

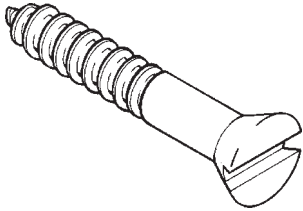
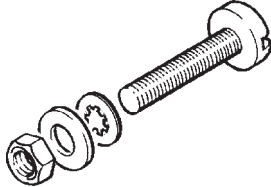
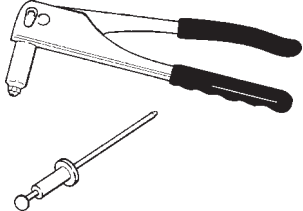
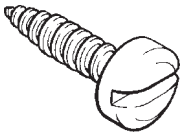
PROCESSING AND FORMING MATERIALS

There are three main ways that materials can be manipulated:

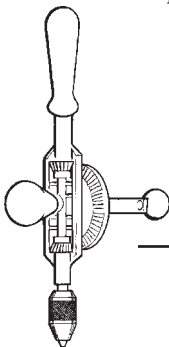
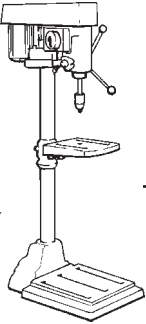
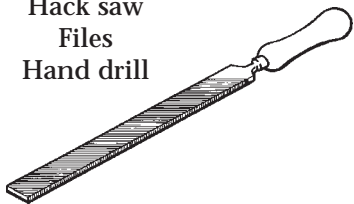
- Fabrication - *This means joining different pieces.*
- Wasting - *This means removing material using hand or machine tools.*
- Forming - *This means shaping by moulding, casting or pressing.*

Often you will have to use two or all of these methods to make your product.

1. FABRICATING

MATERIAL	TEMPORARY FIXINGS	PERMANENT JOINTS
Wood	Wood screws 'Knock down' joints 	Adhesives Joints Dowel Nails Wood screws
Metals	Nuts and bolts 	Soldering Welding Riveting or pop riveting 
Acrylic	Nuts and bolts Screws including self-tapping screws 	'Tensol' cement Self-tapping screws

2. WASTING

MATERIAL	PROCESSES	
	Hand	Machine
Wood	<p>Saw - rip saw, cross cut saw, panel saw, tenon saw, dovetail saw, coping saw, piercing saw Chisels Planes Hand drills</p> 	<p>Jig saw Circular saw Band saw Drilling machine Wood lathe</p> 
Metals	<p>Hack saw Files Hand drill</p> 	<p>Powered hacksaw Drilling machine Centre lathe Milling machine</p>
Acrylic	Hacksaw or Abrafile	

3. FORMING

MATERIAL	PROCESS
Thermoplastics e.g. acrylic	Strip heater Vacuum forming Blow moulding Injection moulding Extrusion
Iron and steel	Hot forming - forging
Copper and brass	Cold forming
Tin plate, aluminium, brass, mild steel, copper in sheet form	Sheet metalwork
Aluminium	Casting

WORK HARDENING OF METALS

If a metal has been **worked** (for example, by hammering, bending or rolling), work hardening takes place. This means that the metal becomes more difficult to bend. It also gets hot. Many manufacturing processes use this effect. The material starts out as **ductile**. This means that it is easy to bend and roll. As it is worked, it becomes harder and stronger.

HEAT TREATMENT

- Annealing *This removes the effects of work hardening.
The metal is heated and allowed to cool slowly.*
- Tempering *This reduces hardness slightly.
The metal is heated to a certain temperature to give the hardness required then cooled quickly (quenched).*
- Case hardening *This is used to give a hard surface to mild steel.
The metal is heated and then dipped in carbon powder.*

