



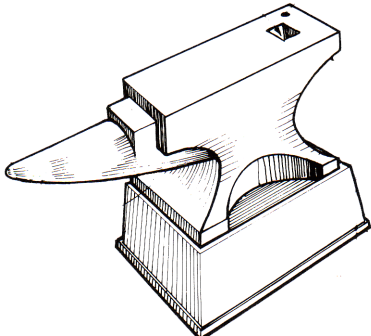
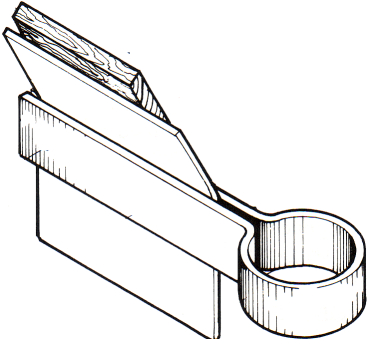
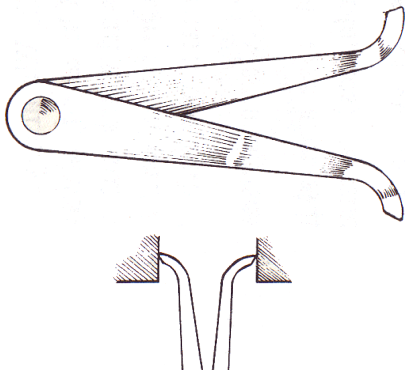
Turnbull High School  
Technical Department

**Practical Metalworking**

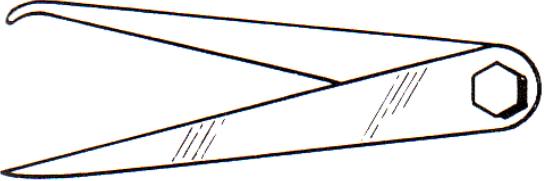
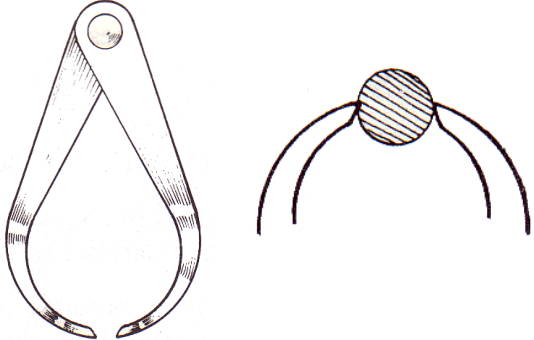
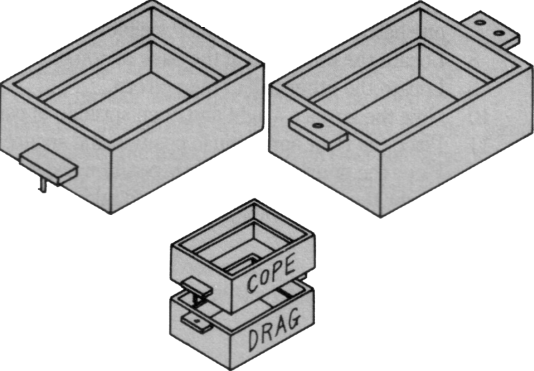
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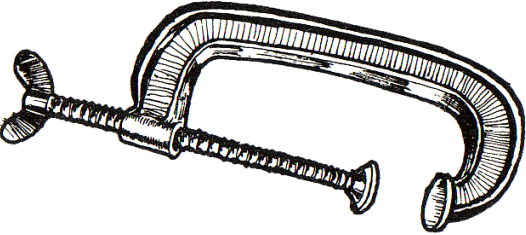

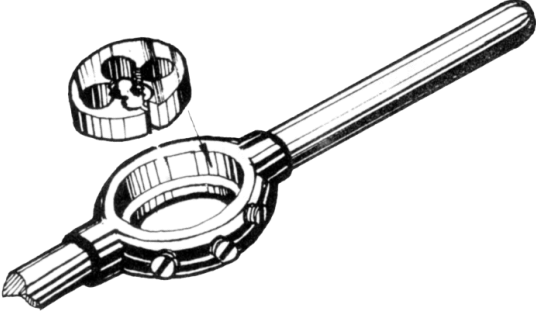
## Practical Metalworking

Tool	Name	Uses
	<b>ANVIL</b>	<p>The Anvil is made from Mild-Steel with a hardened steel working surface welded onto it. It is usually mounted on a Cast-Iron anvil stand to raise it to the correct working height. The main use for the Anvil is during forging operations when metal is pre-heated in the forge before working using the Anvil and other related tools.</p> <p><b>PROCESS—FORGING</b></p>
	<b>BENDING BARS</b>	<p>Where it is required on a sheet of metal, Bending bars are used to fold the material in a straight line. The process involves bending a small piece at a time working back and forth along the material.</p> <p><b>PROCESS—SHEET METALWORK</b></p>
	<b>CALIPERS - INSIDE</b>	<p>The inside calipers are used to measure the inside diameter or size of tubes or similar work-pieces.</p> <p><b>PROCESS - MEASUREMENT</b></p>

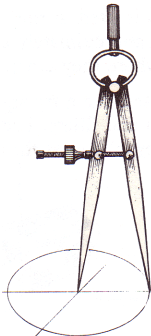
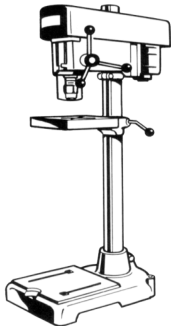
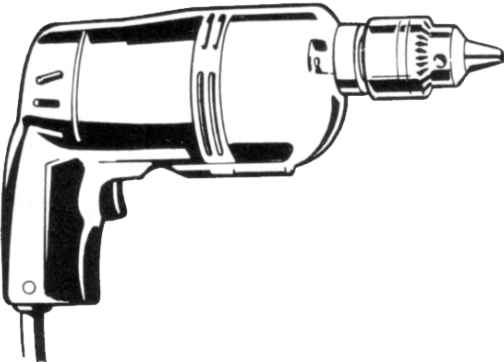
## Practical Metalworking

Tool	Name	Uses
	<p style="text-align: center;"><b>CALIPERS -ODD-LEG</b></p>	<p>Odd-Leg Calipers are used to mark lines parallel to a true edge. They can also be used to find the centre of a piece of material. These calipers can be used on both Metal and Plastic.</p>
	<p style="text-align: center;"><b>CALIPERS -OUTSIDE</b></p>	<p>The outside calipers are used to measure the outside diameter or size of tubes or similar work-pieces, as well as the thickness of materials.</p> <p style="text-align: center;"><b>PROCESS - MEASUREMENT</b></p>
	<p style="text-align: center;"><b>CASTING -COPE AND DRAG</b></p>	<p>The Cope and Drag are the top and bottom section of the mould used in sand-casting. The piece to be casted, the pattern, is put first in the Drag and the casting sand is packed around it before fitting the cope and repeating the packing to make the mould ready for casting.</p> <p style="text-align: center;"><b>PROCESS - CASTING</b></p>

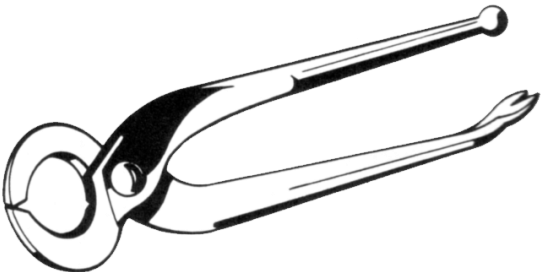
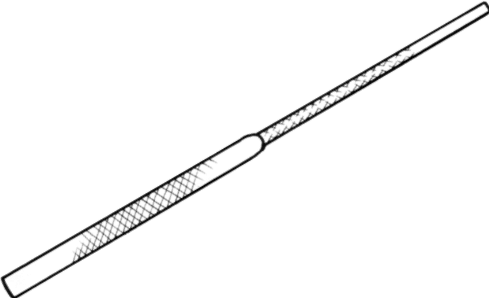
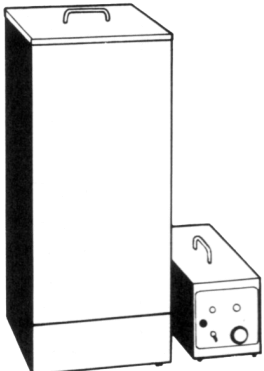
## Practical Metalworking

Tool	Name	Uses
	<p>CRAMP- G-CRAMP</p>	<p>The G-Cramp is used to hold a work-piece down when it is being worked on, or to hold a structure together while being worked on.</p> <p style="text-align: center;"><b>PROCESS - ASSEMBLY</b></p>
	<p>Dies (Split)</p>	<p>These are used external threads. They are made from hardened and tempered carbon steel or high speed steel and are held in another tool called a die-holder which makes using the Die a lot easier and more controllable. One side of the die is tapered, this is the side you should start cutting the thread with. The split in the Die enables the Die to be opened to adjust the when cutting cut of the Die so that a thread can be re-cut if it is found to be too tight.</p> <p style="text-align: center;"><b>PROCESS - THREADING</b></p>
	<p>DIES - DIE HOLDER</p>	<p>The Die fits into the Die-Holder as shown with the tapered side of the die facing out of the holder. The adjustment screws on the side of the holder are used to both adjust and to locate the die. The centre screw opens the split die the more it is tightened and the outer screws hold the Die into the holder.</p> <p style="text-align: center;"><b>PROCESS - THREADING</b></p>


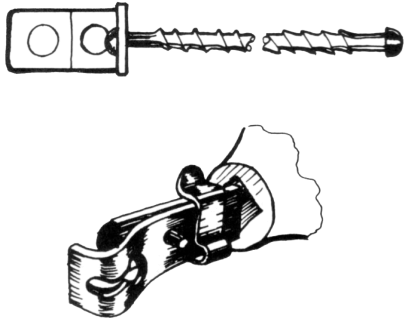
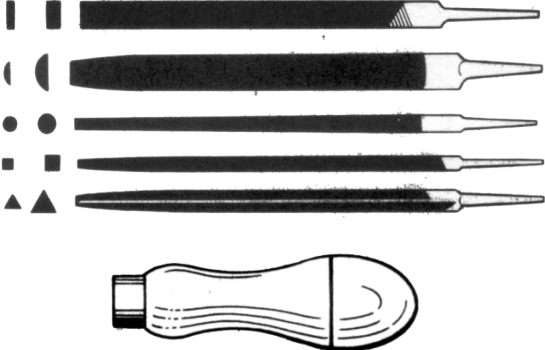
## Practical Metalworking

Tool	Name	Uses
	<b>DIVIDERS</b>	<p>Dividers are used when marking out on Metal and Plastic. They are used in much the same way as you would use a compass to draw an arc or circle onto paper. The Dividers have two sharp pointed ends, one will locate in the centre of the circle, which may be centre-punched on metal to make the job easier, and the other end will be used to scribe the curve.</p> <p><b>PROCESS - MARKING-OUT</b></p>
	<b>DRILL -PILLAR or PEDESTAL DRILL</b>	<p>These type of drill are usually chosen as they are very portable. They can be taken to the work-piece and with the increased use of cordless drills, they can be used in situations where only a manual drill could have been used before.</p> <p><b>PROCESS - DRILLING</b></p>
	<b>DRILL - POWER(HAND)</b>	<p>These type of drill are usually chosen as they are very portable. They can be taken to the work-piece and with the increased use of cordless drills, they can be used in situations where only a manual drill could have been used before.</p> <p><b>PROCESS - DRILLING</b></p>

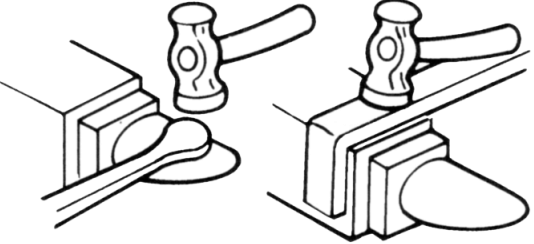
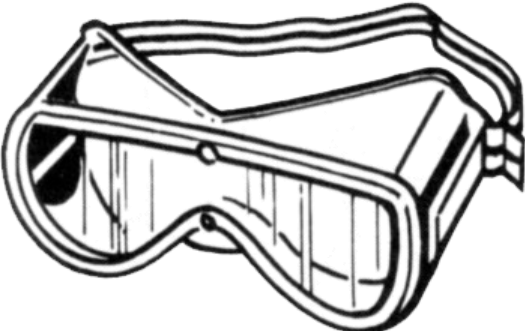
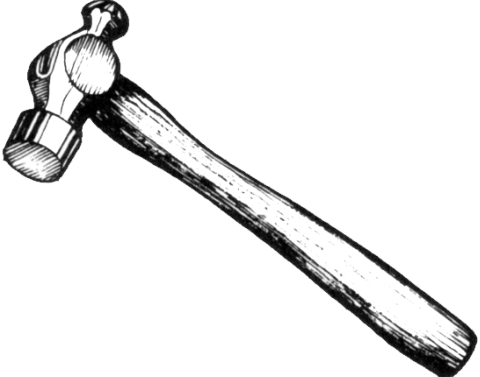
## Practical Metalworking

Tool	Name	Uses
	<p>END CUTTERS</p>	<p>The End-Cutters are used to trim back rivets to the correct size when manual riveting.</p> <p style="text-align: center;"><b>PROCESS - RIVETING</b></p>
	<p>FILE -NEEDLE FILE</p>	<p>A needle file is a very small file (120mm-180mm are typical sizes) and are used for very precise work. Due to the files being very thin and small they must be handled with care as they are easily broken.</p> <p style="text-align: center;"><b>PROCESS - FILING</b></p>
	<p>FLUIDISER</p>	<p>The Fluidiser is used to plastic coat metal components. It works by blowing air through plastic powder, this makes the powder behave like a liquid. The metal components, once they have been heated to a suitable temperature high enough to make the plastic powder stick to it, is dipped into the fluidised bath of plastic powder, where it becomes coated. It can then be placed in an oven to give the plastic time to turn into a smooth glassy finish.</p> <p style="text-align: center;"><b>PROCESS - DIP-COATING</b></p>

## Practical Metalworking

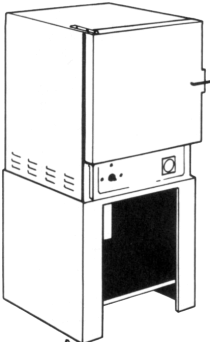
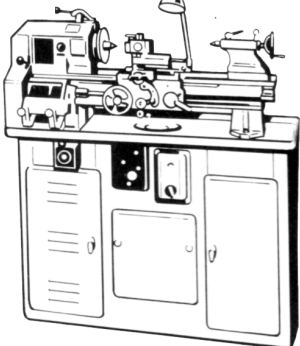
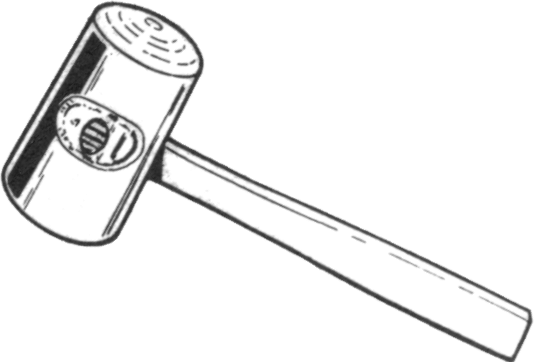
Tool	Name	Uses
	<p style="text-align: center;">FILES -FILE-CARD</p>	<p>The File-Card is used to clean the File when the teeth of the file get clogged or filled with waste material.</p> <p style="text-align: center;"><b>PROCESS - FILING</b></p>
	<p style="text-align: center;">FILES - ABRA FILE</p>	<p>The Abra file is a very thin flexible file which is usually used in conjunction with a small saw frame. The file is round and enables the Abra File to cut complex shapes in thin metals, plastics and woods by being able to cut in all directions. The diagram shows the fixing to help it attach it to the saw as well as details of the blade as well.</p> <p style="text-align: center;"><b>PROCESS—FILING</b></p>
	<p style="text-align: center;">FILES -WORKSHOP FILES</p>	<p>The files shown are the typical type of files found in a workshop. They are the FLAT, HALF-ROUND, ROUND, SQUARE and THREE-SQUARE. The sharp part at the end of the files shown is called the tang, it is this that fits into the file handle which is also shown. A file should never be used without a handle as the tang is very sharp. The files can be used on all three materials used in the course.</p> <p style="text-align: center;"><b>PROCESS - FILING</b></p>

## Practical Metalworking

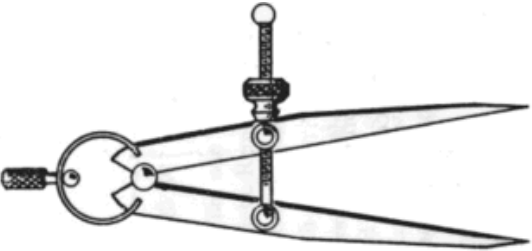
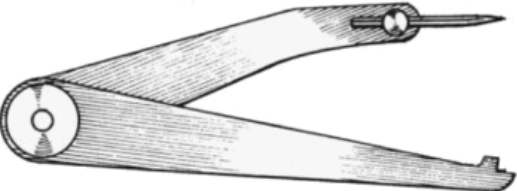
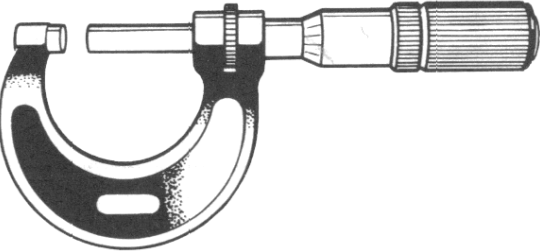
Tool	Name	Uses
 An illustration showing two hammers and an anvil. One hammer is positioned to strike a piece of metal on the anvil, while the other is shown in a different position, possibly demonstrating a different forging technique.	FORGING	<p>Forging is achieved by heating metal until it is red hot and then by using an anvil to support it and a hammer to strike it. This enables shapes to be created using forging operations.</p> <p><b>PROCESS - FORGING/HEAT TREATMENT</b></p>
 An illustration of a pair of safety goggles with a strap, designed to protect the eyes from flying debris or sparks.	GOGGLES	<p>Goggles are the main protection for eyes when using machines in the Craft and Design workshop. They enable clearer vision as well as protection from foreign objects entering the eyes.</p> <p><b>SAFETY</b></p>
 An illustration of a ball-pein hammer, featuring a wooden handle and a metal head with a flat face and a rounded, ball-shaped end.	HAMMER -BALL-PEIN	<p>The Ball-Pein Hammer is used in many situations. The most common are when forging, chiseling with metal and when riveting.</p> <p><b>PROCESS - SHAPING/RIVETING</b></p>



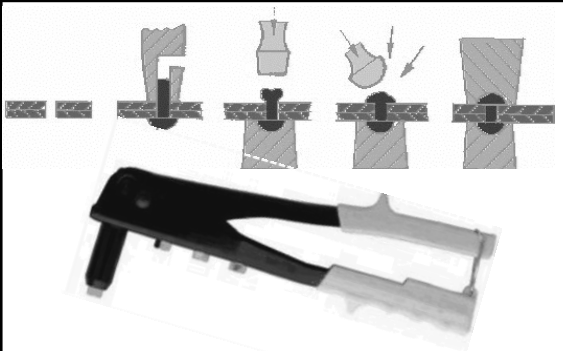
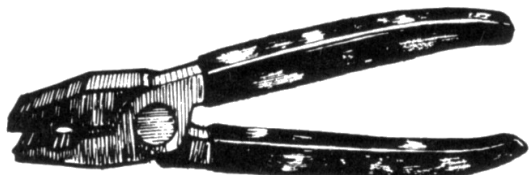

## Practical Metalworking

Tool	Name	Uses
	<p style="text-align: center;"><b>HEATER - CONVECTION OVEN</b></p>	<p>The Convection Oven is used for several things in Practical Metalworking. It is used mostly to heat metals to the correct temperature before they are dip-coated and returned to the hot oven for the plastic coating to gloss-over. .</p> <p style="text-align: center;"><b>PROCESS - HEATING METALS FOR PLASTIC</b></p>
	<p style="text-align: center;"><b>LATHE -METAL WORKING</b></p>	<p>The Metalworking Lathe is used to cut metal into different shapes. It works by rotating the metal work-piece very quickly and then use cutting tools to shape the rotating material.</p> <p>Processes include, facing-off, parallel turning, drilling, threading, taper turning, chamfering and knurling.</p> <p style="text-align: center;"><b>PROCESS - SHAPING METAL</b></p>
	<p style="text-align: center;"><b>MALLET - HIDE</b></p>	<p>The main use for the Hide Mallet is shaping of sheet metal. The reason the Hide material is used is that it does not mark or damage the sheet metal to the same degree as hammers and other types of mallet.</p> <p style="text-align: center;"><b>PROCESS - SHAPING METAL</b></p>

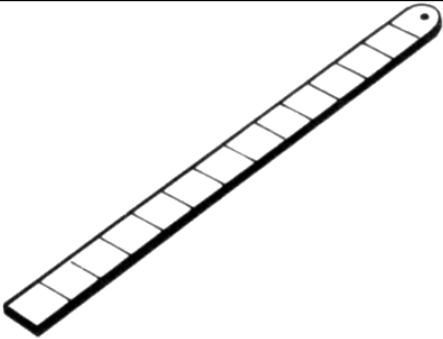
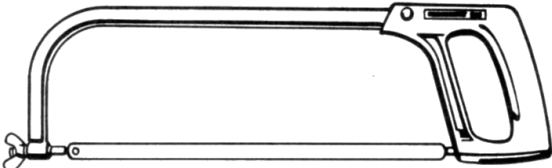

## Practical Metalworking

Tool	Name	Uses
	MARKING OUT-DIVIDERS	<p>The Dividers are used to mark our circular shapes onto metal. The Dividers will need a Centre-Punched mark to locate one end of the Divider to stop it slipping on the surface of the metal.</p>
	MARKING OUT-ODD-LEG CALIPERS	<p>The Odd-Leg Calipers are used for marking lines parallel to a known edge. The sharp point marks the metal and the stepped end locates onto the edge of the metal.</p> <p><b>PROCESS - MARKING OUT</b></p>
	MICROMETER	<p>Micrometers are used to measure objects with great accuracy. It is mostly used to measure metal materials which are either flat or round.</p> <p><b>PROCESS - MEASUREMENT</b></p>

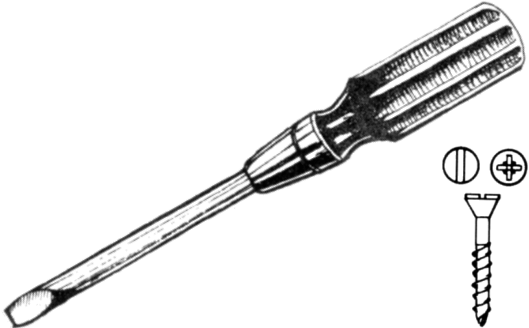


## Practical Metalworking

Tool	Name	Uses
 <p>The diagram shows four stages of riveting: 1. A hole is drilled in a metal plate. 2. A rivet is inserted into the hole. 3. The rivet is partially inserted into a second metal plate. 4. The rivet is fully inserted and the two plates are joined. Below the diagram is a black and silver pop-rivet gun.</p>	<p>RIVETING</p>	<p>Riveting can be done using solid rivets and also using a pop-rivet gun (on bottom). Riveting joins metal plates together permanently and is very strong.</p> <p style="text-align: center;"><b>PROCESS - JOINING METALS</b></p>
 <p>A pair of black pliers with a serrated cutting edge on the jaws.</p>	<p>PLIERS</p>	<p>Pliers are mainly use to grip small work pieces. Some types of pliers also have an extra cutting area which makes it possible to use them as wire-cutters. Although they come in many shapes and forms, a typical set of pliers is shown here.</p> <p style="text-align: center;"><b>PROCESS - MANY USES</b></p>
 <p>A grey metal centre punch with a conical tip and a hexagonal base.</p>	<p>PUNCHES- CENTRE</p>	<p>The punch shown here is a Centre Punch, it is mostly used for marking out on metal where it is used to mark a centre position when a hole is to be drilled.</p> <p style="text-align: center;"><b>PROCESS - MARKING OUT</b></p>

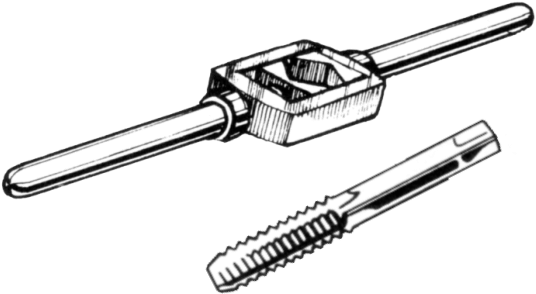
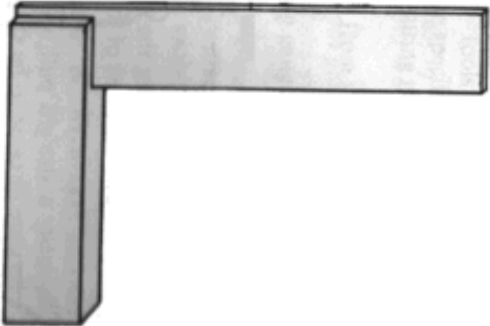
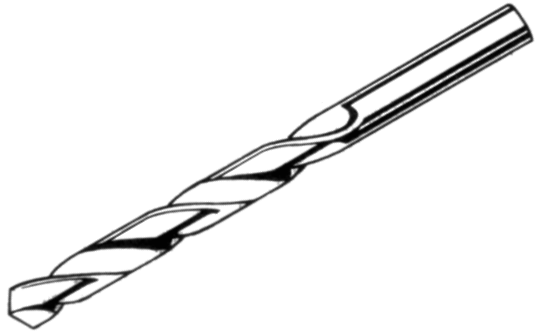
## Practical Metalworking

Tool	Name	Uses
	<b>RULER</b>	<p>The Ruler is used for general measurement up to 300mm. The flat end where the scale starts is very useful when used in conjunction with other Marking Out tools as well as normal measurement tasks. For sizes greater than that covered by this type of rule, a metre stick should be used</p> <p style="text-align: center;"><b>PROCESS - MEASUREMENT</b></p>
	<b>SAW -HACKSAW</b>	<p>This Hacksaw is mainly used to cut metal and features a thin replaceable blade pulled tight across the saw frame.</p> <p style="text-align: center;"><b>PROCESS - SHAPING METAL</b></p>
	<b>SAW -JUNIOR HACKSAW</b>	<p>The Junior Hacksaw is used in a similar way to the Hacksaw shown above, but as it is a lot smaller, it is used on smaller work-pieces or where access is limited. As with the larger Hacksaw, the blade is easily replaced when worn out.</p> <p style="text-align: center;"><b>PROCESS - SHAPING METAL</b></p>

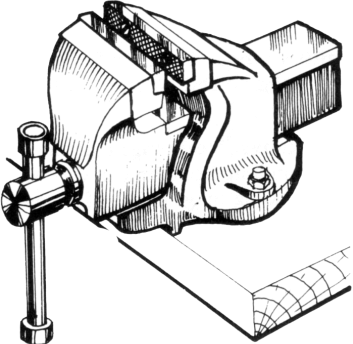
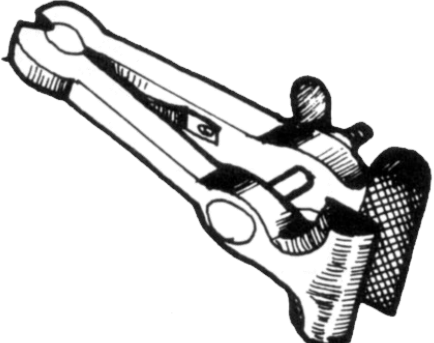

## Practical Metalworking

Tool	Name	Uses
	SCREWDRIVER	<p>There are several types of Screwdrivers used in Practical Metalworking, each type will look slightly different as they are designed for different tasks. The major design difference is the blade and what type of screw it is designed to work with. Two types of screw are shown here, the SLOT and PHILLIPS, each has its own design of screwdriver to cope with its shape.</p> <p><b>PROCESS - JOINING MATERIALS</b></p>
	SCRIBER	<p>The Scriber is used in a similar way to a pencil on wood, when marking lines onto Metal and Plastics. The point of the Scriber is made of tool steel which is very hard and capable of marking onto most common materials used in Practical Metalworking</p> <p><b>PROCESS - MARKING OUT</b></p>
	TIN SNIPS	<p>Snips, or as they are sometimes called, Tin snips, are used for cutting out shapes in sheet metals and sometimes soft plastics. Snips come in several forms which makes them suitable to cut in straight lines, curves to the left of curves to the right.</p> <p><b>PROCESS - CUTTING METALS</b></p>




## Practical Metalworking

Tool	Name	Uses
	<p>TAPS</p>	<p>Taps are used to cut internal threads in Metals and Plastics. The Tap Holder at the top of the picture, is used to grip the Tap so it can be used to cut a thread inside a pre-drilled hole. The Tap is made from very hard materials such as high-speed steel or tempered carbon steel so that they do not wear when being used.</p> <p style="text-align: center;"><b>PROCESS - THREADING</b></p>
	<p>ENGINEERS SQUARE</p>	<p>The Engineers Square has many uses in Practical Metalworking. It can be used for marking with a scribe or pen for lines at 90° to an edge. It is also used to check right angles across the end of a piece of material or checking squareness when assembling or constructing a model.</p> <p style="text-align: center;"><b>PROCESS - MARKING OUT/ASSEMBLY</b></p>
	<p>TWIST DRILLS</p>	<p>The Twist Drill is the most commonly used type of drill used in Craft and Design. It can work on all materials used in the course and can be used in hand-drills as well as powered drills. The maximum size of drill that can be used depends on the size of the chuck used in the drill itself.</p> <p style="text-align: center;"><b>PROCESS - DRILLING</b></p>

## Practical Metalworking

Tool	Name	Uses
	<p><b>VICE -ENGINEERS</b></p>	<p>The Engineers Vice is Bolted to the bench and is used to hold metal. The addition of a soft material as jaw-covers enables soft metals and plastics to be held in this type of vice without being damaged by the hardened diamond pattern grips fixed in the vice.</p> <p style="text-align: center;"><b>PROCESS - GENERAL METALWORKING</b></p>
	<p><b>VICE -HAND VICE</b></p>	<p>The Hand Vice is used for holding small and irregular shaped work-pieces when operations such as riveting or drilling are being undertaken. This type of vice is also very useful when drilling sheet metals.</p> <p style="text-align: center;"><b>PROCESS - GENERAL METALWORKING</b></p>
	<p><b>WELDING- MIG-WELDER</b></p>	<p><b>Metal Inert Gas (MIG) welding</b> is a welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. Welders wear protective clothing, including heavy leather gloves and protective long sleeve jackets, to avoid exposure to extreme heat and flames. In addition, conventional welding Helmets are worn and they contain dark face plates to prevent exposure to the bright light of the welding arc.</p> <p style="text-align: center;"><b>PROCESS - JOINING METAL</b></p>

## Practical Metalworking

Tool	Name	Uses
	<p style="text-align: center;"><b>WELDING - SPOT-WELDER</b></p>	<p>Spot welding is a process in which contacting metal surfaces are joined by the heat obtained from resistance to electric current flow. Work-pieces are held together under pressure exerted by electrodes and the process uses two shaped copper alloy electrodes to concentrate welding current into a small "spot" and to simultaneously clamp the sheets together.</p> <p style="text-align: center;"><b>PROCESS - Joining Metals</b></p>
	<p style="text-align: center;"><b>WELDING - WELDERS MASK</b></p>	<p>The Welders Mask is used to protect the welders eyes from the very bright light produced by the Welding process which can damage the eyes if they are not adequately protected.</p> <p style="text-align: center;"><b>PROCESS - SAFETY EQUIPMENT</b></p>
	<p style="text-align: center;"><b>WELDING - WELDERS PROTECTION</b></p>	<p>The Apron and Gloves are also safety equipment which must be used when Welding. They stop exposure to harmful light and stop clothes and skin being damaged by welding sparks or particles.</p> <p style="text-align: center;"><b>PROCESS - SAFETY EQUIPMENT</b></p>