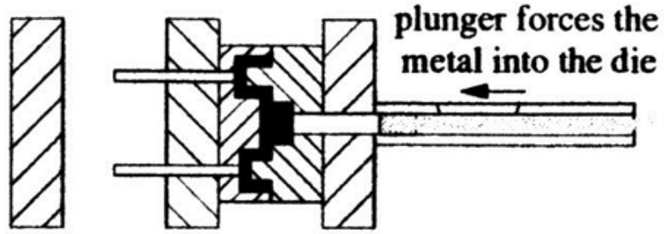
The holes to allow the molten metal into the die (the sprues) are normally too small for metal to fall through under gravity. A ram system is normally used to force the metal in under pressure, so the system is often known as Pressure Die Casting

This method is normally automated and can produce over 100 castings per hour.

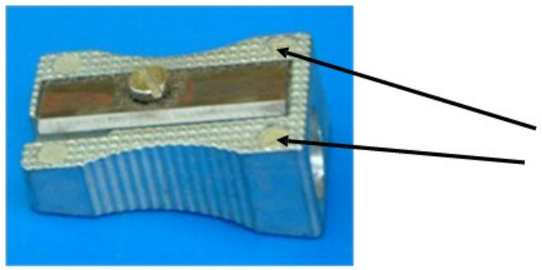
Stage 1
A measure of molten metal is poured into the charge chamber.



Stage 2
An injection piston, or plunger, then forces the metal into a water-cooled die through a system of sprues and runners.



Stage 3
The metal solidifies rapidly and the casting is removed, complete with its sprues and runners.



This pencil sharpener has been 'die cast'. It has ejector pin marks on each corner.

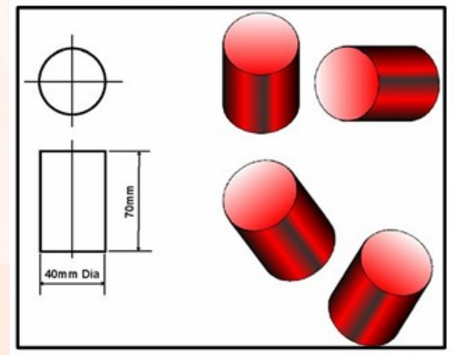
http://www.youtube.com/watch?v=LH8B3i6e8d4

THEORY manufacturing in industry

CAD/CAM

CAD/CAM stands for Computer Aided Design / Computer Aided Manufacture. This is the process whereby the product is designed using a computer, and the machines used to make it are controlled by a computer. Drawings and instructions written on pieces of paper are not required.

Computer Aided Design
Computer programs can be used to draw accurate, scaled drawings of the design of a product in both 2D and 3D. In 2D, dimensions can be added automatically and drawings of parts that are used a lot, such as nuts & bolts can be inserted like clip-art, from a drawings bank. In 3D, rendering (colour & texture) can be added as well as highlighting and shading. The view can be made to twist and turn so that it can be viewed from any angle. In industry, powerful programs can be made to animate moving parts and to work out the forces that the part will have to stand up to, so that it does not break in use. This can save hours of testing prototypes.



Advantages
Faster accurate drawing
Drawings of common parts can be inserted from a drawings bank, or library
Changes can be made quickly and easily
Dimensions can be added automatically
Printouts can be to any scale. In 3D, the object can be viewed from any angle

Disadvantages
The cost of the computer and pro- grams
Early ideas are recorded faster by sketching
A pad of paper and a pencil can be used anywhere

Computer Aided Manufacture
Computers can control cutting machines such as drilling machines, lathes, milling machines etc. The computer controls the movement of the cutter very accurately (accuracy to 500th of a millimetre is possible). In the CAD/CAM system, data from the CAD drawing is downloaded to the CAM program which is then used to control the cutting machine. A computer can also be used to control the handling of the parts to be cut from one machine to another. Computer controlled fabrication (joining parts together) is also possible. Parts can be automatically held together in the right positions, while they are welded, riveted or glued by computer controlled equipment. Injection moulding and vacuum forming can be done by computer controlled machines.

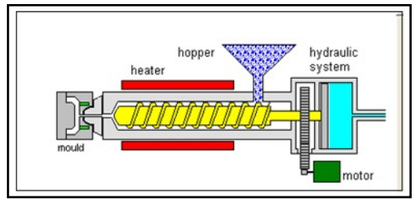
Advantages
- Very accurate work
- The machine does not need breaks
- The machine does not get tired and inaccurate
- Changes of design can be made quickly

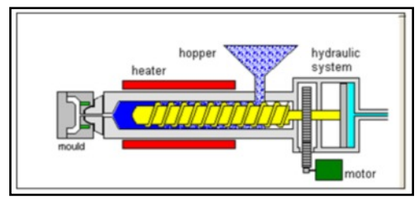
Disadvantages
The cost of the computers and programs
The high cost of the machines
The loss of jobs

2 THEORY manufacturing in industry

Plastics - Injection Moulding

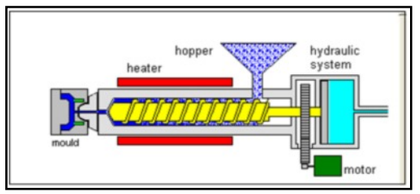
The process of injection moulding injects hot soft plastic through an injector into a mould rather than into long shaped strips. It is a process which allows large quantities of plastic components to be made quickly. Thermoplastic granules are heated until they soften. Then the material is forced under pressure into a mould. When cooled, the mould is opened and a component, which is the exact shape of the cavity is taken out. Injection Moulding is one of the most important industrial processes in the mass production of plastic goods. The cost of producing the moulds can be very high, therefore it is necessary to manufacture and sell large quantities of the product being manufactured to recover costs.

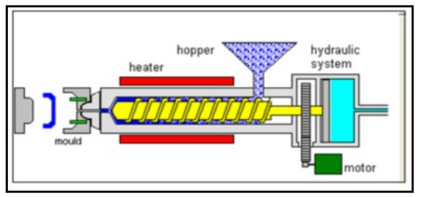




Stage 1
The first stage in the process is to place plastic granules into the HOPPER. The granules are then carried along the auger towards the injector.

Stage 2
As the granules are pushed along the auger they are heated at the same time making them into a hot soft plastic paste



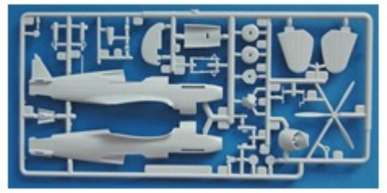


Stage 3
The hot soft plastic paste is then pushed out the end through an injector into the mould.

Stage 4
As the plastic paste is pushed out the injector into a mould/pattern it is held here for a short time while it cools. It is then ejected. Examples of articles which are injection moulded are mobile phone covers, buckets etc.

http://www.youtube.com/watch?v=WHwTHarf8Ck

Uses
Components produced by injection moulding vary from golf tees, spoons, wash basins, buckets, airfix models to product casings

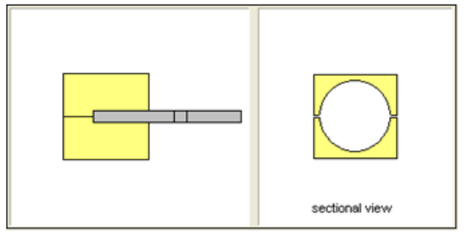


Identifying Features
A way of telling if a product has been injection moulded is to look for ejection pin marks on the surface of the product. These are normally circular marks left when the pins force the product out of the mould

THEORY manufacturing in industry

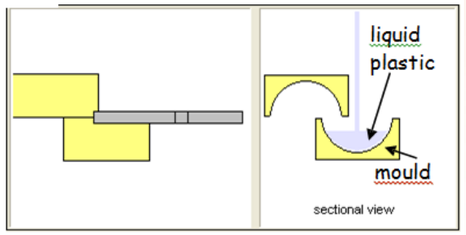
Rotational Moulding

This plastic process is used to create objects such as balls.



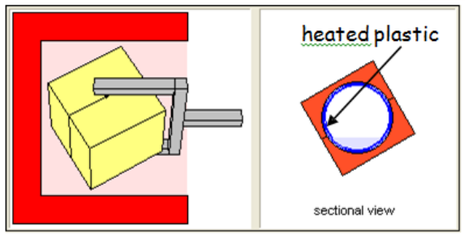
the rotational mould.

Stage 1
At this stage the liquid plastic is poured into the mould. The mould is then sealed and the process of rotating it begins.

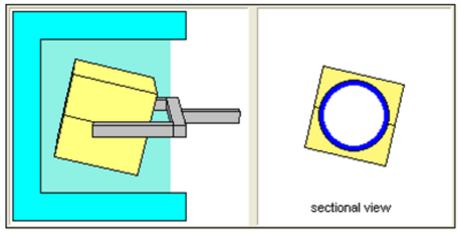


http://www.youtube.com/watch?v=VPLaUzMh3Rw

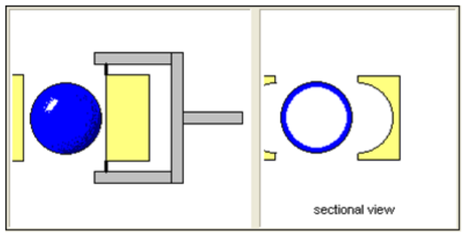
Stage 2
This stage shows the plastic being heated as it is rotated around the mould. The heated plastic coats the inside wall of the mould.



Stage 3
The completed plastic mould is now cooled before ejection from the mould.



Stage 4
The moulded shape is ejected from the mould. The picture here shows a hollow sphere.



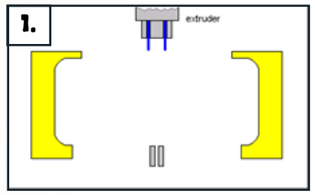
http://www.youtube.com/watch?v=CcGSKJxLfj8

THEORY manufacturing in industry

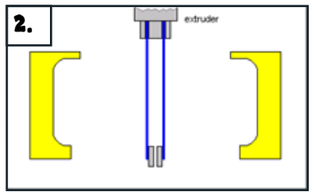
Blow Moulding

Extrusion blow moulding is an automated process that is used extensively to make bottles and other lightweight, hollow parts from Thermoplastic materials.

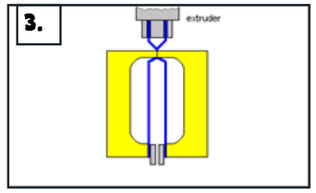
Process
The cycle starts with the mould open (1).



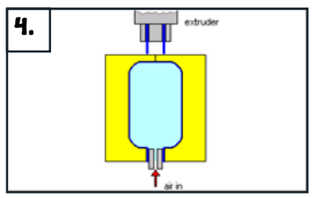
A hollow length of plastic, called a parison, is extruded down between two halves of the mould (2).



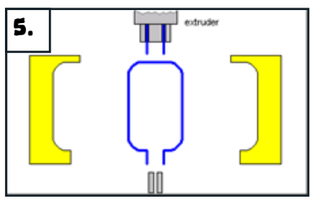
The mould closes and compressed air is blown into the Inside of the parison which inflates it, pushing the soft plastic Hard against the cold surfaces of the mould (3).



The plastic is cooled by the mould, causing it to harden quickly (4).



The mould is then opened, the moulding ejected and the Waste (called flash) is trimmed off with a knife (5).



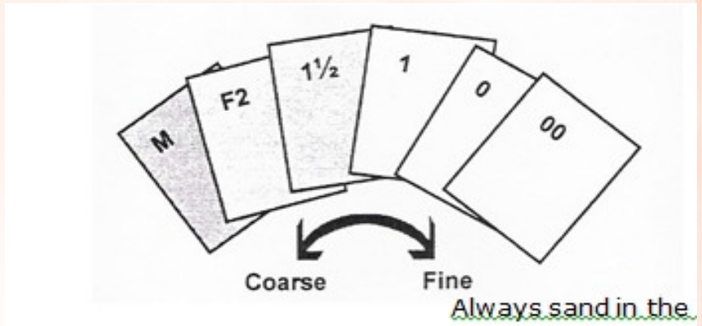
http://www.youtube.com/watch?v=7SvkDF6pkCE

THEORY finishes

Surface finishes

Wood

Before applying a finish it is important to make sure that the surface is very smooth and free from blemishes (marks and scratches) by firstly using an appropriate plane or scraper and then different grades of abrasive paper in the direction of the grain.



Sequence to applying varnish to a piece of wood

1. The Smoothing Plane (Smaller brother of the Jack Plane) is used first to remove pencil lines and any major blemishes.
2. Next, use a Medium grade of glass paper sand all surfaces.
3. The next stage is to apply a fine sprinkle of water over the surface of the wood. This raises the grains in the wood which when dry will be sanded off using a Fine Graded glass paper. This technique gives a better overall finish.
4. Using a Fine Graded glass paper sand down all surfaces.
5. Apply first coat of varnish. Allow to dry.
6. Using a Fine Graded gla
7. Apply second coat of va

Types of finish available

- Water Based Varnish
- Spirit Based Varnish
- Wax Polish
- Coloured Wax Polish
- Danish Oil
- Coloured Stains
- Paints

1.

2.

3.

4.

5.

6.

7.