WORKING WITH METALS
PART THREE

This mobile revision pdf is based on detailed work found in the 'EQUIPMENT AND PROCESSES' section. Tap on the green link button below to go to the complete website section

Tap the blue button to view equipment / processes covered by this Revision PDF

WORKING WITH METALS PART TWO

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THE JUNIOR HACKSAW

The Junior hacksaw is a small scale version of a full size hacksaw. Two hands are required to use the full size hacksaw, whilst one hand is needed for the junior hacksaw. They are available in a range of designs and two are seen here.

The junior hacksaw is used to cut and shape metals, tube and some plastics. Where thicker and more robust materials are to be cut, a full size hacksaw is used.

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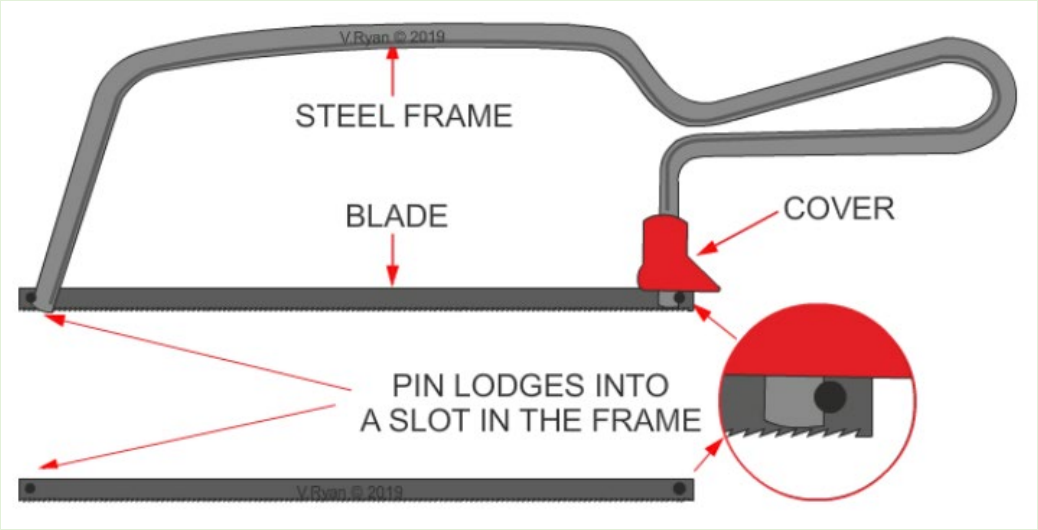

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THE JUNIOR HACKSAW

Junior hacksaw blades are usually 150mm (6 inch) in length and they vary in the number of teeth (per inch). Teeth per inch (TPI), is the standard used across blades, when ordering replacements. The blades are either cast steel or high speed steel. High speed steel are more expensive, but tend to retain their sharpness longer and are less likely to break. They are normally bought in packs of 5 or 10.

Tap the image for more information

TEETH PER INCH (25mm)	SUITABLE FOR CUTTING
14 TPI	LARGE SIZES, ALUMINIUM AND OTHER SOFT METALS.
18 TPI	SUITABLE FOR GENERAL WORKSHOP CUTTING.
24 TPI	FOR CUTTING STEEL PLATE UP TO 5/6mm.
32 TPI	FOR CUTTING HOLLOW SECTIONS AND TUBING.

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HOW TO USE THE JUNIOR HACKSAW

Place the material in an engineers vice. The junior hacksaw is held in one hand and then pushed forward (the teeth of the blade face forward, away from the handle). The 'cut' only takes place on the forward stroke. The first few 'cuts' should be taken with care, until a grove is cut in the metal, which guides the saw blade and then more rapid sawing can take place.

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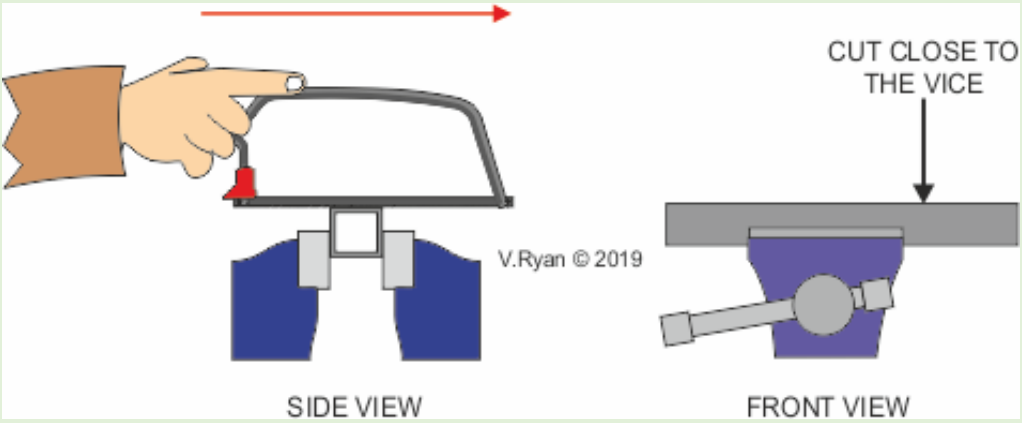

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THE ENGINEERS VICE

An Engineers vice / Fitters vice, is a basic and yet very important piece of equipment. There are a variety of versions, the one below being the ‘plain’ version. The main body is manufactured from cast iron or steel, with the cast iron version being cheaper. The size of the vice is determined by the distance across the jaw (as seen on the front view below) and not the distance between the open jaws,

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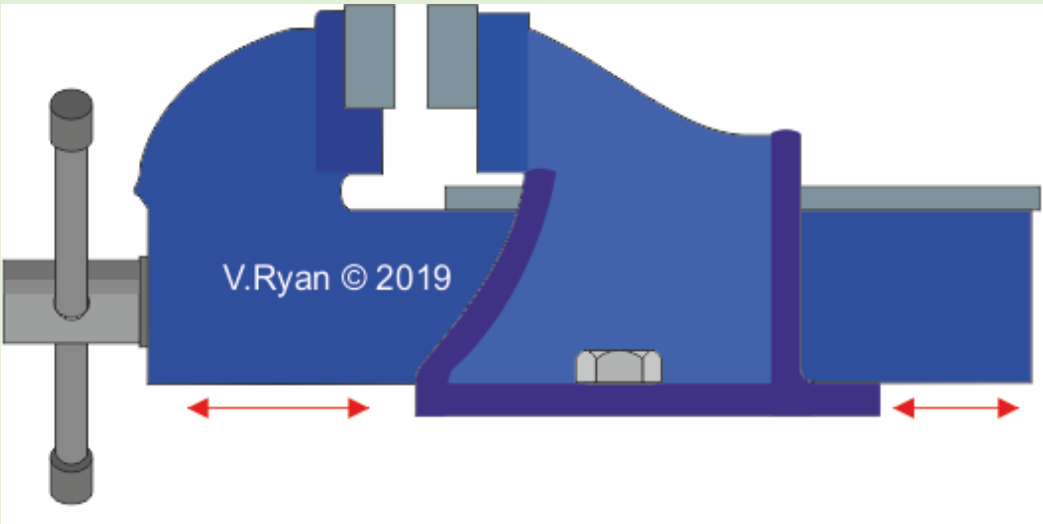

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THE ENGINEERS VICE

Fibre grips fit over the jaws of the vice. They prevent material being marked / damaged when gripped by the steel jaws of the vice. Some vice grips are manufactured from a soft metal such as aluminium (which can be manufactured easily in a workshop).

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HOW TO USE THE ENGINEERS VICE

The engineers vice is normally used, when cutting and filing is taking place.

The diagram below, shows a piece of steel being filed. The material is placed low in the vice and held firmly between the jaws. Fibre jaws have not been used in this case. But, if the surface needs protecting, then fibre jaws should be fitted to each jaw.

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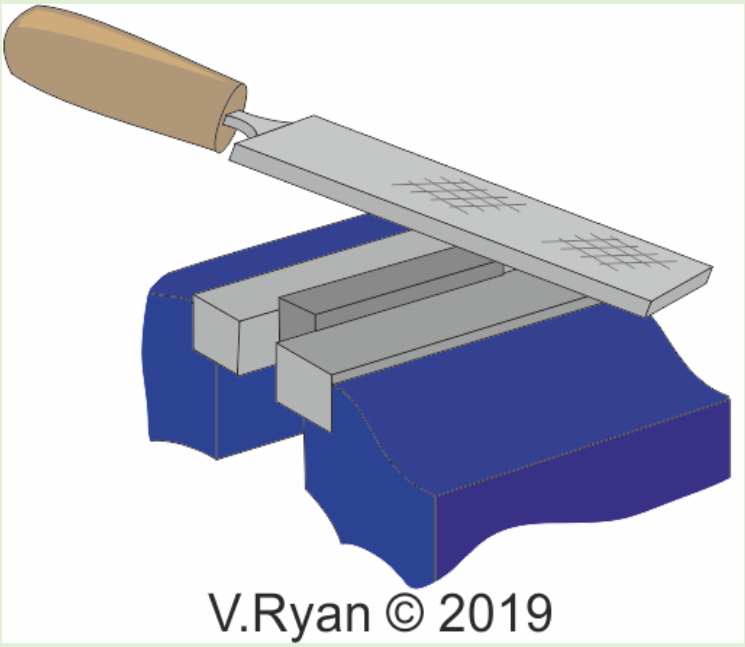

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THE LEG VICE (SOLID BOX VICE)

The Leg Vice is for heavy duty work, being manufactured from wrought iron or mild steel, with cast steel jaw pieces. It is often used during forge work. The long 'tommy bar', allows for forceful leverage. The vice is used for hot and cold forming of metal. It is ideal for holding long pieces of steel, because the jaws are well away from the bench / stand and relatively high from the ground.

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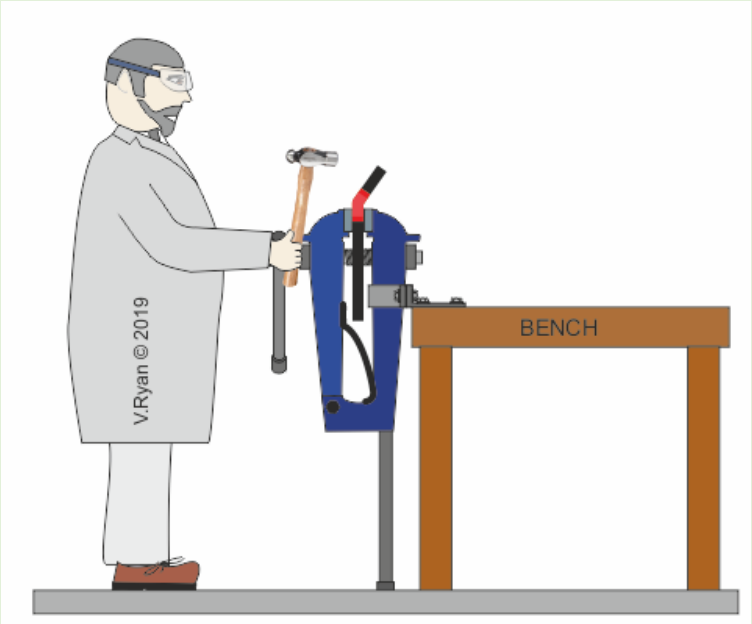

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THE LEG VICE

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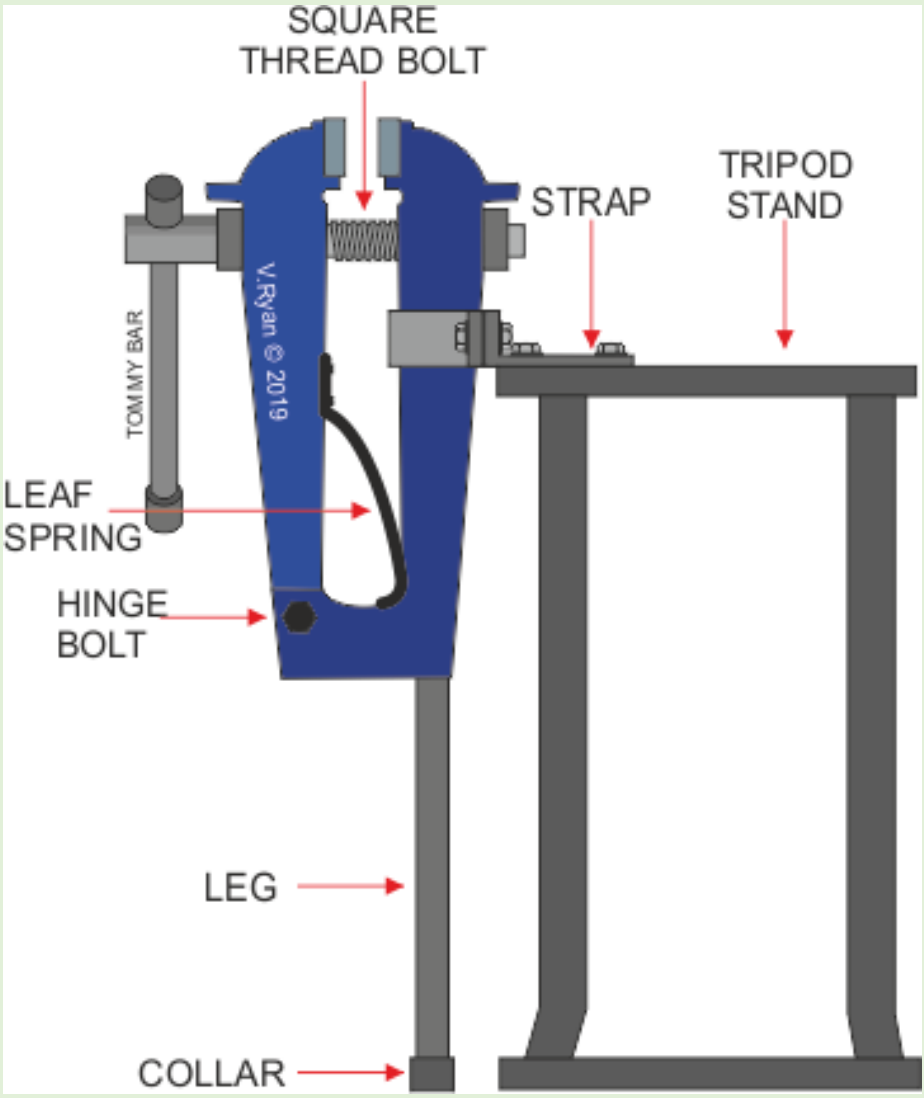

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THREAD CUTTING USING A TAP

Small diameter internal threads can be cut by hand, using a tap holder / wrench. The tap is manufactured from high speed steel. Cheaper versions are manufactured from carbon steel. In both cases they are hardened, in order to withstand the thread cutting they will endure, throughout their usable life time.

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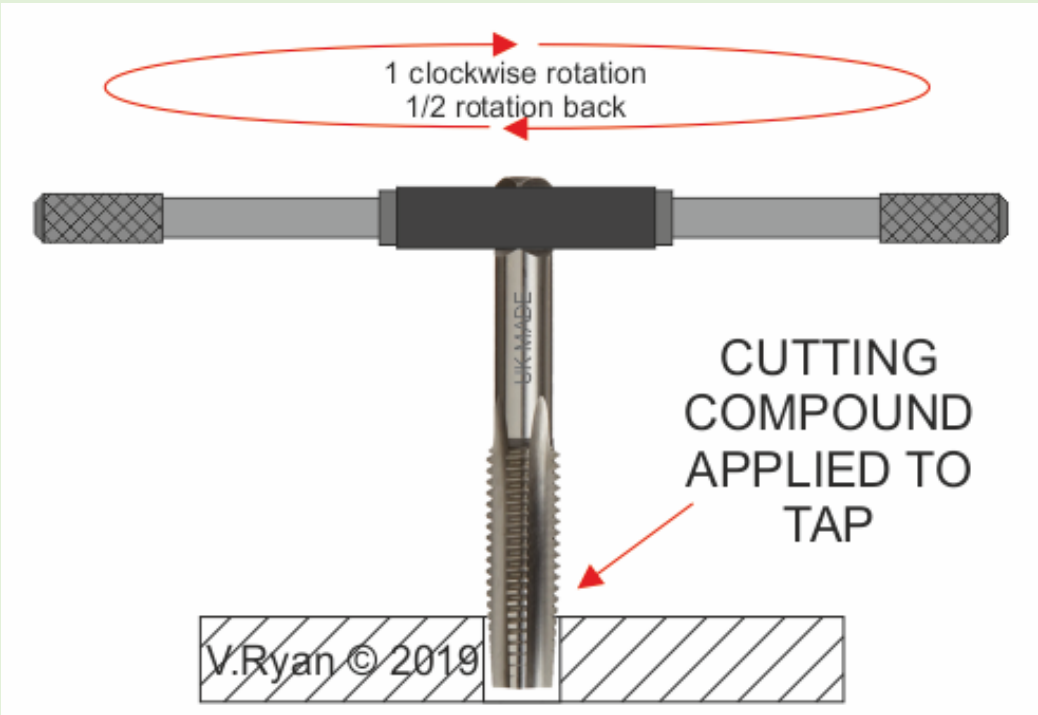

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THREAD CUTTING USING A TAP

Taps are normally bought as a set of three. The ‘taper’ tap is the most used, as it will cut a thread through a hole. If a thread is required in a ‘blind’ hole (a hole NOT drilled all the way through), the taper tap is used first, followed by the ‘intermediate’ tap and finally the ‘plug’ tap.

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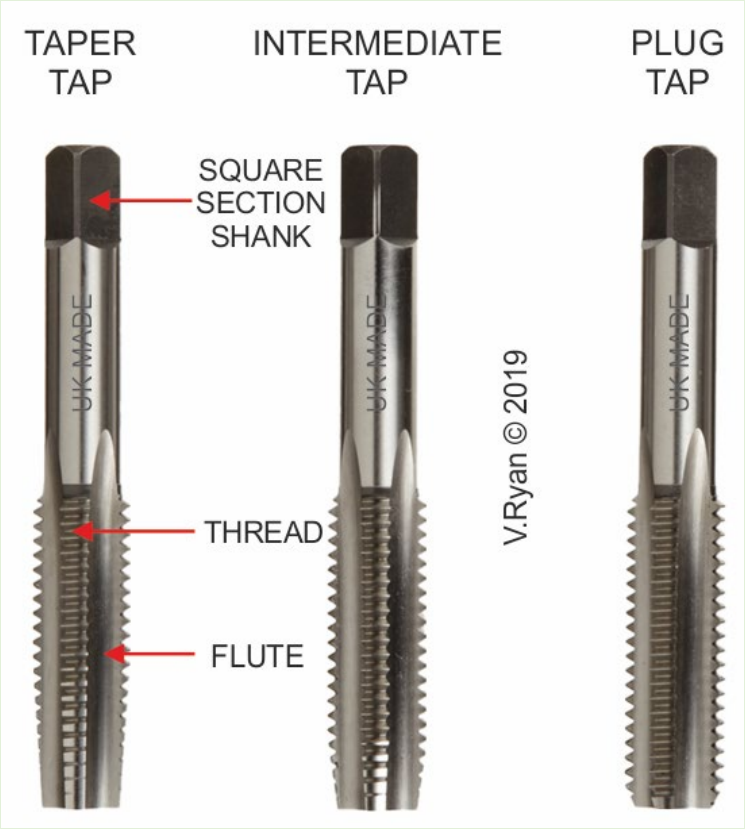

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TAPPING DRILL SIZES

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METRIC SIZE (M)	TAPPING DRILL SIZE
2mm M2	1.6mm
3mm M3	2.5mm
4mm M4	3.3mm
5mm M5	4.2mm
6mm M6	5.0mm
8mm M8	6.8mm
10mm M10	8.5mm
12mm M12	10.2mm
14mm M14	12.0mm
16mm M16	14.0mm
18mm M18	15.5mm
20mm M20	17.5mm

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CUTTING EXTERNAL THREADS WITH A STOCK AND DIE

Cutting an external thread is achieved through the use of a die, held in a stock. Dies are manufactured from carbon steel or high speed steel, hardened and tempered. The stock is usually manufactured from mild steel.

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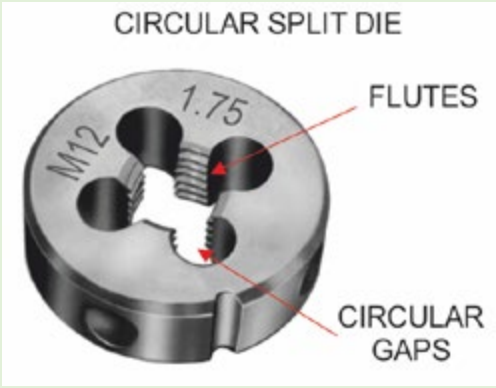

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HOW TO USE A STOCK AND DIE

A chamfer is filed on the end of the steel section. The stock/die is placed on the chamfer and turned a full clockwise rotation, followed by half a turn in an anticlockwise direction. During the process cutting compound is applied to help produce a 'smooth' and accurate thread

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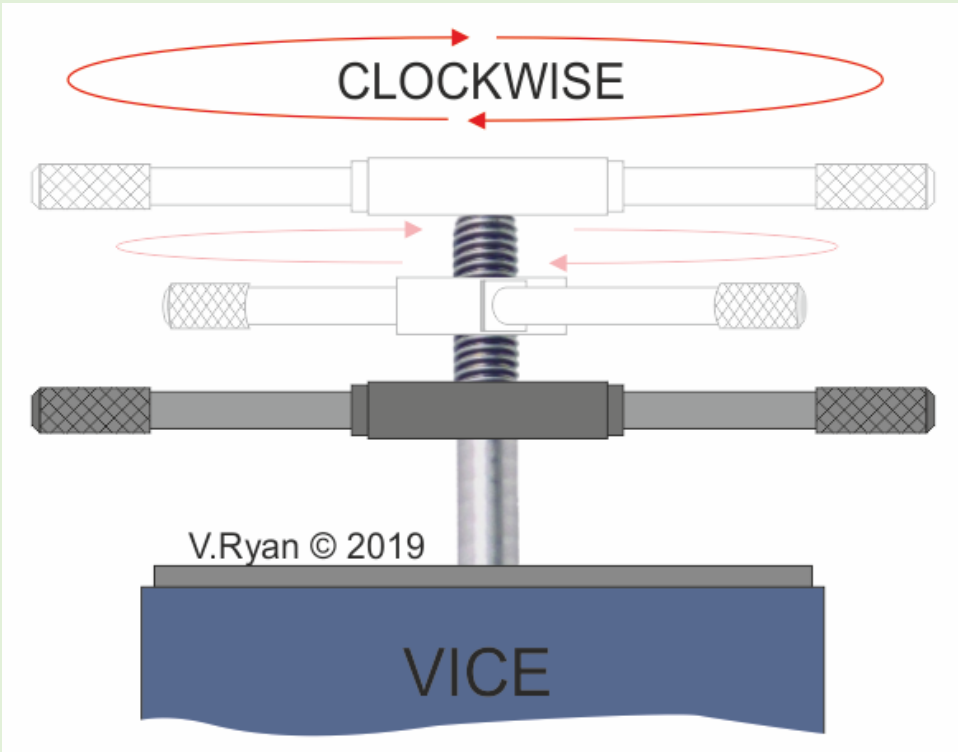

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USING A LATHE AND A TAILSTOCK DIE HOLDER

The Tailstock Die Holder, is used to manually cut a thread, when using a centre lathe. The use of this die 'stock'.
This techniques ensures that the thread is straight and accurately cut.

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USING A LATHE AND A TAILSTOCK DIE HOLDER

The holder fits into the tailstock and the die holder section rotates, through the use of a ‘tommy’ bar. As it is rotated by hand, a thread is cut. This is easier than using a regular stock type die holder.

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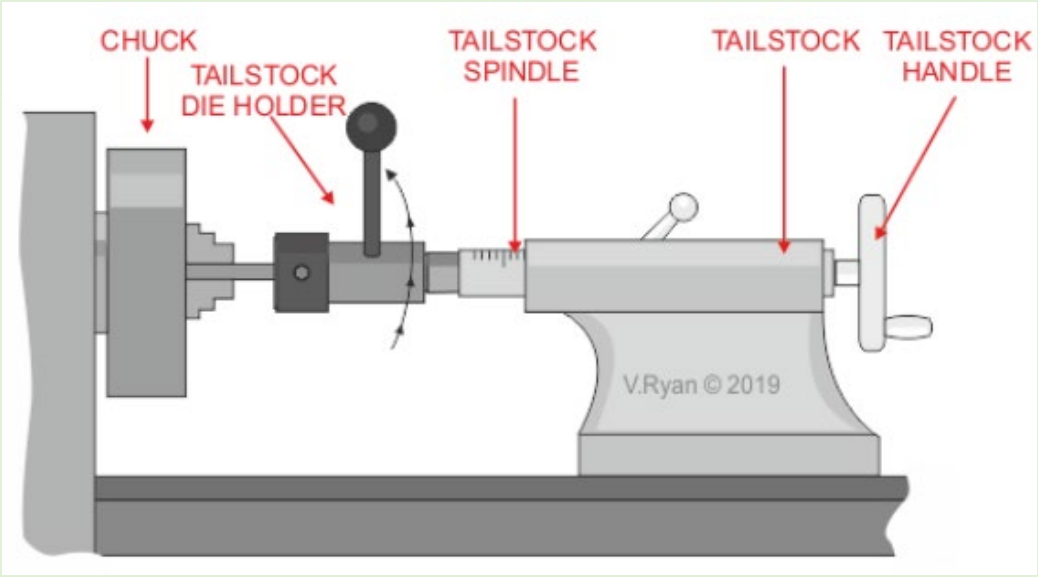

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REAMERS

A drilled hole is accurate for most engineering processes, but there are times when absolute precision is required. When this level of accuracy is needed, a hole is first drilled with a normal twist drill, slightly smaller than the finished hole. The drilled hole should be drilled within 0.05mm to 0.1mm, of the final finished diameter. A reamer is then used to finish the hole to the exact size, producing a smooth finish.

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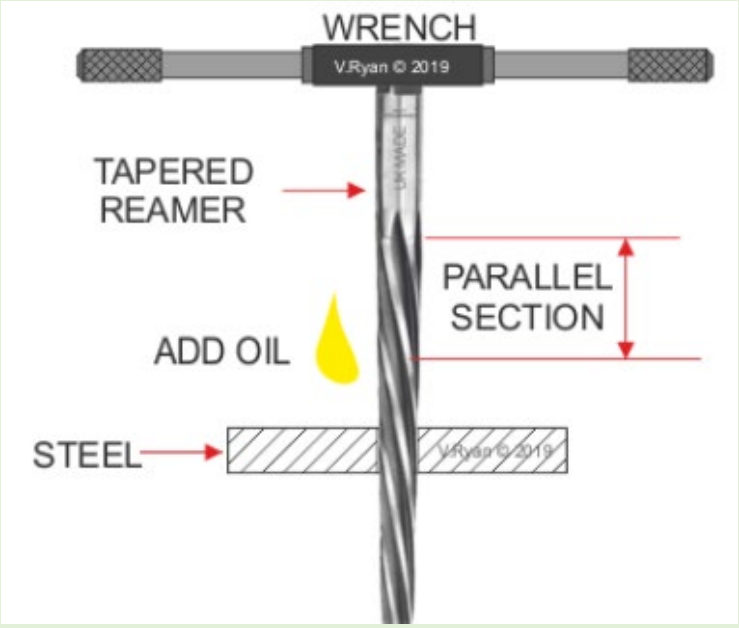

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REAMERS

The three main types of reamer are shown below. Hand reamers, machine reamers and taper reamers.

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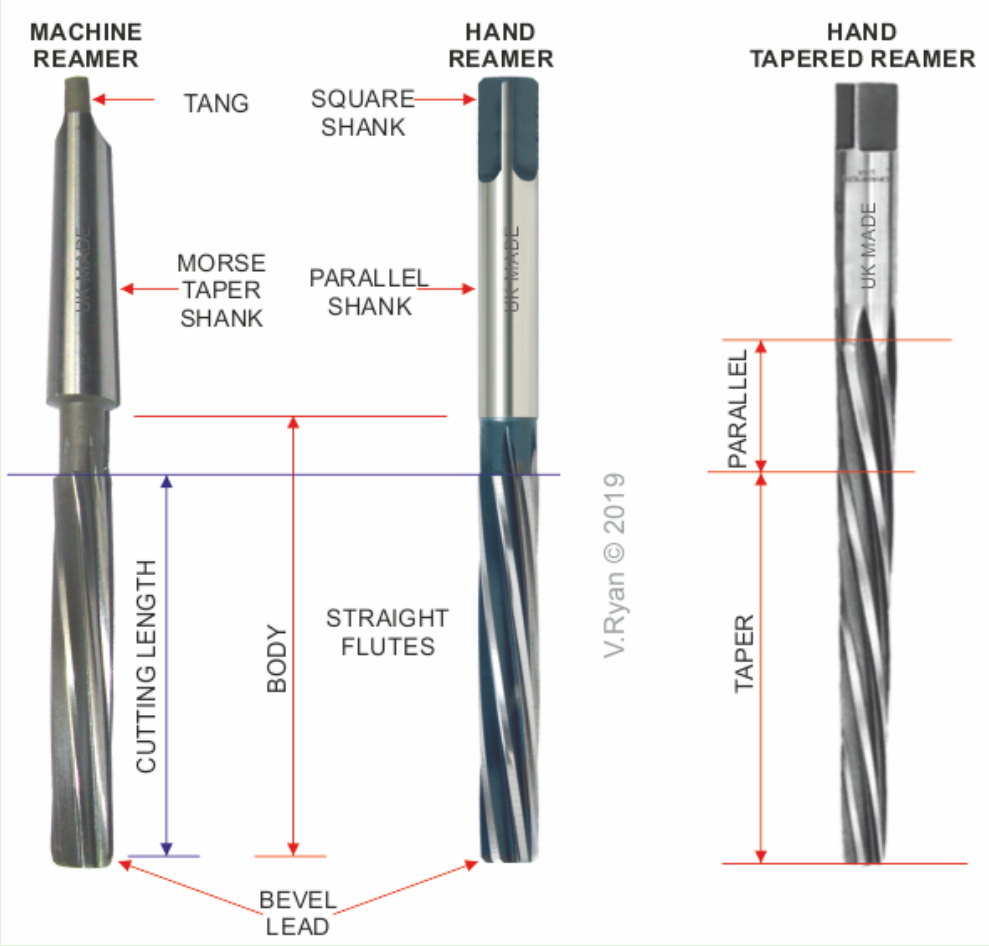

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MACHINE REAMERS

Here, a machine reamer being used, to accurately finish a drilled hole to size. The material has been drilled on the centre lathe, to within 0.05mm of the final diameter. The reamer should be slowly introduced to the material, with coolant being applied liberally. One continuous ‘pass’ of the reamer through the drilled hole, should produce the accurate finished dimension.

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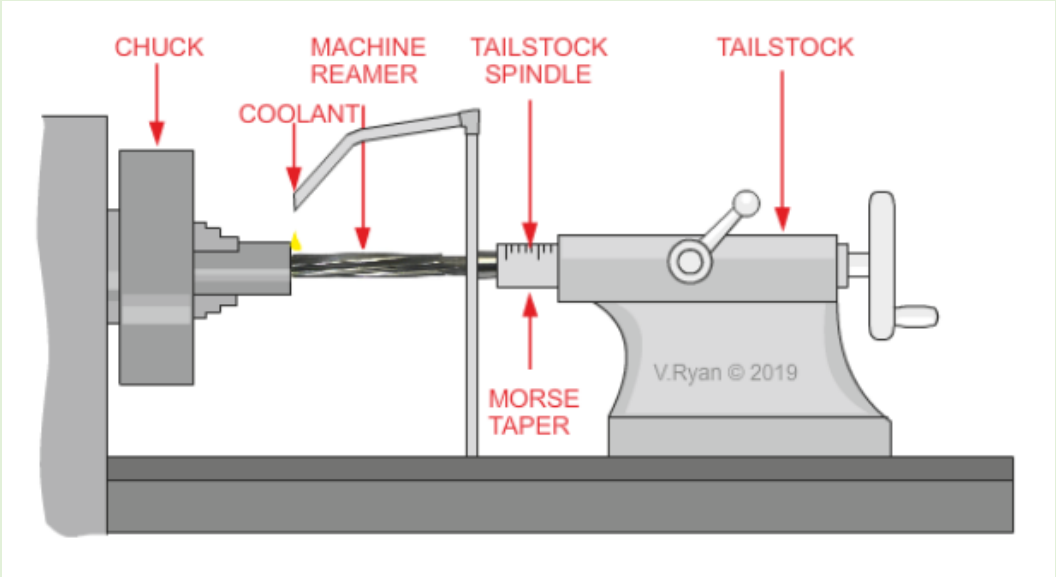

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TAPER REAMERS / TAPER PINS

Taper reamers are used to produce tapered holes, capable of receiving a taper pin. Taper pins are used to fit gears, cams, pulleys and collars to shafts. Shown below is a motor with a pulley wheel attached. The pulley wheel is secured with a tapered pin. The hole goes through the collar of the pulley and the motor's shaft. It has been drilled and then reamed to a specific taper.

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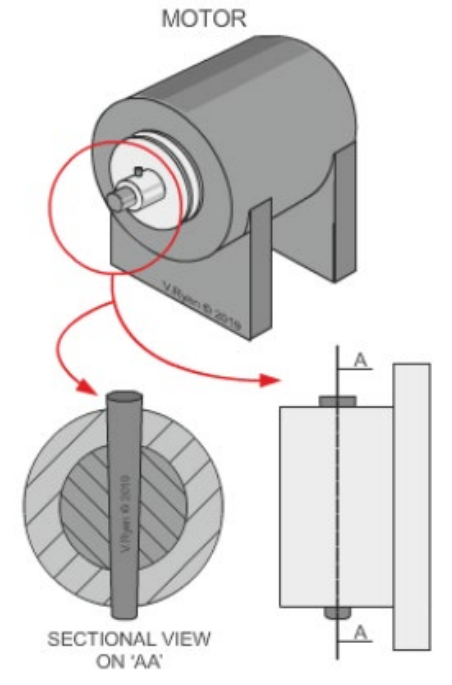

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ADJUSTABLE / EXPANDING REAMERS

Adjustable reamers have 5 or 6 blades, which can be set to ream a small number of accurate diameters.
The diameter is set by turning both the 'adjusting' nuts, at the same time.

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THE PIERCING SAW

The Piercing Saw is normally used to cut and shape non-ferrous sheet metal, such as brass, copper and nickel silver. It holds a very fine blade and is capable of very accurate work.

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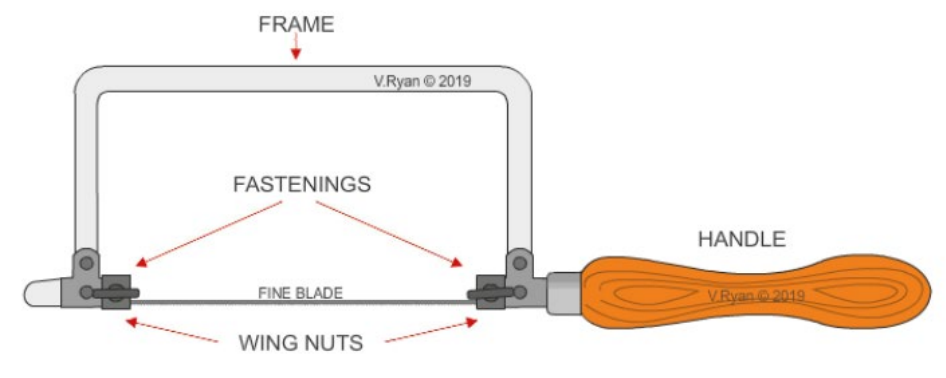

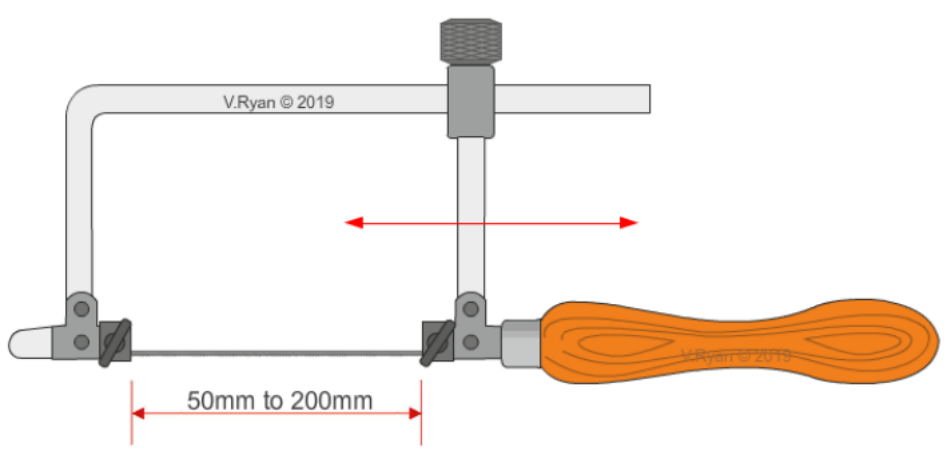

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THE PIERCING SAW

The sheet metal being cut, is placed on a jeweller's bench pin (sometimes called a V-board or bird's mouth board). The metal is held down firmly, whilst the saw is held almost vertically and sawing begins. Sawing should be even and constant, using the full length of the blade. Wiping the blade with bees wax, helps produce a smooth sawing action

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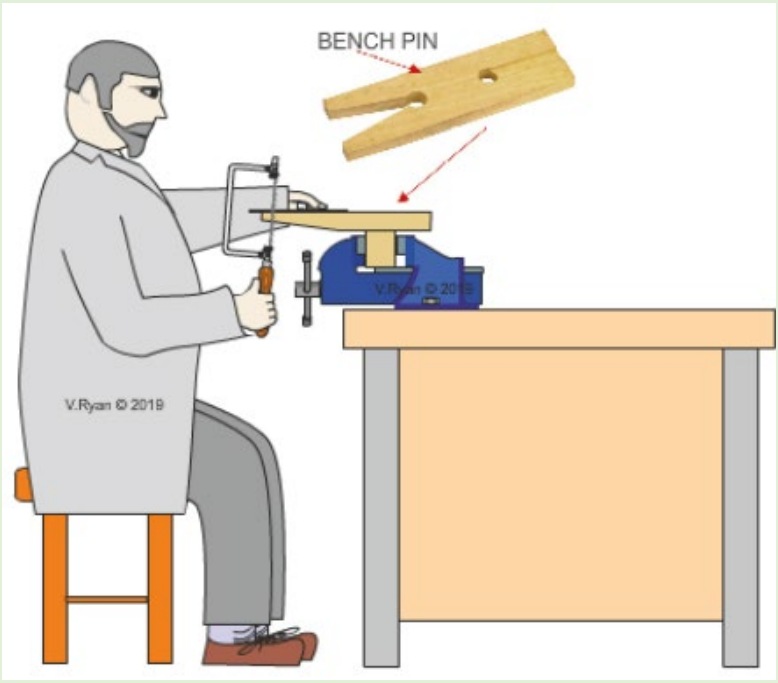

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THE RADIAL ARM DRILL

The Radial Arm Drill, looks similar to a normal machine drill. However, it differs in a variety of ways. The main difference, is that the distance between the drill chuck and the pedestal / vertical column, can be adjusted. This means that large sizes of material, can be set up on the table, for precise drilling.

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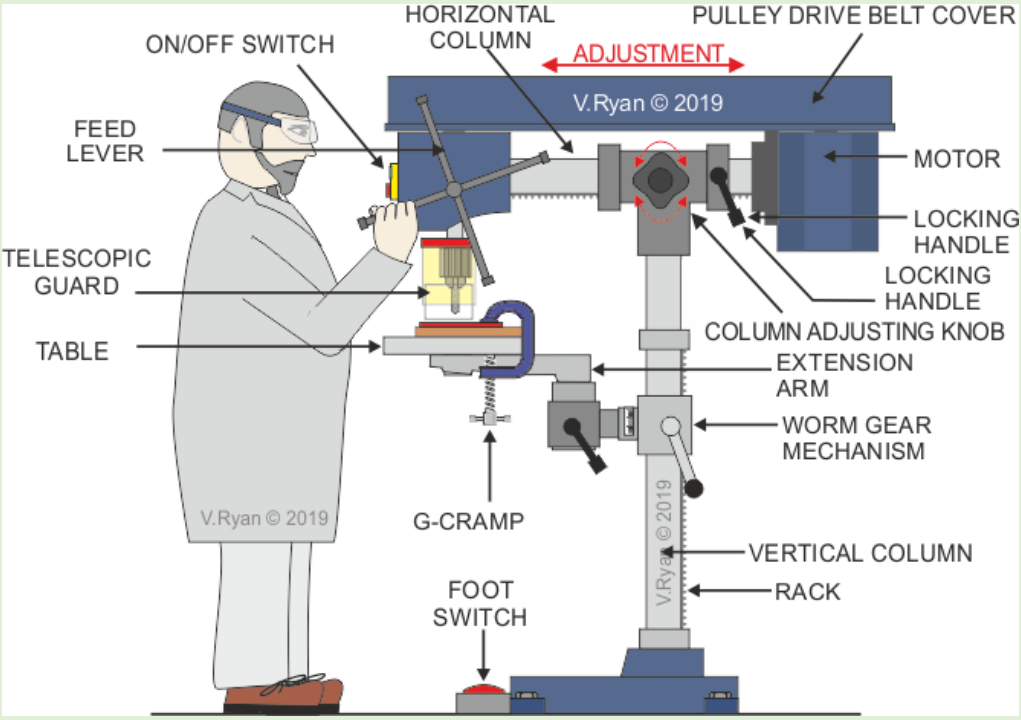

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THE RADIAL ARM DRILL

The head of the drill and the table can be adjusted, so that they can be set at a range of angles. They must be locked in position before drilling takes place.

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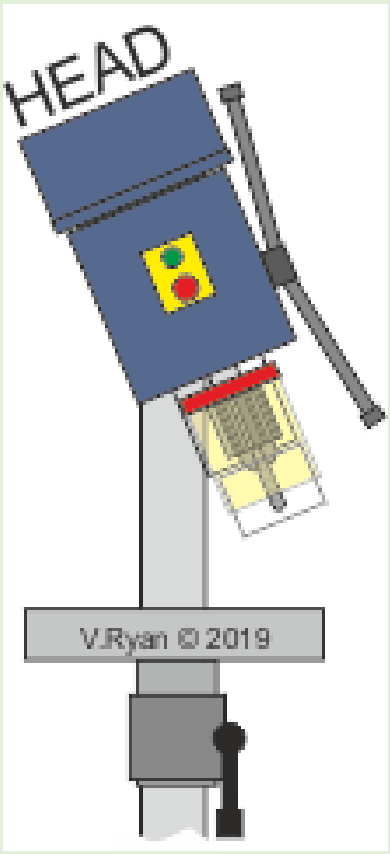

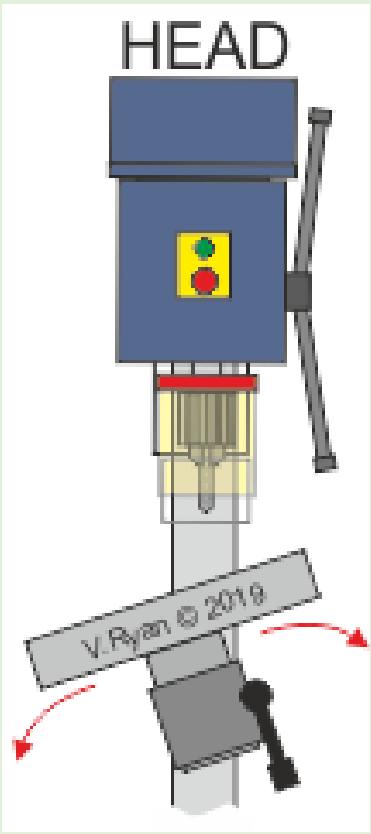

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THE RADIAL ARM DRILL

The plan view shown below, shows one more way the radial arm drill can be adjusted. The pulley drive arrangement and drill head can be rotated and locked in a new position.

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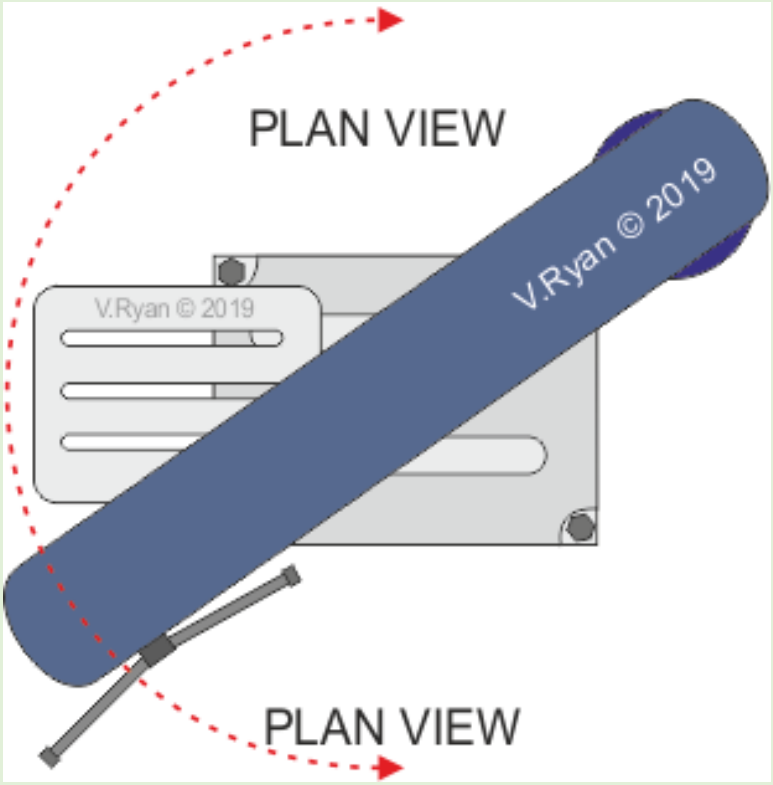

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COLD CHISELS

Cold chisels are used to cut and shape ‘cold’ metal, although they are only occasionally used in a modern workshop.. The highest quality cold chisels are manufactured from nickel chromium steel. The cutting edge is ground and then hardened and tempered, to lengthen the life of the sharp edge. The shank is left ‘soft’, as it must be able to withstand the shock of heavy blows from a ball pein hammer.

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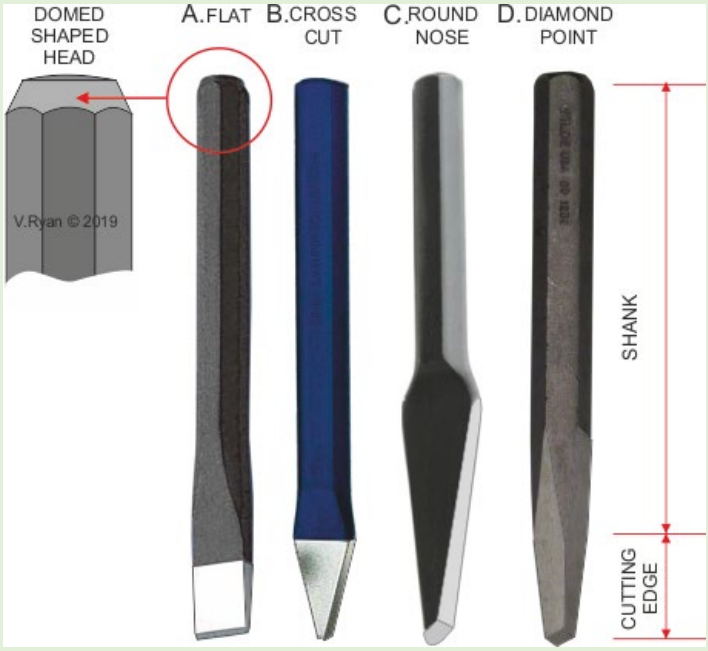

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HOW TO USE A FLAT COLD CHISEL

Thin gauge steel sheet and plate, can be cut with a 'flat' chisel. The steel is marked out with a scriber. A dot punch is used to create punch marks along the line. In use, the flat cold chisel is held at a slight angle to the vice. Steady blows are delivered with a ball pein hammer.

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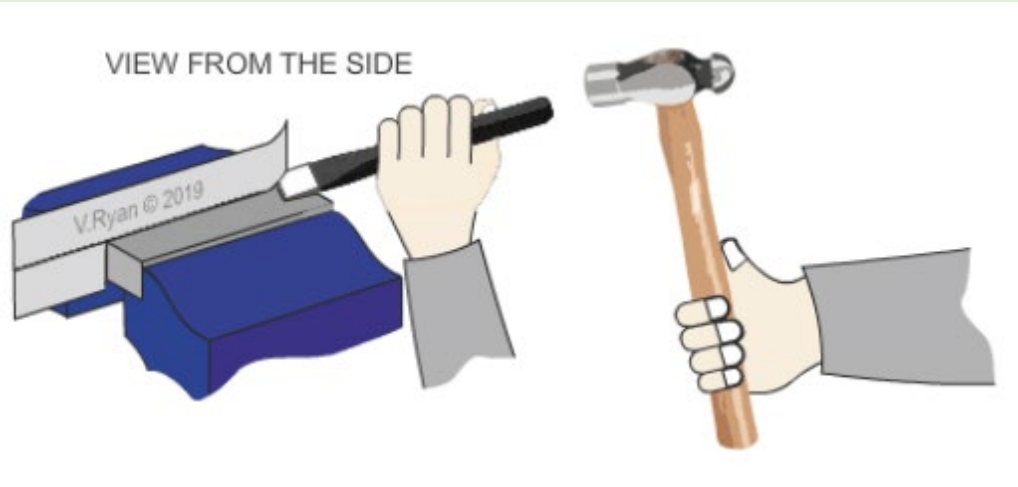

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