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MOBILE REVISION

WORKING WITH METALS
PART TWO

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

WORKING WITH METALS
PART TWO

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THE HAND VICE

A hand vice is useful, when holding sheet metal and thin metal sections. This is especially the case when drilling. Sheet metal / thin sections can ‘spin’ out of machine vice when being drilled, because there is not enough surface area to hold it securely between the jaws and has the potential to cause serious injury. A hand vice is designed for holding thinner materials.

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THE HAND VICE

The hand vice, shown below, is one safe way of holding the sheet metal whilst drilling. The sheet metal is held firmly in the hand vice. It also rests on scrap wood, on the table of the drilling machine

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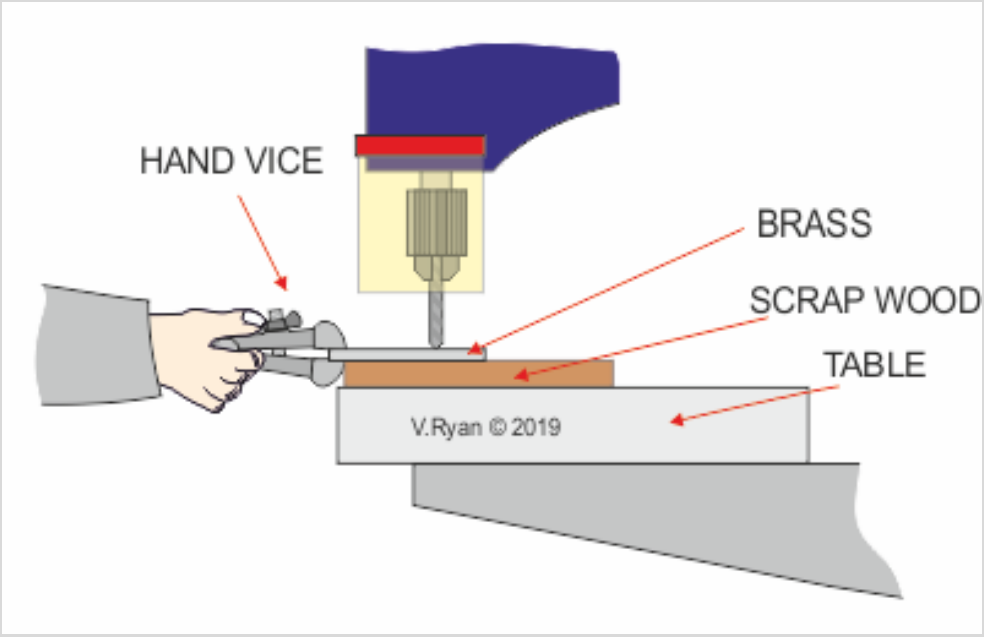

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THE MACHINE VICE

Machine vices are supplied in a range of sizes, from light duty to heavy duty vices. The light duty vices, are designed for general drilling, such as drilling a hole on a pedestal drill. Heavy duty vices are designed for holding materials to be machined, for example, on milling machines or for drilling substantial holes in resistant materials such as steel. Both types of machine vice, tend to be supplied with a handle or a tommy bar.

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THE MACHINE VICE

The lightweight machine vice seen below, has been bolted to the table of the drilling machine. This means it is secured in the correct position and will not move, even if the drill bit 'grabs' the work. Depending on the material being drilled and the size of hole, it is usually safe to hold the vice in the hand (by the handle) and not necessary to bolt it to the drilling table.

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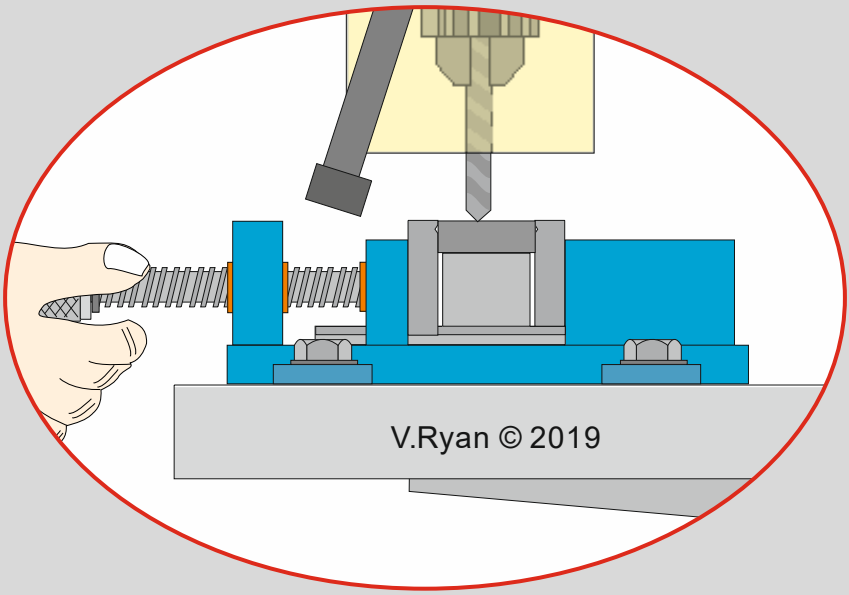

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THE MACHINE VICE

This heavy duty machine vice, is bolted to the vertical milling machine.
Heavy duty machine vices are designed to hold substantial sizes of metals (steel etc...), so that they can be machined.

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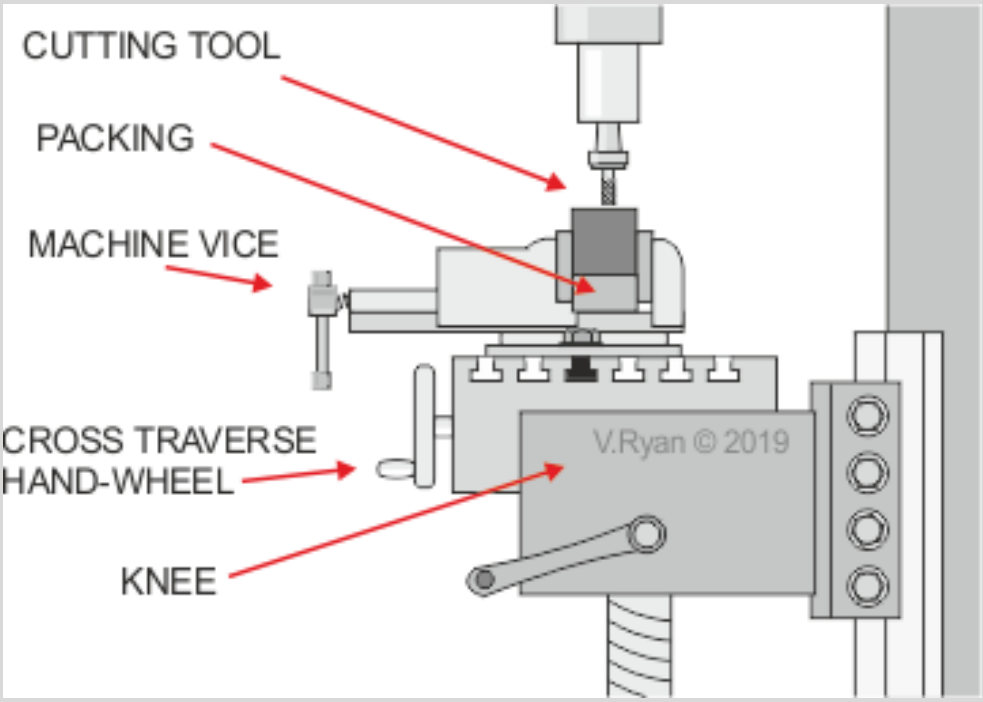

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ENGINEERS SPRING DIVIDERS

Spring dividers are a general marking out tool, for arcs, circles and radii. This tool used for accurate marking and has a fine adjusting nut to ensure precise measuring / marking out. The adjusting nut firmly holds the scriber point at a set distance.

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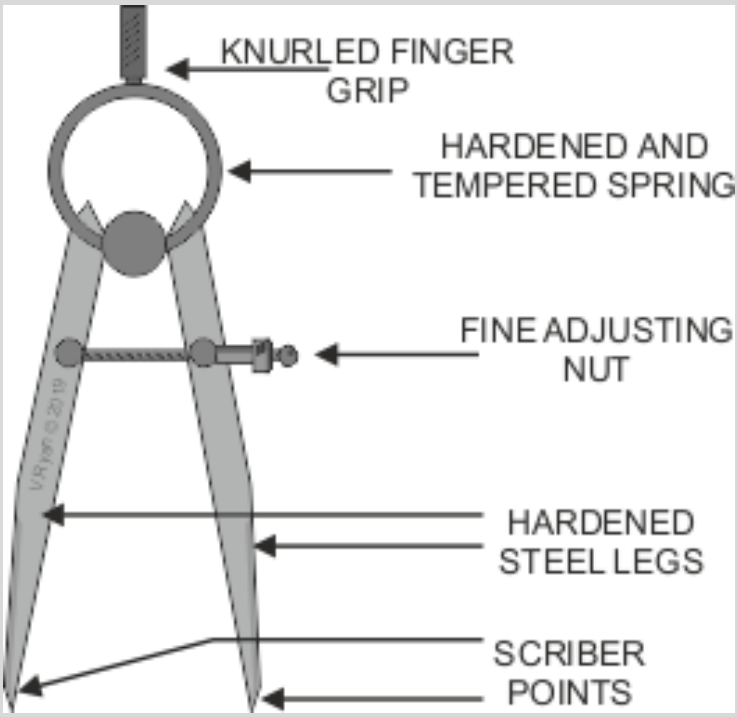

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ENGINEERS SPRING DIVIDERS

The point of rotation of the spring dividers, is punched with a ‘centre punch’, ensuring that the scriber point does not slip out of position. The dividers are then rotated, scribing the arc / circle. This should be done lightly at first and then with a little more weight. Sometimes rotating the sheet metal, whilst holding the dividers in position, works really wel

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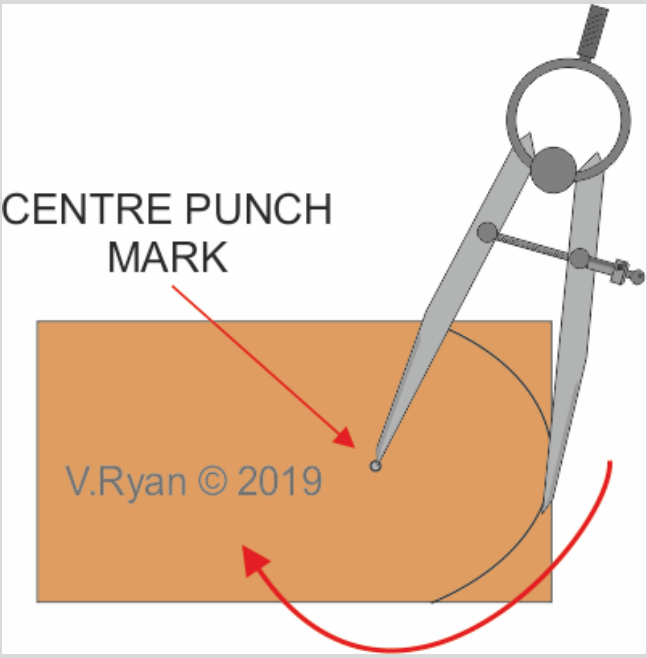

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FIRM ODD-LEG CALIPERS (JENNY CALIPERS)

The two calipers seen here are similar. They are manufactured from tool steel and each scriber / scriber point, has been hardened and tempered. They are for marking out the surface of sheet metal and for checking parallel edges.

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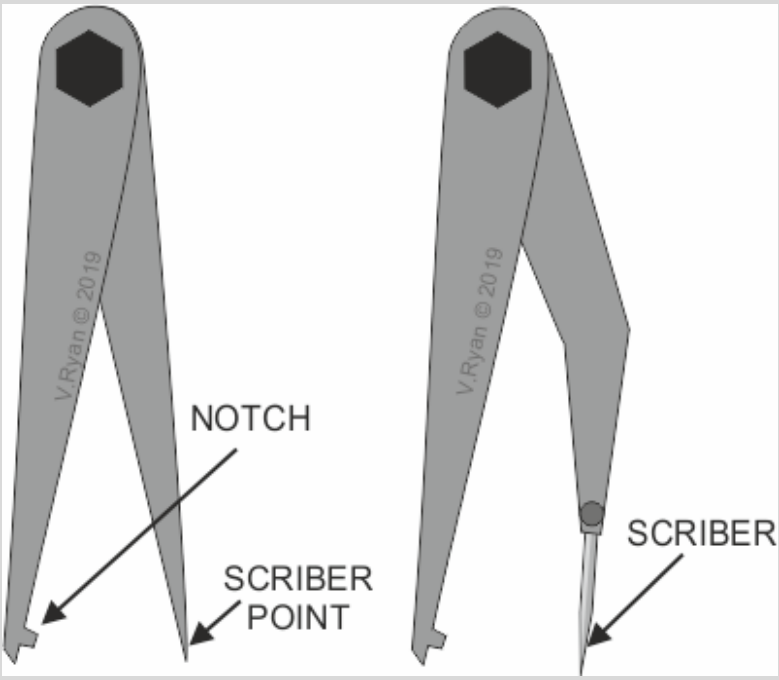

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FIRM ODD-LEG CALIPERS (JENNY CALIPERS)

They are easy to use. First set the distance required, using a mm scale on a steel rule. The transfer it to the metal surface, by ensuring the notch is lodged against one edge of the metal, then simply ‘drag’ the scriber, across the surface.

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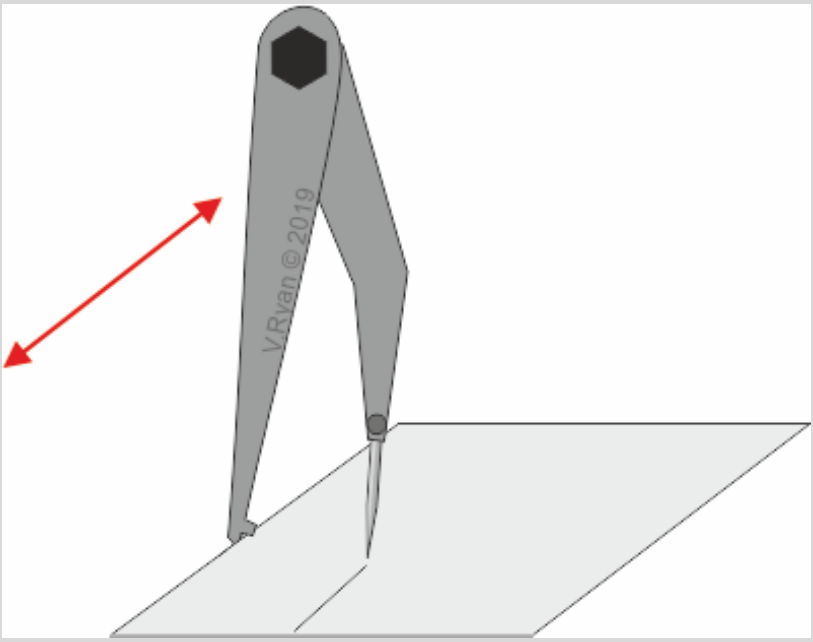

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OUTSIDE AND INSIDE CALIPERS

These inside and outside calipers, each have a spring and an adjusting screw. The adjusting screws allows for fine adjustment, which means they can be set more accurately than a ‘firm’ type caliper, which is simpler in design.

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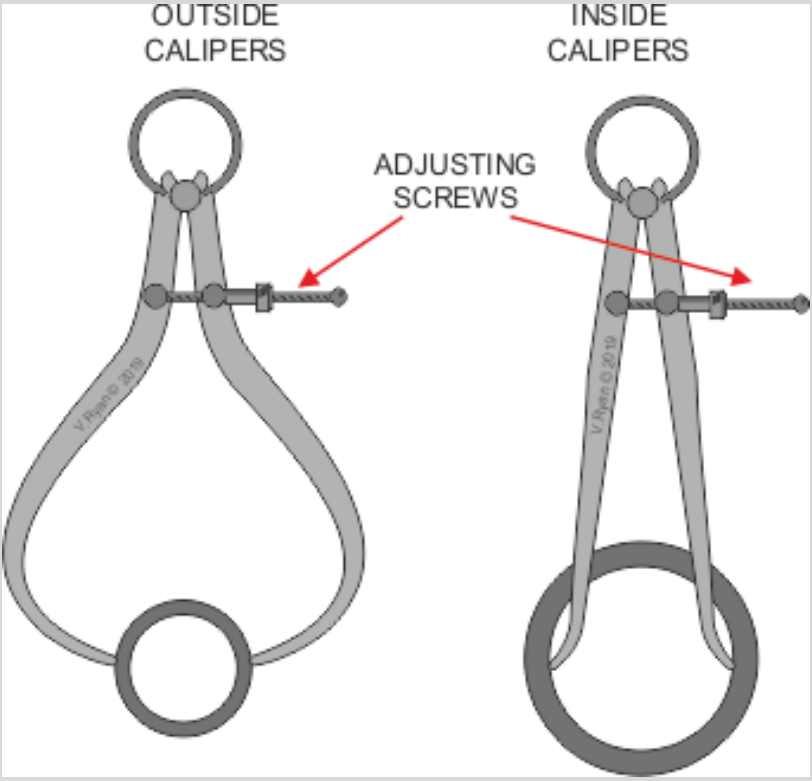

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TRAMMELS FOR ENGINEERING

Trammels are available in a range of sizes and allow for the scribing of large arcs, beyond the capacity of spring dividers. They are also ideal of transferring measurements. The knurled grips can be loosened and tightened, allowing them to slide along the round section bar. This means that a distance can be set quickly and the fine adjuster used for a more accurate measurement.

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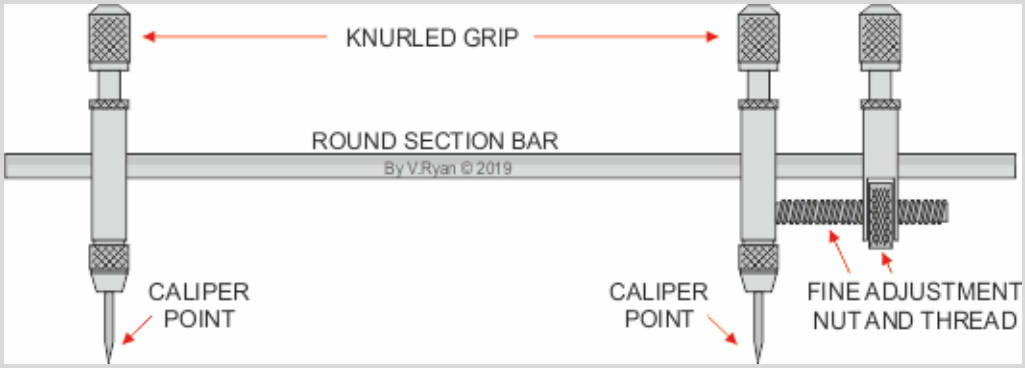

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TRAMMELS FOR ENGINEERING

Using a trammel to scribe an arc on the surface of sheet metal, is shown below. A centre punch ‘indentation’, is at the centre of the arc, ensuring that the trammel does not slip on the surface, during scribing.

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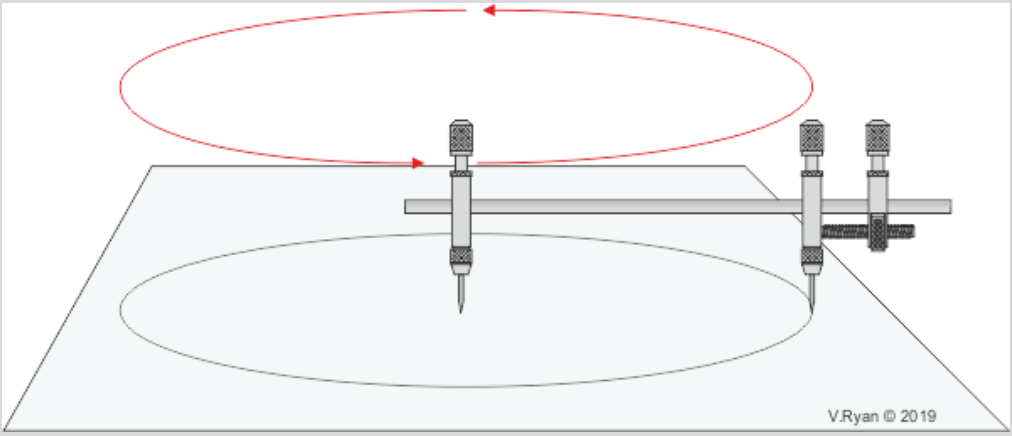

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TOOLMAKERS' CLAMP

The toolmakers' clamp has a number of uses. It can be used to clamp materials together, to enable marking out and even during welding. Toolmakers' camps are sometimes used to secure materials during drilling, although often, more capable clamps are available for this process

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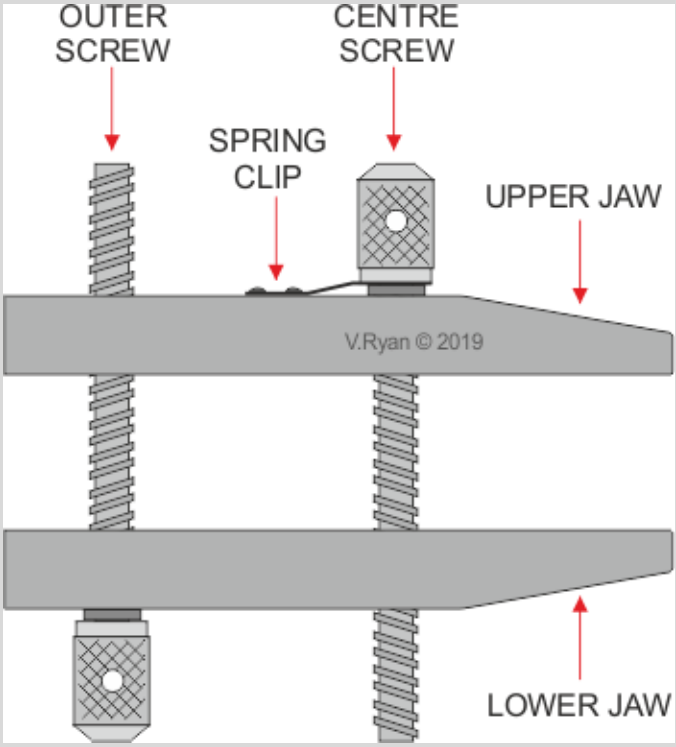

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TOOLMAKERS' CLAMP

The diagram below, shows how the toolmakers' clamp being used to secure / hold material, during practical work.

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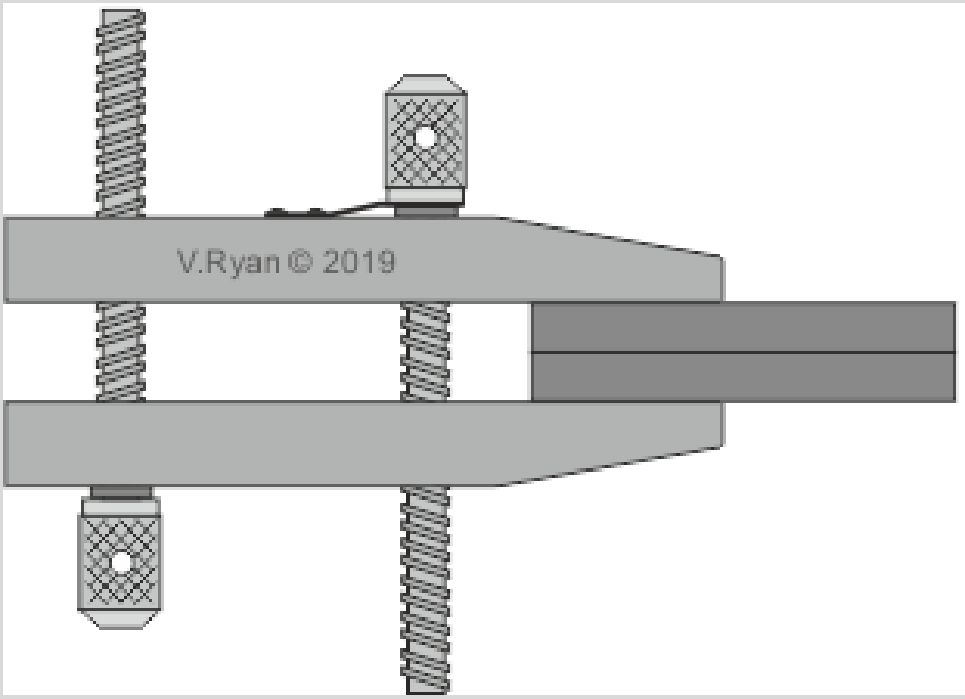

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CLAMPS - VEE BLOCKS

Vee Blocks are accurately machined to produce precise surfaces. They are manufactured in pairs (which are numbered), and should be kept together, as they are identical.

Usually, one vee block has a clamp, allowing round section materials to be clamp in place. The other vee block acts as a support

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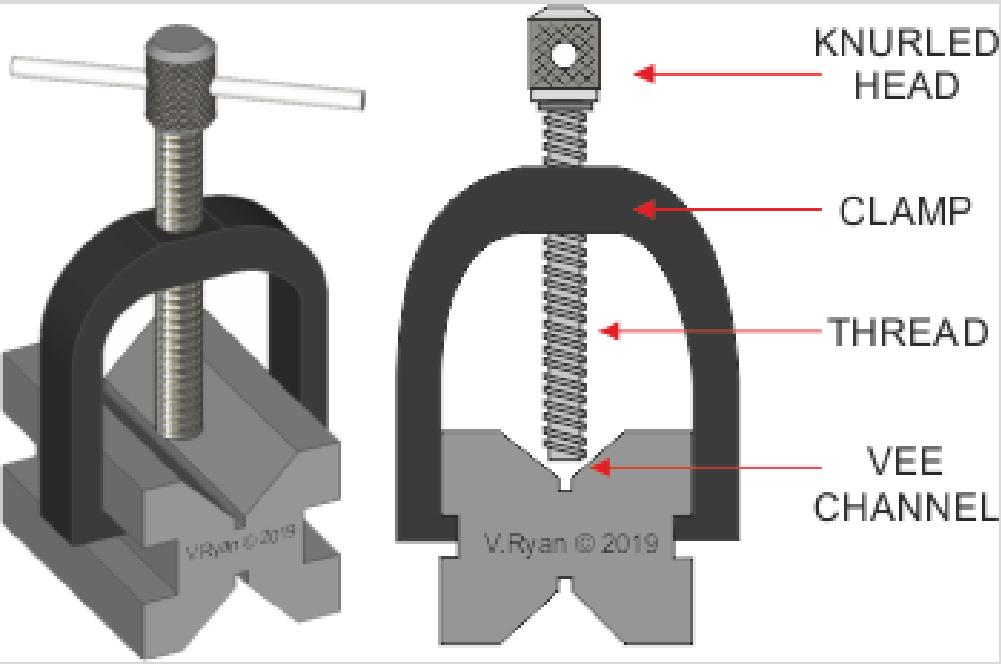

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CLAMPS - VEE BLOCKS

Vee blocks are ideal for marking round section material. In this diagram a 'key seat rule', sits on the round section metal, making it easier to mark out.

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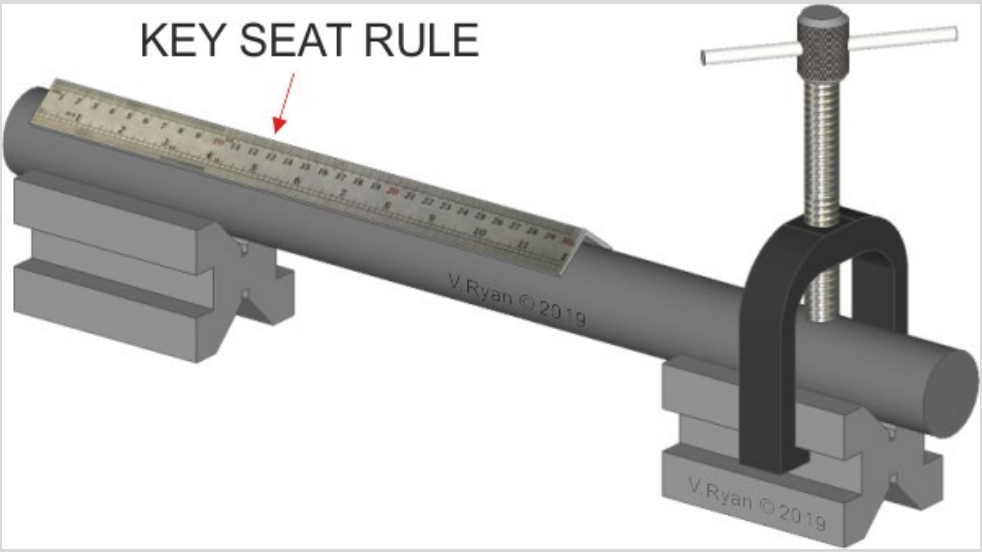

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CLAMPS - VEE BLOCKS

The diagram below, show how vee blocks can be used to secure material in place, whilst being drilled. Notice, how the block is fixed to the drill table, by bolt clamps.

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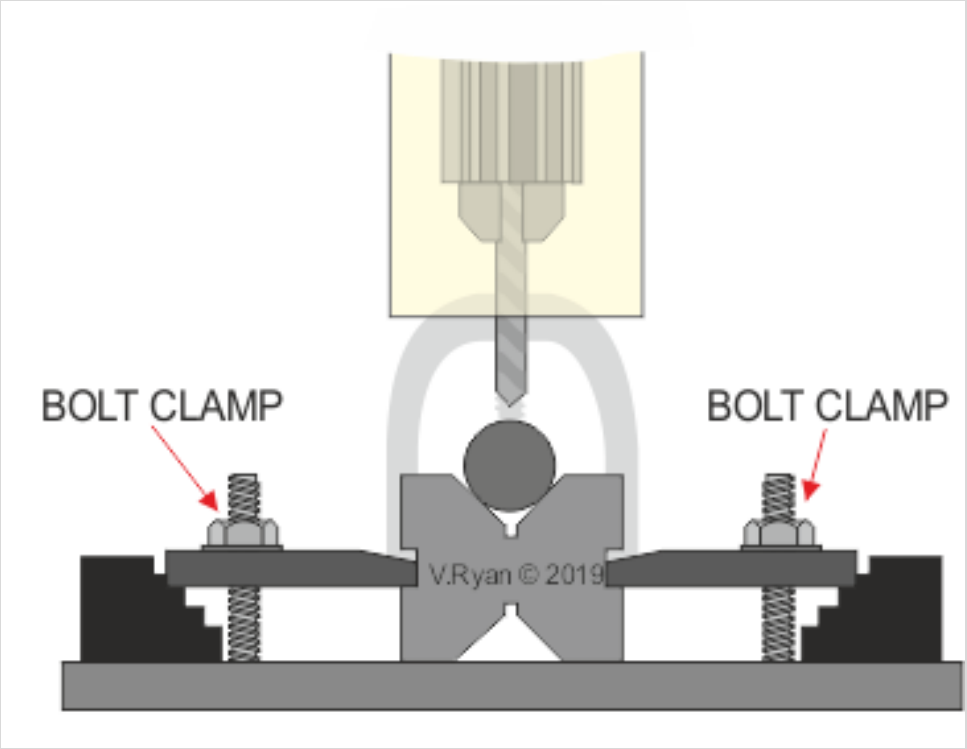

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ANGLE PLATES

An angle plate is a 90 degree section of cast steel, with two accurately machined surfaces. They are used to hold material, that can not be held in any other way (i.e. machine vice). The slots, are for nuts and bolts, which are used to secure material, for example, when drilling.

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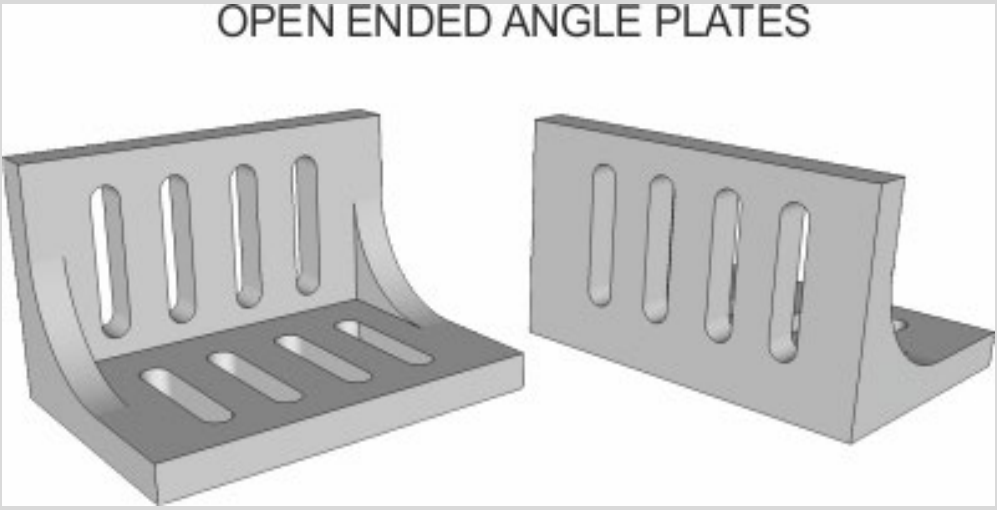

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HOW ANGLE PLATES ARE USED

Here, the material to be drilled is held in position by two bolts and rests on 'supporting' packing (accurately cut steel). The angle plate is bolted to the table of the drilling machine.

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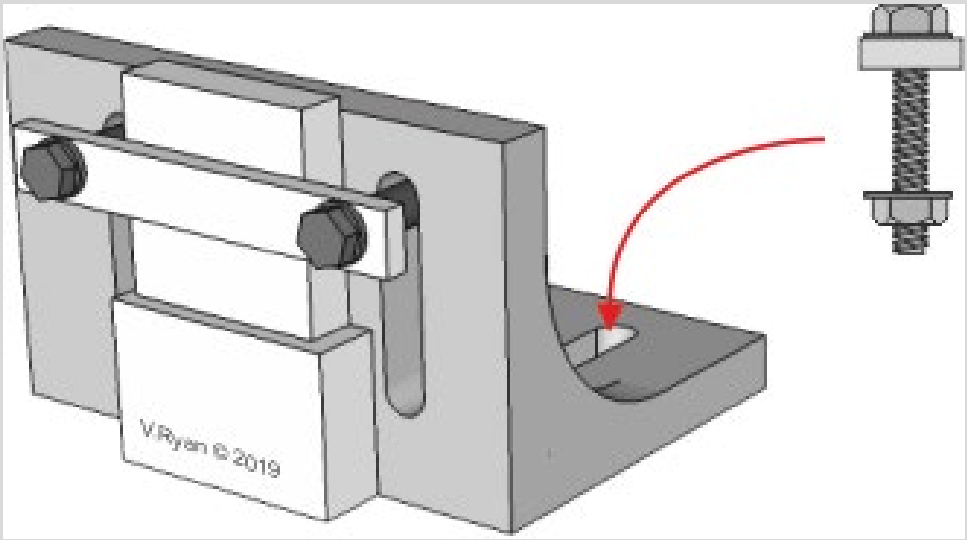

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HOW ANGLE PLATES ARE USED

This is another example of the use of an angle plate, for clamping irregular shaped work in position.
This is an aluminium casting, that requires a hole to be drilled, through its top surface

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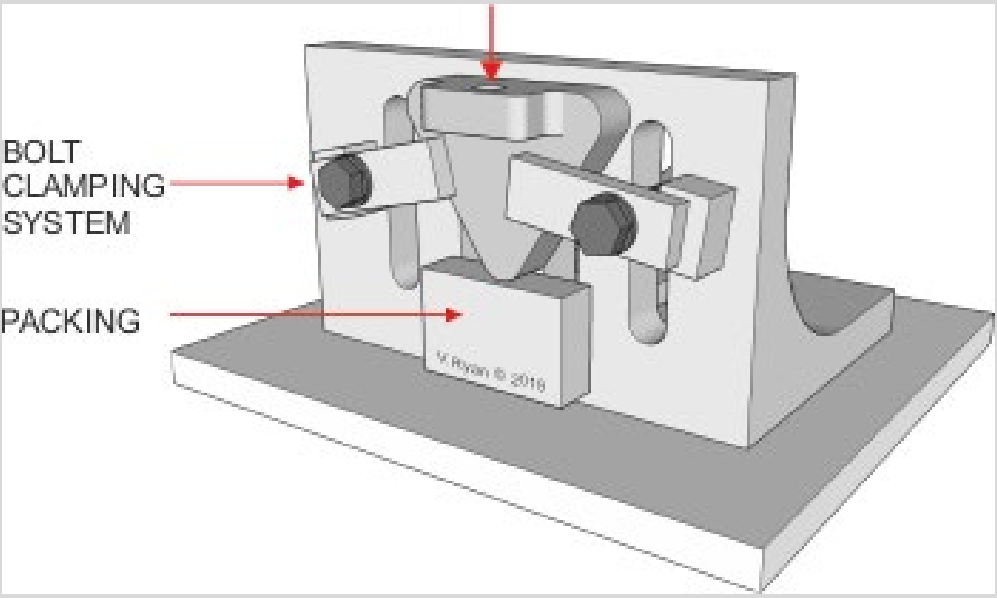

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ENGINEERS DIAL INDICATOR (GAUGE)

Engineers use a metric dial indicator (gauge), for testing a surface for being parallel. The sensitive spring loaded plunger, at the bottom of the indicator, registers minute movement on the dial. This type of dial indicator, is often used in conjunction with a surface gauge, as seen in the diagram below.

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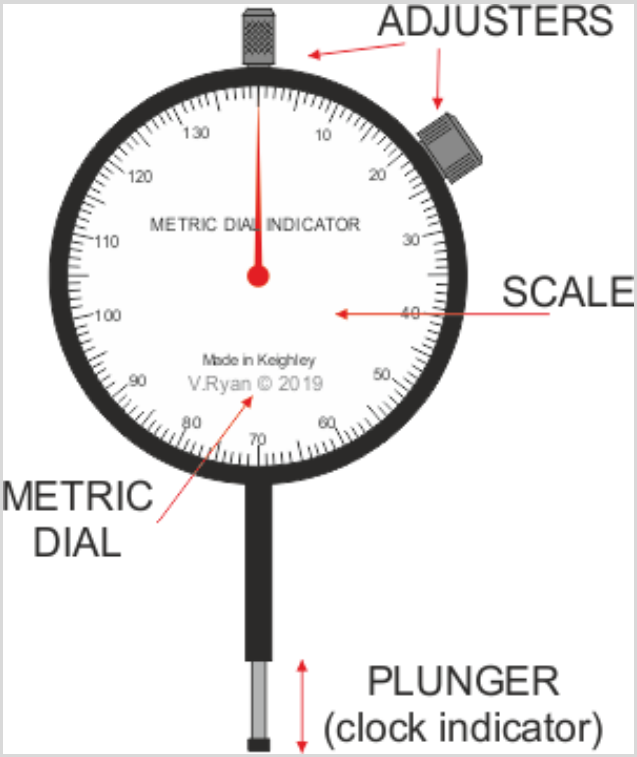

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ENGINEERS DIAL INDICATOR (GAUGE)

The dial indicator is placed above the metal surface being tested. It is lowered until the plunger is slightly depressed by the surface. The scale is then set to zero, using the adjusters. As the dial indicator is moved along the surface of the metal, by pushing the surface gauge, any variation in height is detected.

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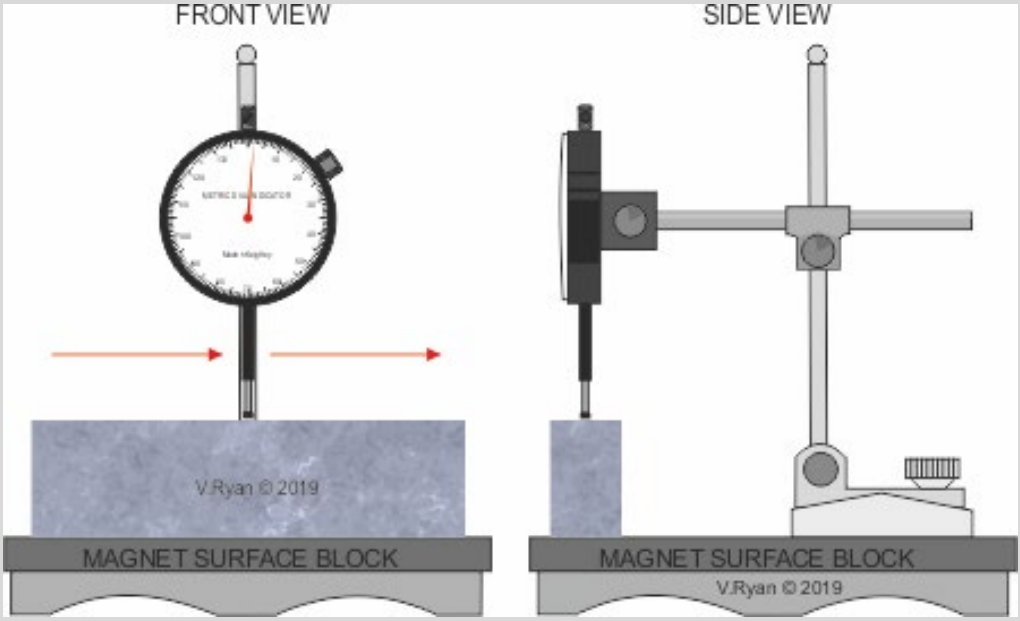

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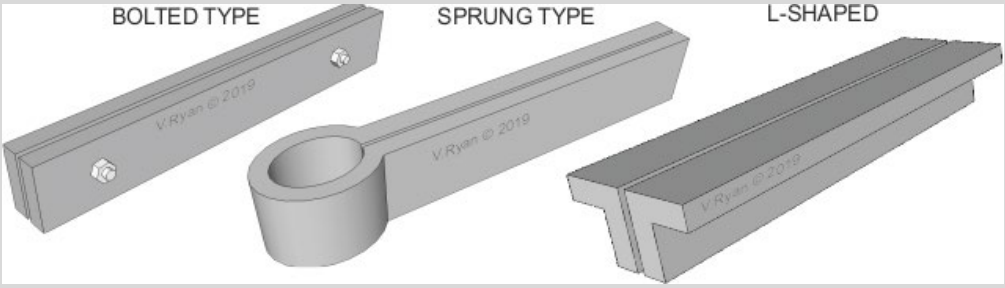
FOLDING BARS

Folding bars are a tool / piece of equipment, for working with sheet metal. They are placed in a vice and used to 'fold' the sheet metal, to a 90 degree angle. 'Folding' is the correct term for bending or forming sheet metal to an angle.
Commercially available folding bars, are the 'sprung' type, 'bolted' type and the 'L-Shaped' folding bars.

'ZOOM IN' on the image below to view the three types

Tap the image for more information



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USING FOLDING BARS

The sheet metal is place between the two working surfaces of the folding bars and placed in a vice. It is important to double check, that the sheet metal is positioned accurately in the folding bars, before securing in the vice.

It is good practice to file the edges of the sheet metal first, removing sharp burrs. Also, wear safety gloves before carrying out the next step (next slide)

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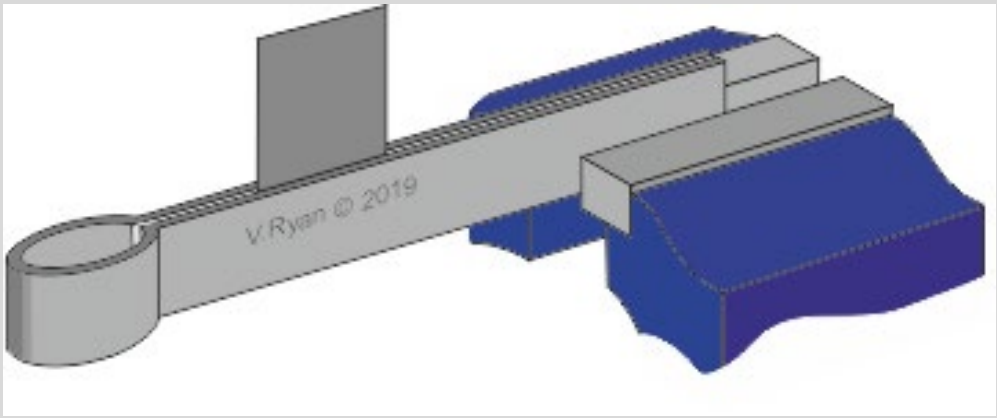

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USING FOLDING BARS

Hand pressure is normally enough, when folding 'thin' sheet metal (especially aluminium or copper), but a mallet can be used if required. As a precaution, wear workshop safety gloves, which will protect your hands, if they slip along the 'shape' edge of the sheet metal.

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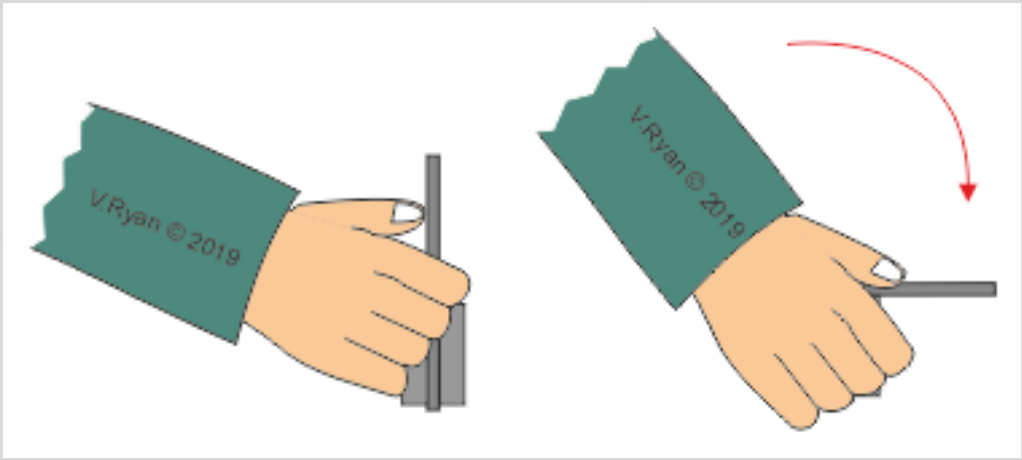

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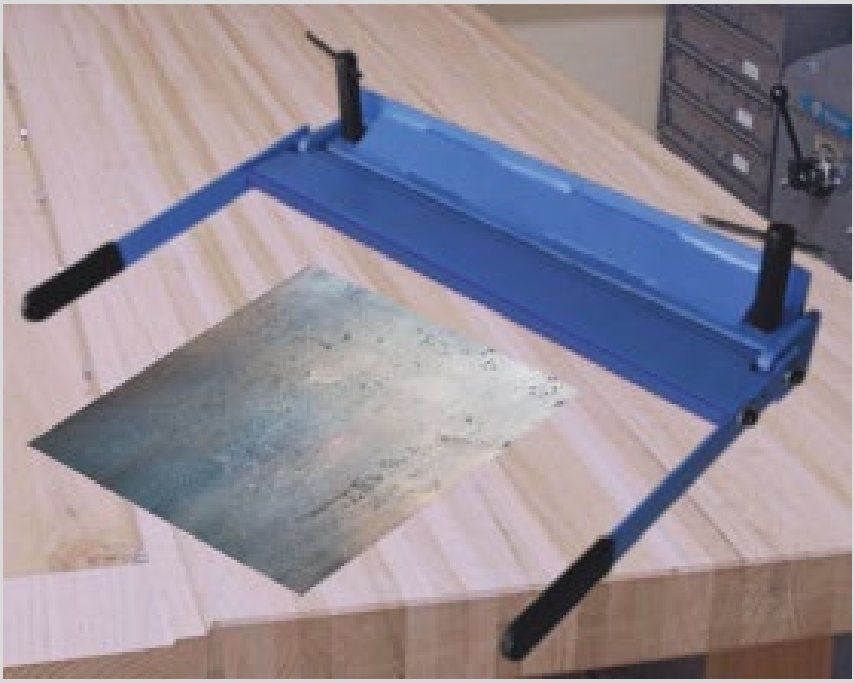
MANUALLY OPERATED - SHEET METAL FOLDING MACHINE

Folding sheet metal can be made easier, through the use of a manual folding machine. A typical manual folding machine and is desktop sized. Folding machines favoured over folding bars, when the sheet metal is larger, than can be managed comfortably using folding bars.

Tap the image for more information



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MANUALLY OPERATED - SHEET METAL FOLDING MACHINE

The manual folding machine is ideal, when there is a need to fold the same angle many times, for instance during batch production. Folding bars are for smaller scale work and suitable for most school based sheet metal work.

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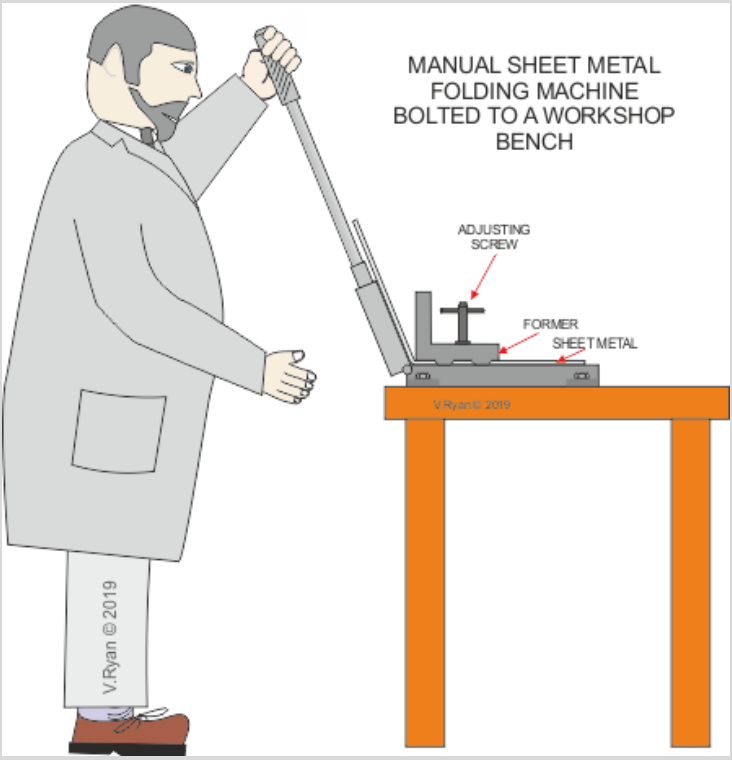

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TINMAN'S SNIPS

Tinman's Snips are ideal for cutting 'thin' sheet metal, such as aluminium, copper and brass. They are operated by hand and are normally used after the sheet metal has been softened through the annealing process.

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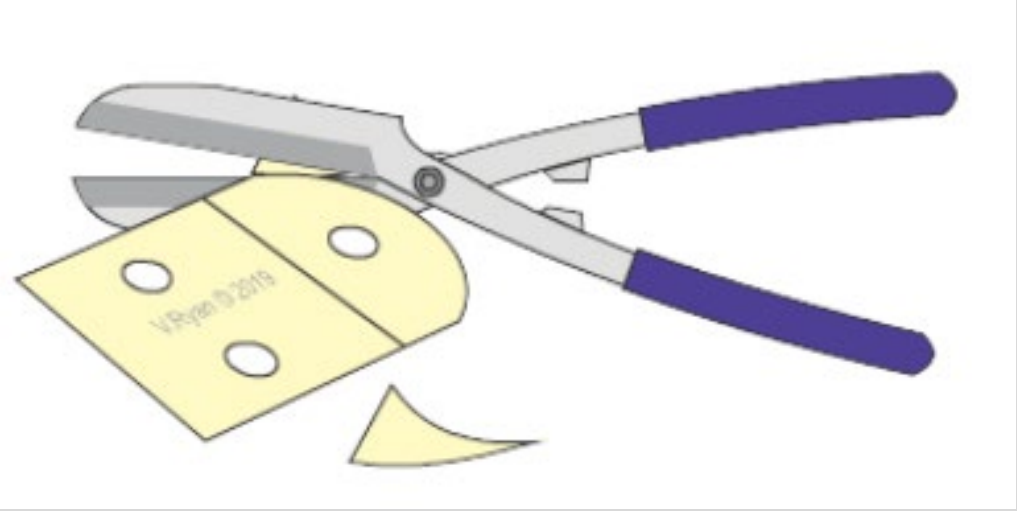

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TINMAN'S SNIPS

Straight tinman's snips are ideal for cutting 'straight' lines. The straight jaws act as a guide, helping to cut in a straight line.

Tap the images for more information

Curved tinman's snips are for cutting curves. The curved 'jaws' / cutters, help the user to follow a curved guideline.

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LIGHT DUTY BENCH SHEARS

A bench mounted sheet metal shears, is ideal for cutting sheet steel and other sheet metals, such as copper and brass. The blades are designed to minimise the production of sharp burrs, on the edge of the sheet metal being cut. They are ideal when a large size of sheet metal is being cut / shaped.

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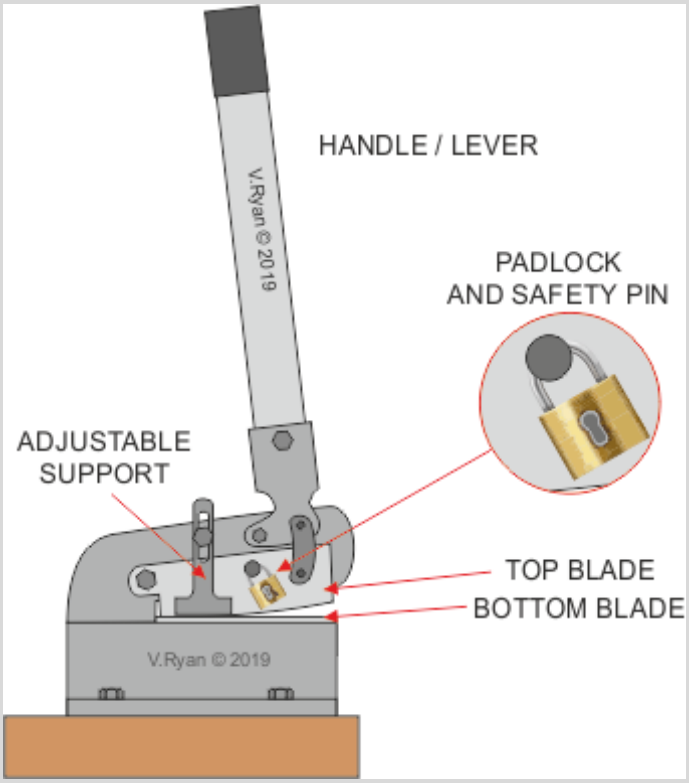

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LIGHT DUTY BENCH SHEARS

The sheet metal is placed between the top and bottom blade. The handle / lever is carefully, but firmly, pulled in the direction indicated by the arrows and the top blade moves downwards, cutting along the marked guideline

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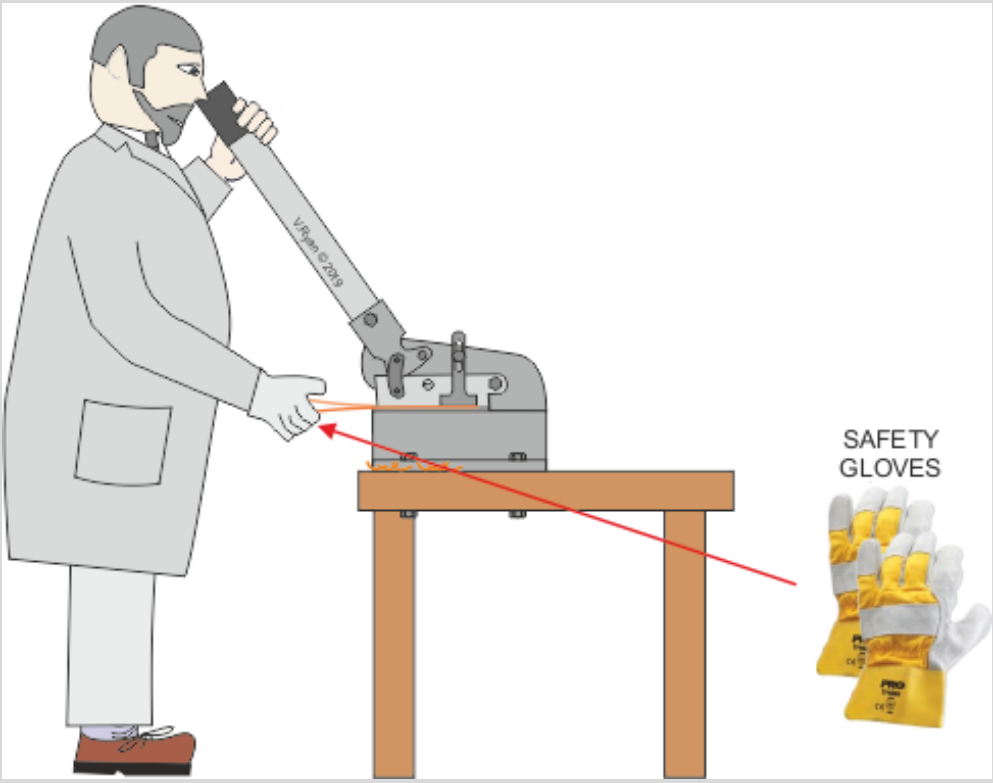

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THE ENGINEERS SPIRIT LEVEL

Spirit levels are a simple instrument, dominated by an air bubble, trapped in ethanol, in a tube of glass. Spirit levels are used by a range of skilled users, including surveyors, builders, civil engineers and many more. Spirit levels are generally cheap to buy, although those developed for engineering are precision measuring instruments (with high level sensitivity). Their cost reflects the precise engineering involved in their manufacture

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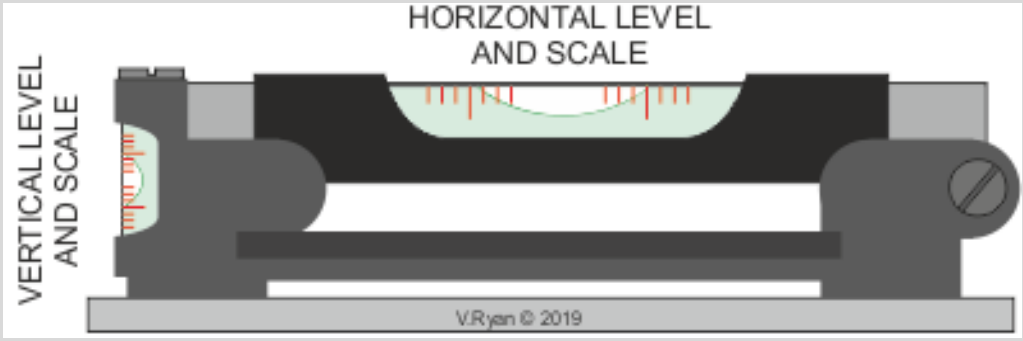

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THE ENGINEERS SPIRIT LEVEL

Spirit levels are used to check that a machine is 'level' when it is installed in a workshop.

The table of this drilling machine has been set at an angle during a drilling process and returned to horizontal. The engineers spirit level has been used to ensure that the table is exactly level and ready for the next drilling process.

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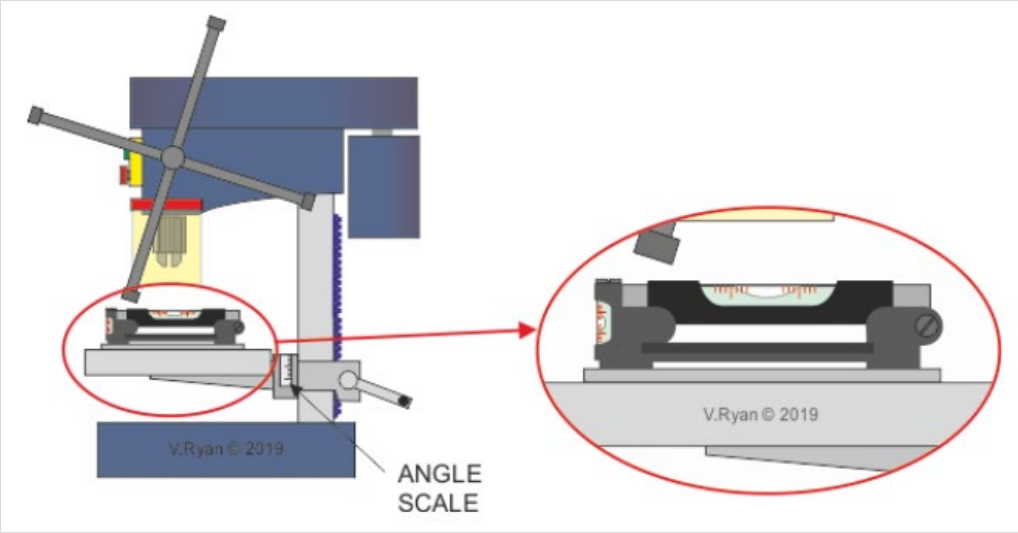

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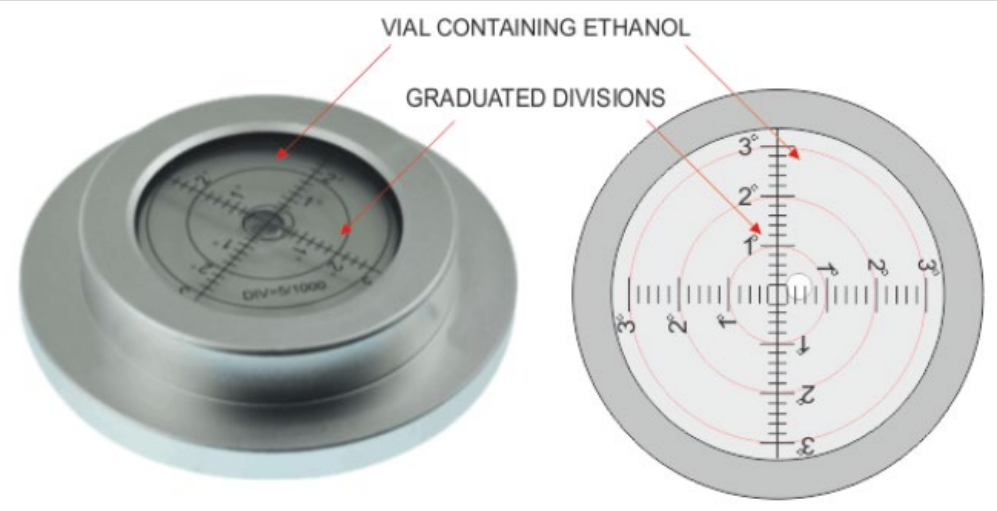
BULL'S EYE SPIRIT LEVEL

The Bull's Eye spirit level is widely used by surveyors and within the construction industry. This type of level is also useful in engineering. It also has the advantage when used on a machine bed, in identifying the 'level' of both the 'X' and 'Y' axis. The process of using the bull's eye level is called, "centre bubble levelling".

Tap the image for more information



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BULL'S EYE SPIRIT LEVEL

The bull's eye spirit level is being used to help set up a vertical miller, so that it's table is level in both the 'X' and 'Y' axis. Precision engineering requires machinery to be set up accurately. A poorly 'set-up' machine is unlikely to be capable of precision work.

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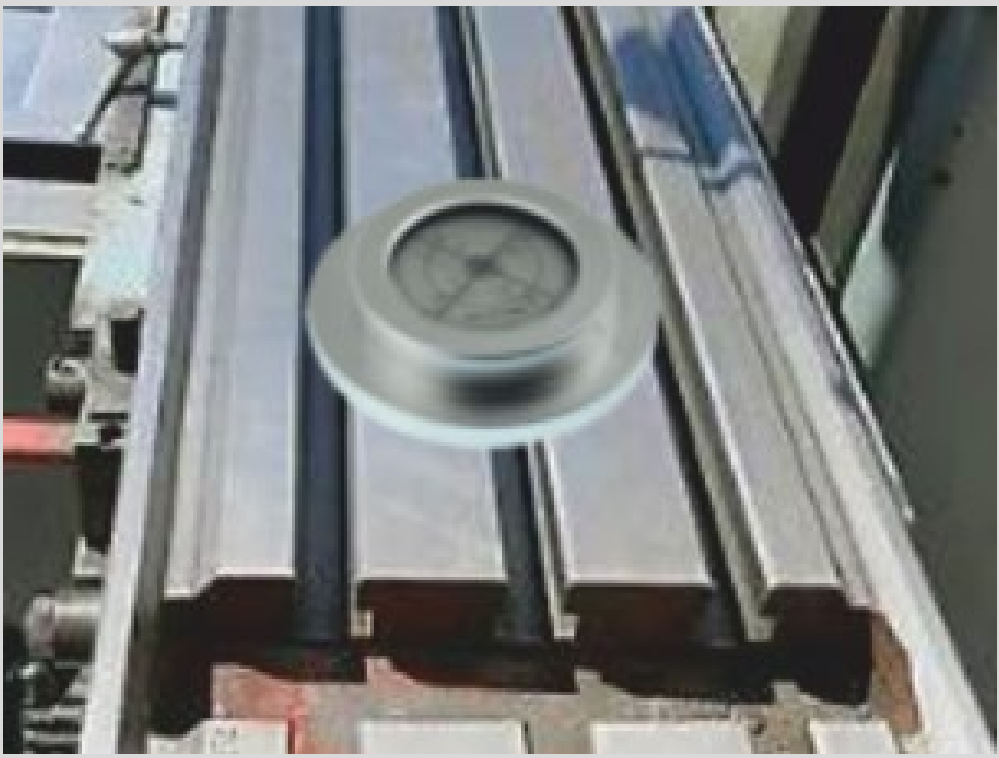

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