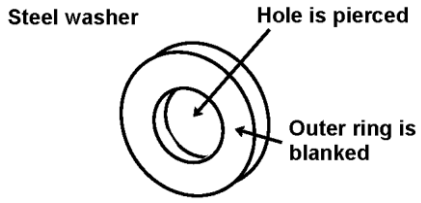
COMMERCIAL PRODUCTION

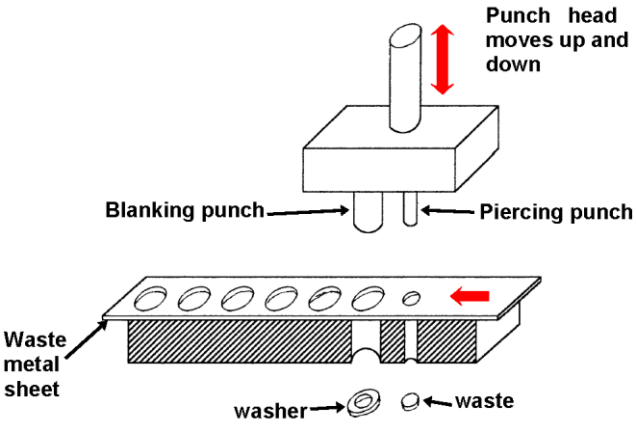
Blanking and Piercing

Blanking and piercing are useful processes for producing identical small metal parts such as washers, for use with nuts and bolts. The processes are normally automated and one machine can turn out more than 1,000 washers per hour.

Piercing is when a press is used to cut holes of any shape out of a sheet of metal. The part cut out is waste.



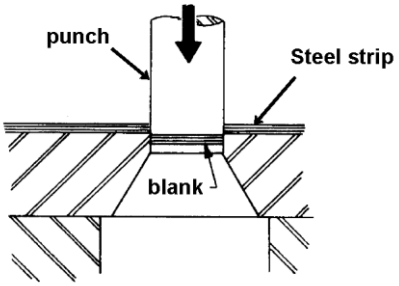
A Blanking and Piercing Press



The steel strip is moved forward one position each time the punch head moves up. Each downward stroke of the punch produces one washer and one piece of waste.

Blanking is when a press is used to cut out a shape that is to be kept and used. The sheet of metal that it has been cut from is the waste.

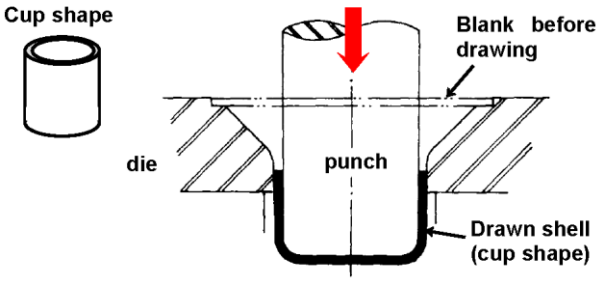
A section view of the Blanking process



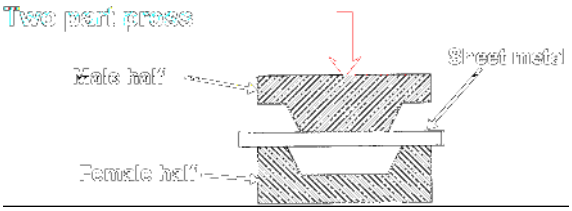
Presswork

Shaping sheet metal by pressing it gives a rigid and tough shell structure. Pressure can be applied by a hydraulic ram.

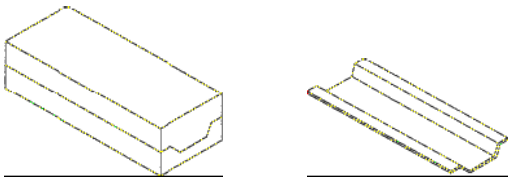
Drawing a metal cup shape



Pressing a channel shape

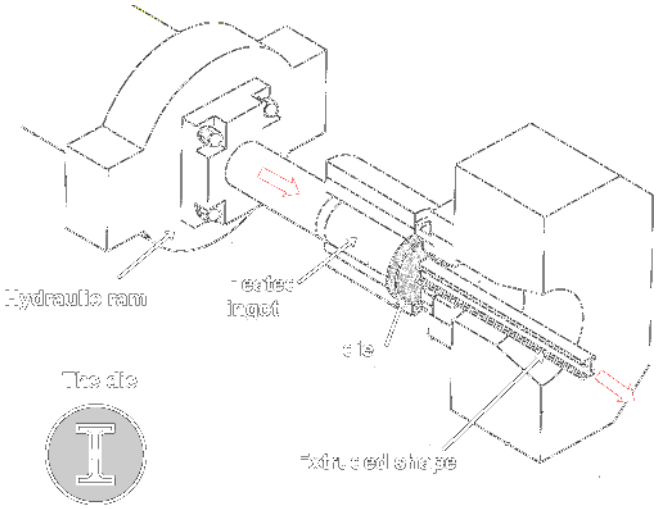


3D view of press **Finished channel shape**



Extrusion

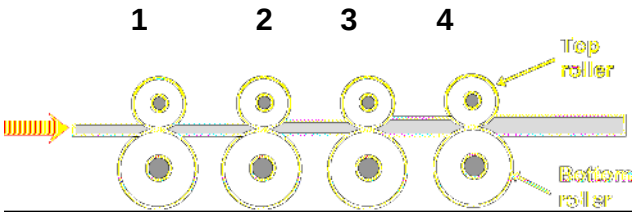
An ingot of metal is heated until it is soft. A hydraulic ram then forces the metal through a shaped hole in a die. This process can produce long lengths of the same shape, e.g. aluminium roof guttering can be produced to the length required (no leaky joints).



Rolling

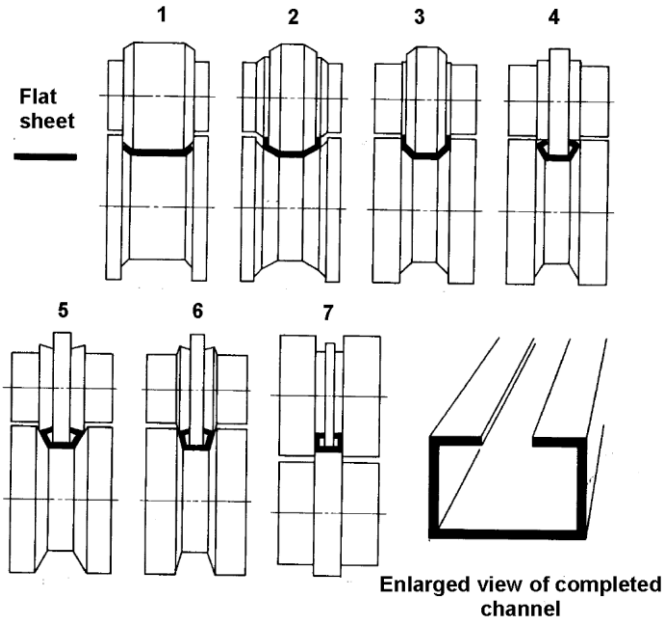
Cold rolling is a process in which a flat strip of metal is passed through a series of rollers that progressively change it into its final shape. Each set of rollers alters the shape a little bit.

The first four of the seven sets of rollers used for making the channel shape are shown below.



Enlarged view of completed channel

A view of each roller in the series, showing how the shape is progressively changed, in seven stages, from a flat sheet to the channel shape.

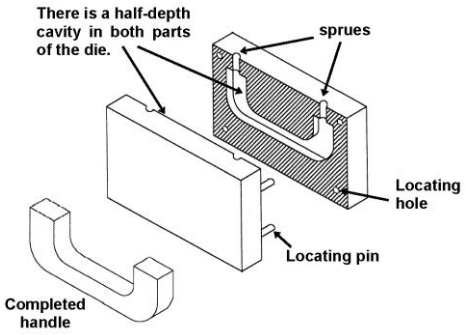


Die Casting

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.

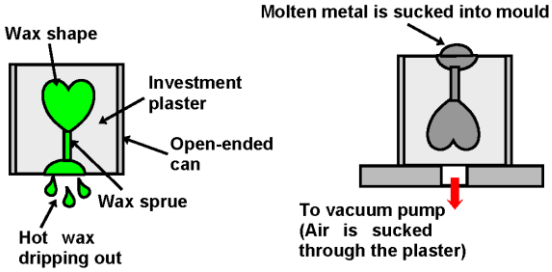
A two piece die for casting an aluminium handle.



Lost Wax Casting (Investment Casting)

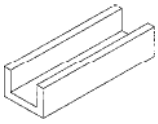
This is a very accurate method of casting small items from jewellery to aircraft engine parts.

1. The shape required is formed in wax. **2.** The shape is then covered in plaster (called investment). **3.** When the plaster is set it is placed in an oven so that the wax can melt and drip out, leaving a cavity of the same shape (the wax is lost). **4.** Molten metal is then forced in and sets. **5.** Finally the plaster is broken off leaving a very accurate casting behind.



KEY WORDS **Blanking: Piercing: Punch: Press: Extrusion: Rolling: Die casting: Lost Wax:**

1. What is the difference between Blanking and Piercing in presswork?
2. Illustrate an example of blanking.
3. Show how a metal cup shape can be made without a seam.
4. Illustrate **two** different ways of making a flat steel strip into the shape shown below.



5. The diagram below shows the cross-section of a length of aluminium roof guttering, 8 metres long. Explain how the guttering can be manufactured.

6. Which casting system is most suited for making a large number of identical components and why?
7. Which is the most accurate method of casting?

WELDING METAL

Welding is a permanent method of joining two pieces of the same metal together by melting them both and letting them fuse together as they cool down and become solid again.

Welding is normally used for steel and aluminium. There are three main types of welding:

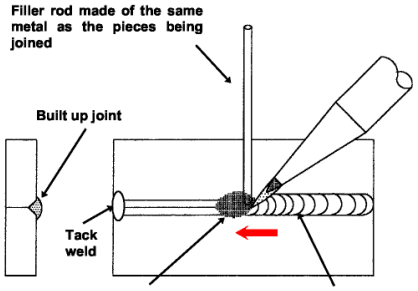
Gas - using an oxyacetylene gas flame

Arc - using an electric spark

Resistance - using an electric current.

Gas Welding

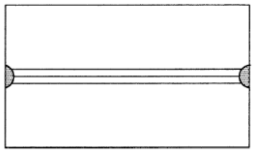
This is the most common form of welding used in schools. Heat is supplied by an oxyacetylene torch that burns acetylene gas mixed with pure oxygen, to a temperature of 3,500°C.



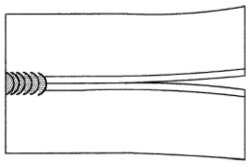
The filler rod is used to build up the joint and to replace the metal that has evaporated. The flame is moved forward in a series of small circular movements to heat a wider area than the diameter of the flame.

Flux is not normally used for welding steel, but is essential in large quantities, when welding aluminium.

Before welding along a joint, both ends need a small weld to hold the ends together. This is called a **tack weld**.

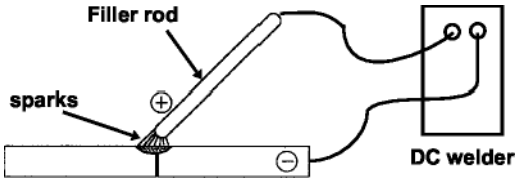


If the ends are not tacked the pieces will warp in the heat and the joint will separate.



Arc Welding

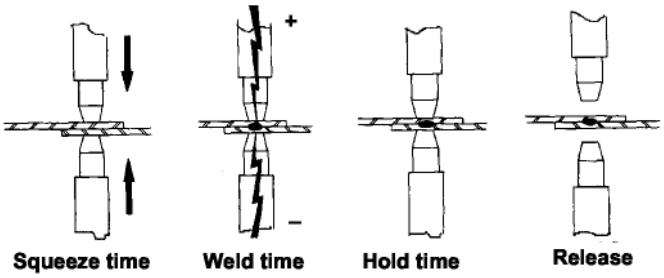
The joint metal and the filler rod are both connected to an electric circuit. When the rod is held a short distance away from the joint, sparks fly between the two. The temperature of the sparks is so high that both the end of the rod and the joint metal melt and form a weld pool.



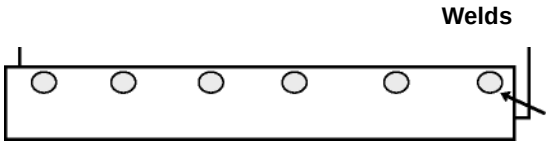
Resistance Welding

Also known as '**spot welding**', this is suitable for thin sheet steel. It relies upon passing a current through the sheets of metal and heating them up where they touch each other, because this is where there is most resistance. (Electrical resistance produces heat).

Two electrodes squeeze the sheets together and then pass an electric current through for approximately 2 seconds, then hold until the weld sets (2 or 3 seconds).



Resistance welding does not produce a continuous weld. The result is like a line of tack welds 30 to 40 mm apart.



1. What are the three main types of welding?
2. Which gases are burnt to produce a welding flame and at what temperature do they burn at?
3. Why is filler rod used?
4. The flame is moved in a series of small circles, why is this?
5. Illustrate why a joint should be tack welded at both ends first.
6. Explain, with illustration, how arc welding works.
7. What provides the heat when spot welding?
8. Illustrate the spot welding cycle and the resulting joint.