Fitting Shop

Introduction

- **Fitting** is the process of assembling parts, after removing unwanted material and bringing the shape to the required form with the help of hand tools.

- The operations required for the same are usually carried out on a work bench, hance the term **bench work** is also involved with fitting.

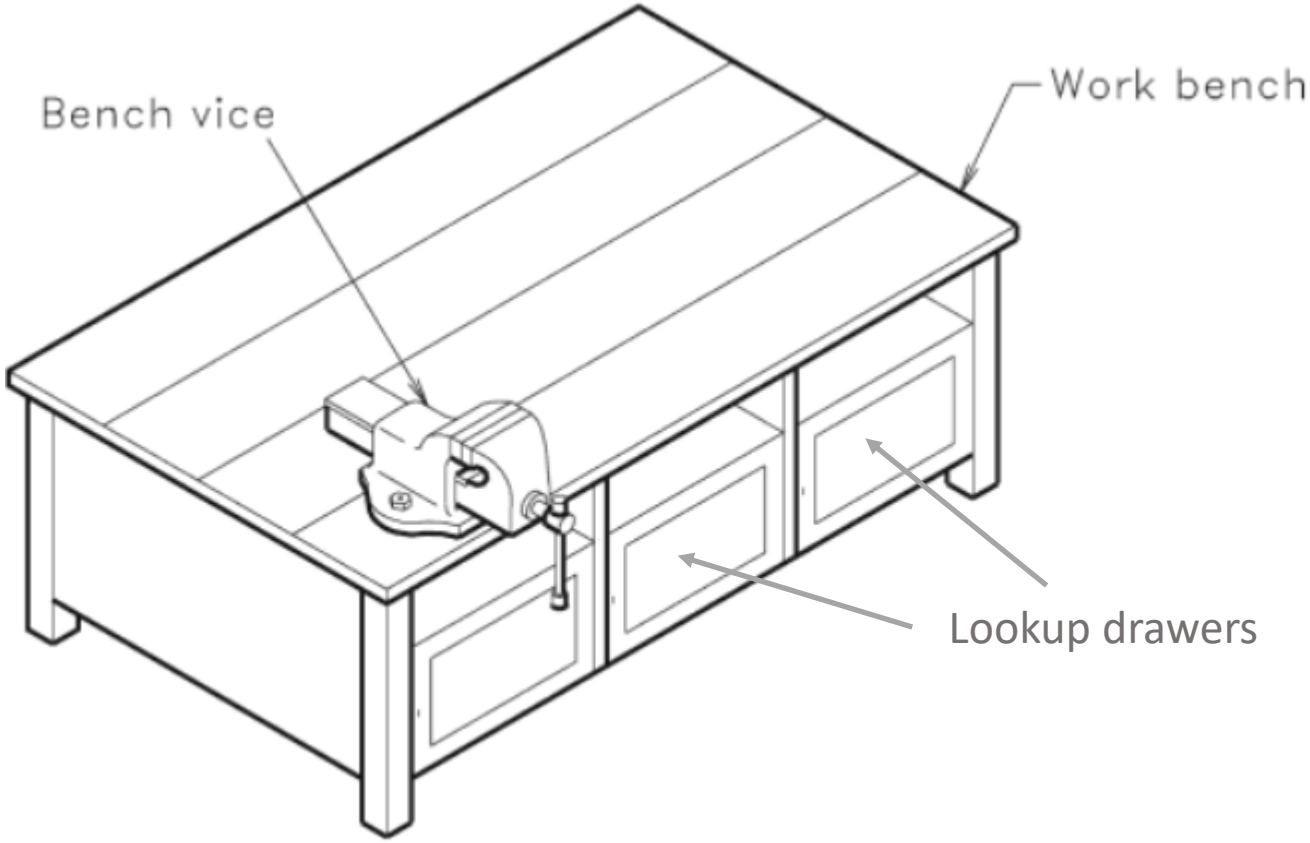
- The tools and related equipment used for fitting processes can be classified as:
  - Workpiece holding devices
  - Cutting tools
  - Measuring and marking tools
  - Tools for assembling and inspection

- The hand operations performed in fitting processes can be classified as:
  - Marking
  - Chipping
  - Hacksawing
  - Filing
  - Scraping
  - Assembling

Workpiece holding devices

1. Bench vice

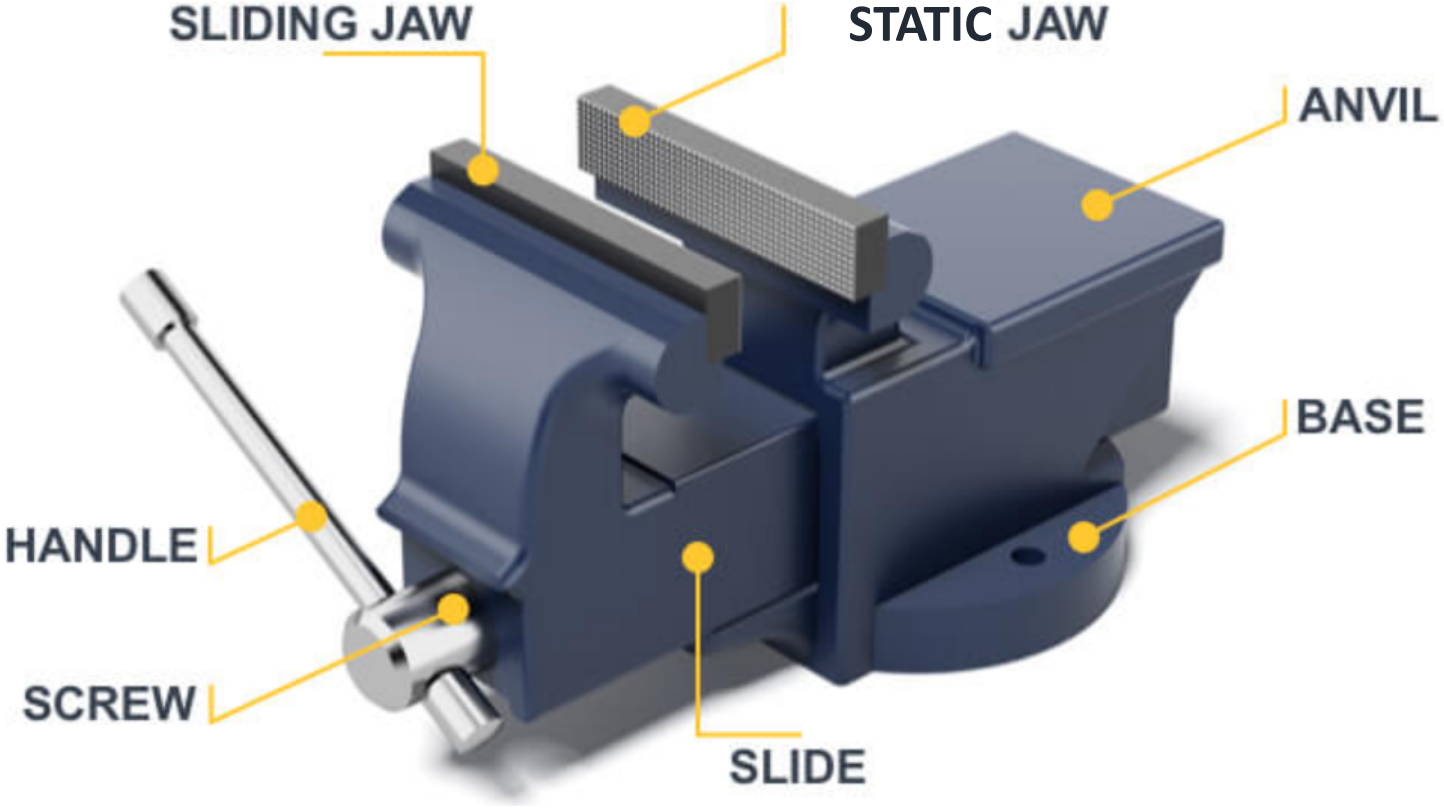
- Fitting operations are generally carried out on a table called **work bench**.
- The work bench is a strong, heavy and rigid table made up of hard wood.
- **Bench vice** is a device used to hold the workpiece and it is rigidly clamped on the top of the work bench.
- Lookup drawers, to keep the tools used for fitting, are usually provided at the bottom of the work bench.

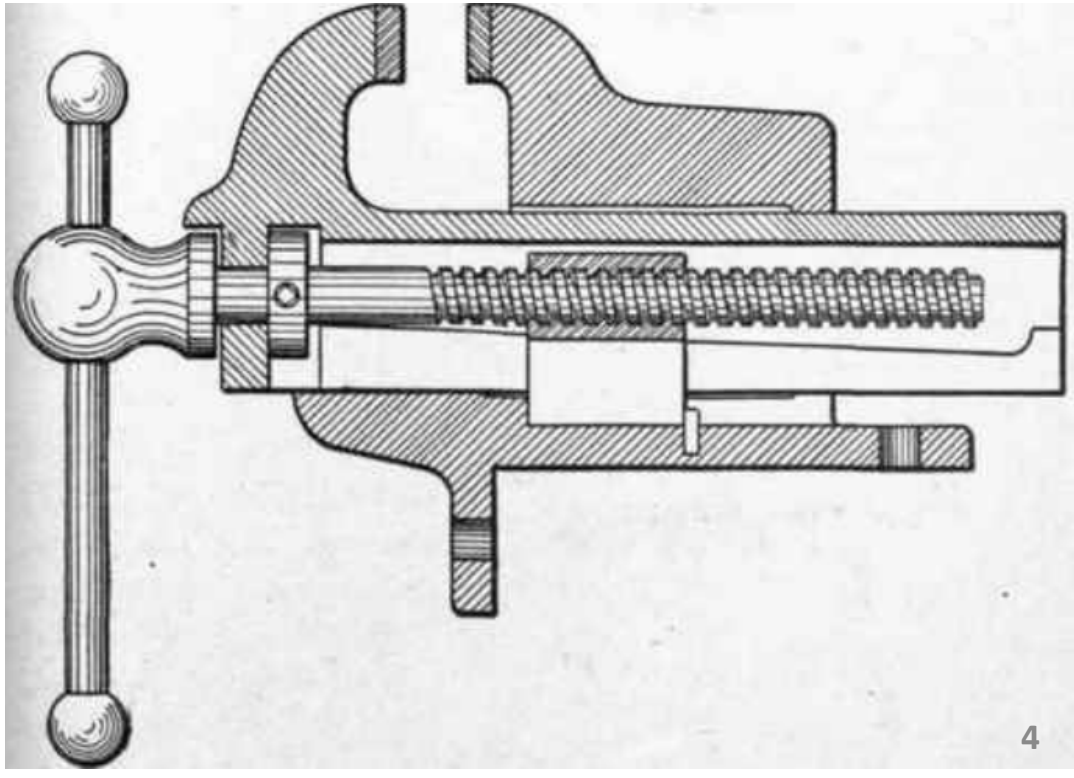


Workpiece holding devices

1. Bench vice

- It consists of one movable jaw and one fixed jaw.
- A workpiece is gripped between the parallel jaws by rotating the screw inside the nut, using the handle.
- The desired pressure is obtained by tightening or loosening the screw.

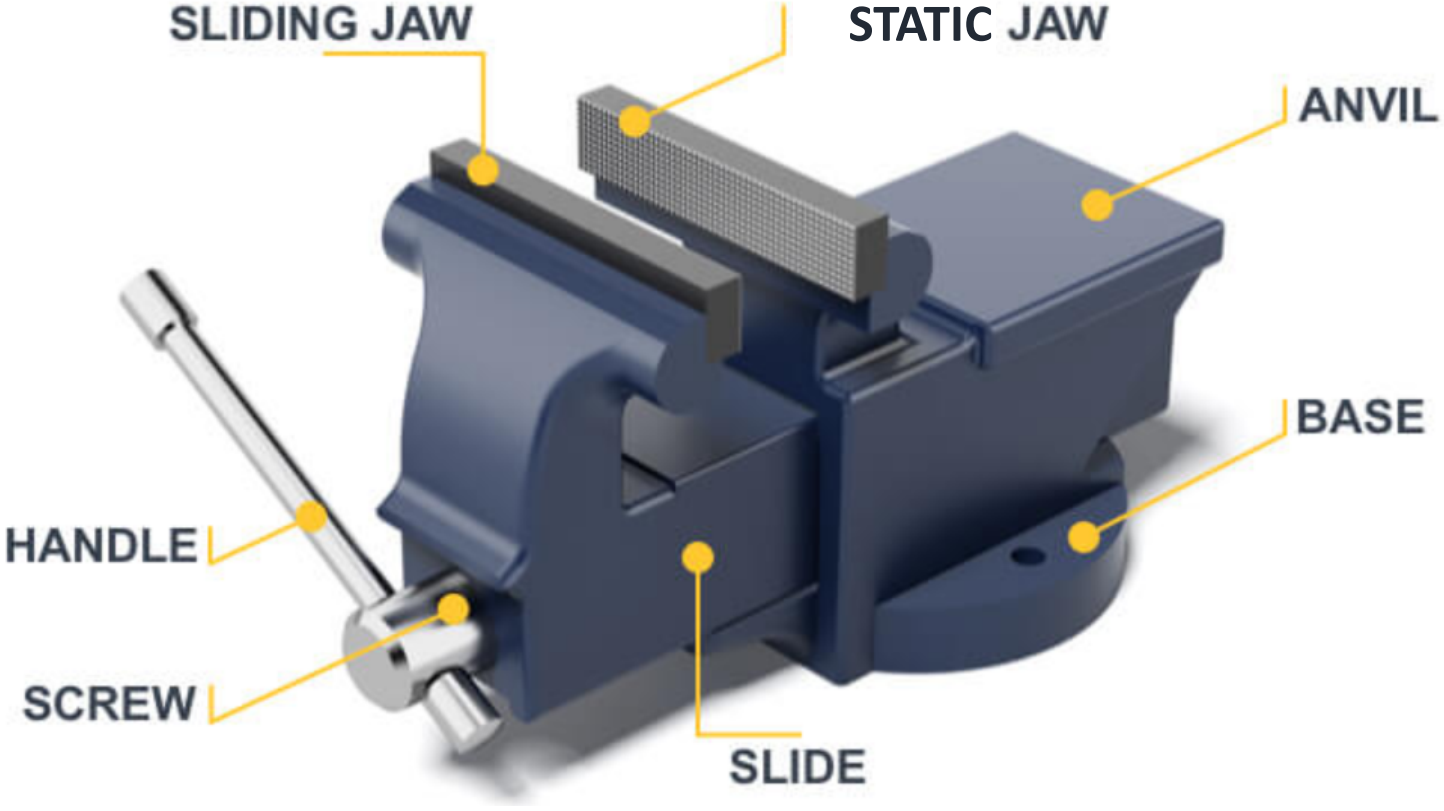


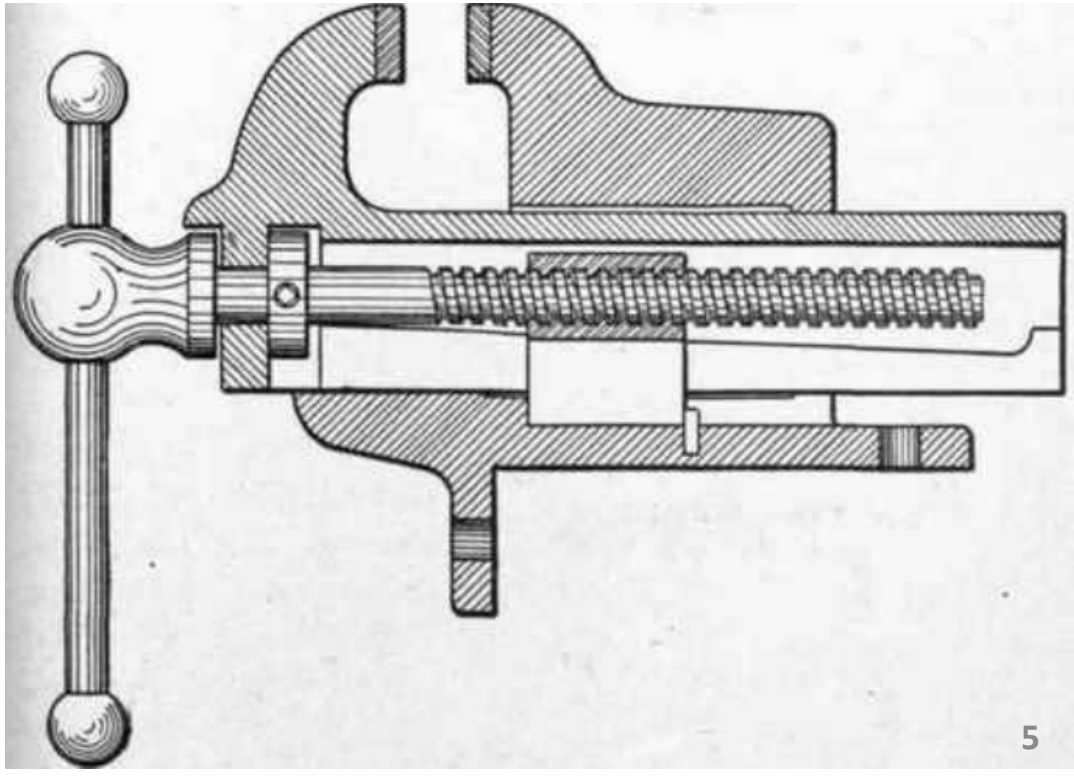


Workpiece holding devices

1. Bench vice

- Cast steel plates (known as jaw plates) are screwed to the jaw for holding the workpiece rigidly.
- Serrations are provided on the jaw plates to increase the gripping ability.
- In order to avoid the gripping marks on the finished surface of the workpiece, soft liners may be attached on the jaw surfaces.

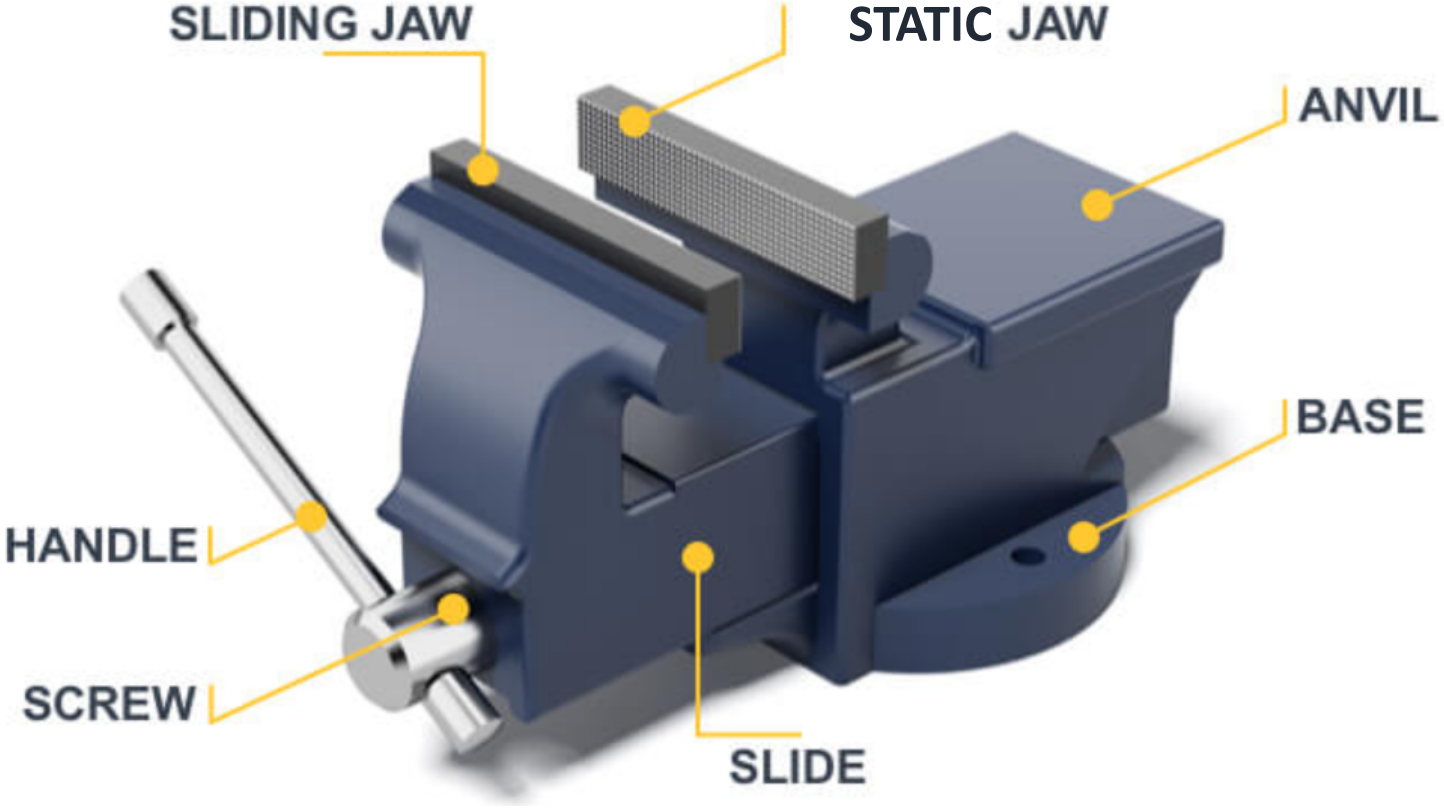


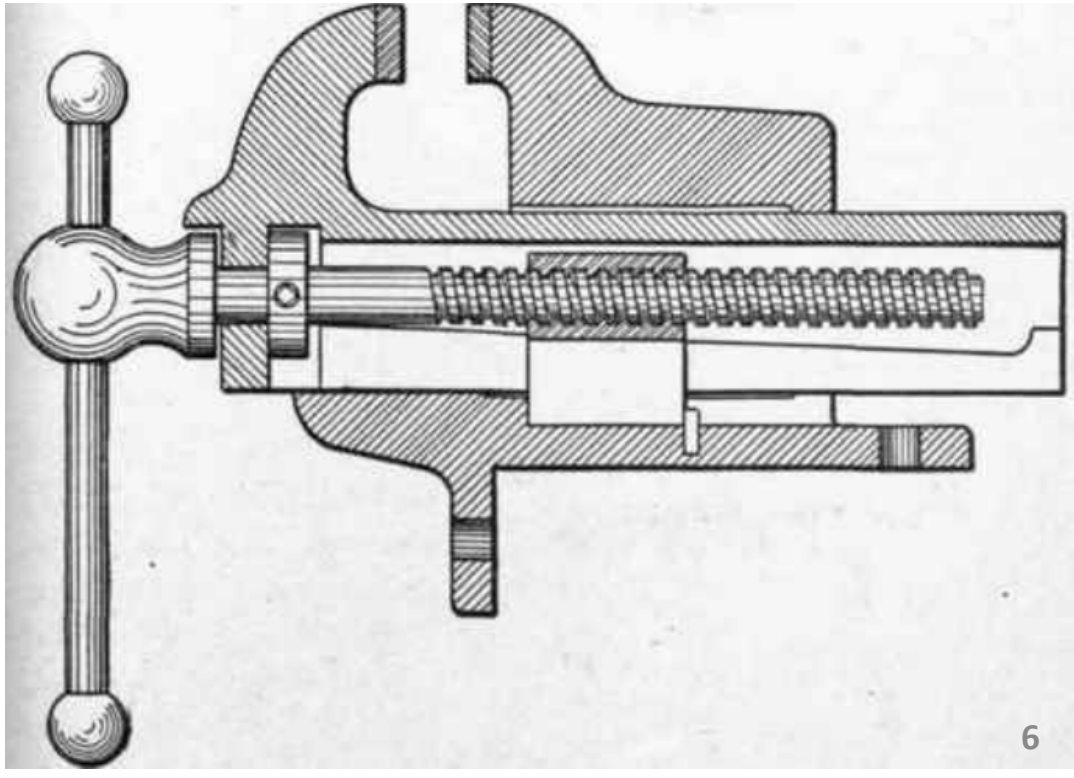


Workpiece holding devices

1. Bench vice

- The body of the vice is made up of iron or steel by casting.
- The base of the vice is bolted on the top of the work bench, nearer to the table edge.
- The size of vice is specified by the width of the jaws and the maximum opening between jaws.

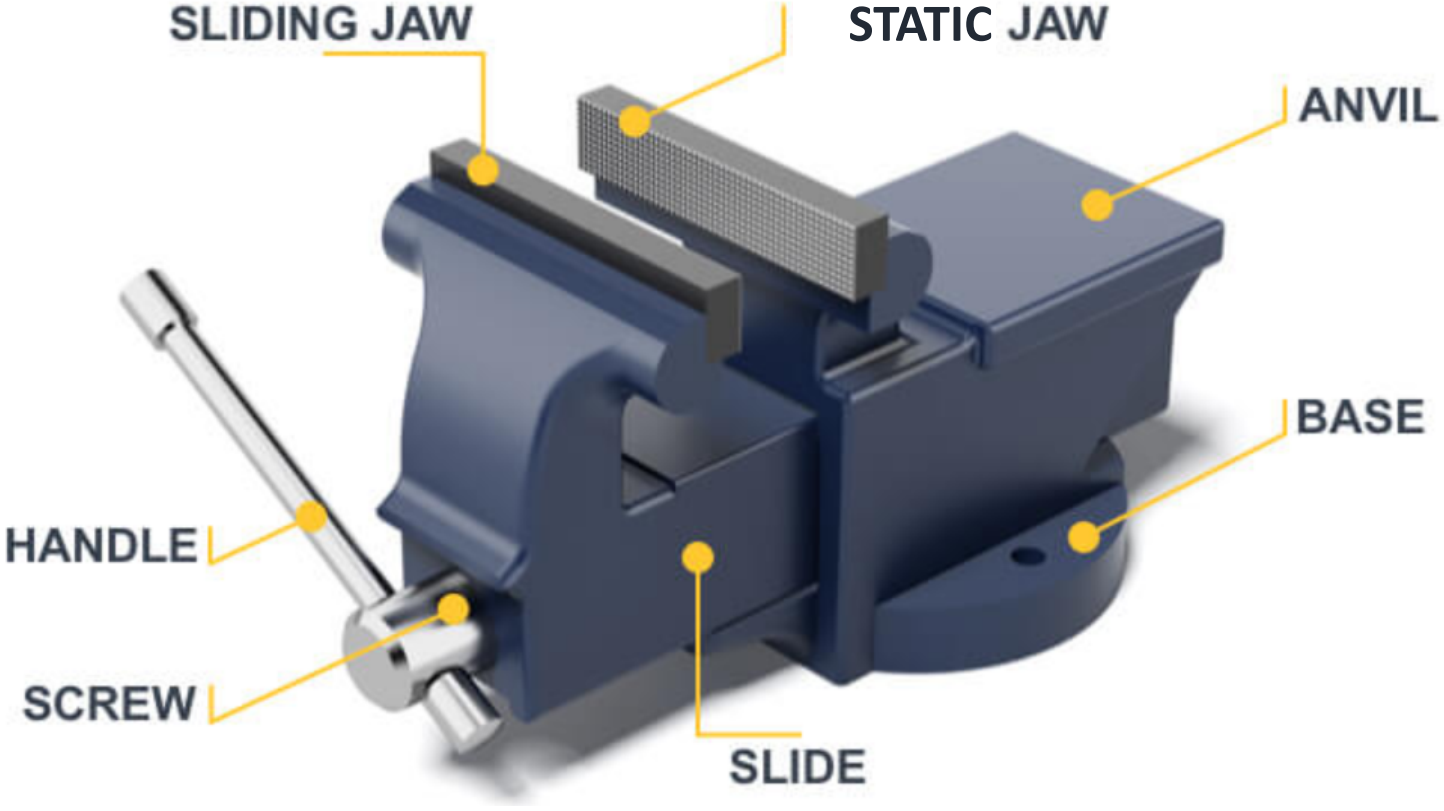


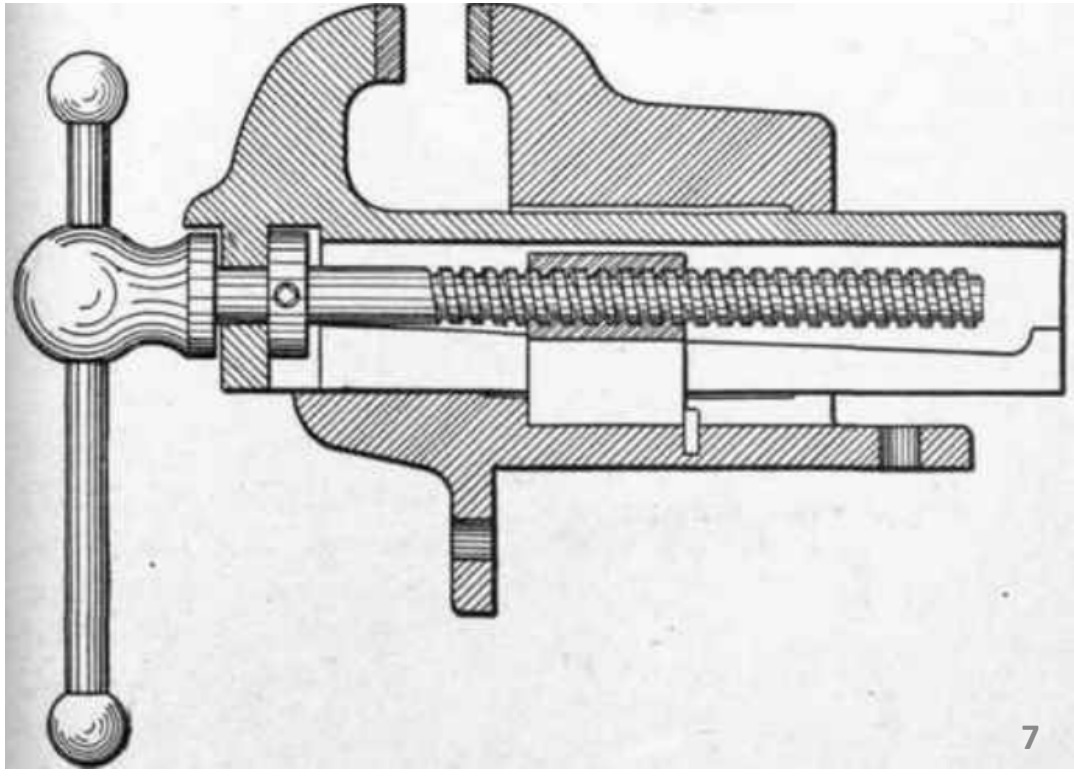


Workpiece holding devices

1. Bench vice

- Anvil provides a place to do the light shaping of materials.
- One can use anvil as a base to hammer small objects like bent nails.





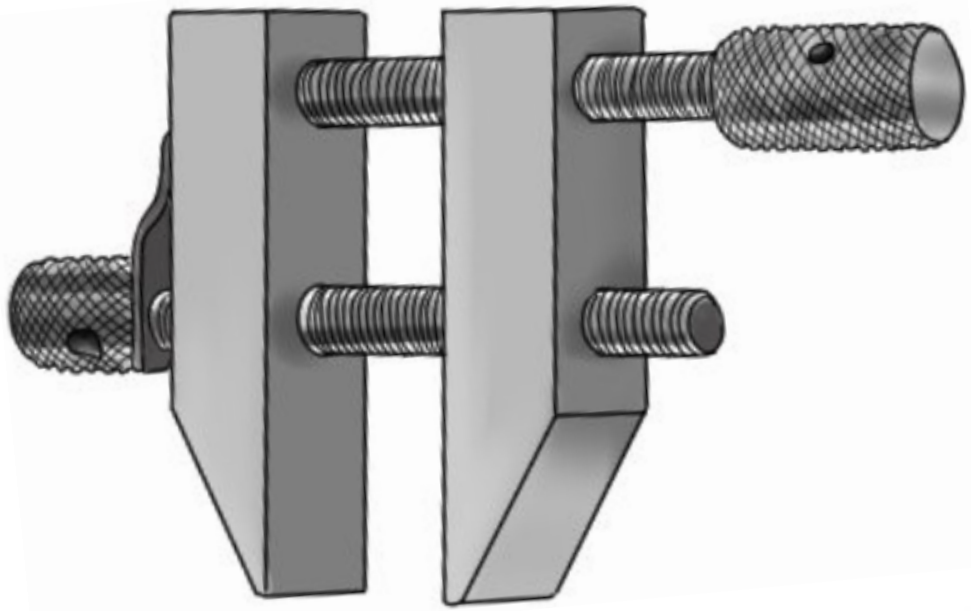
Workpiece holding devices

1. Bench vice

Workpiece holding devices

2. Clamps

- Clamps are used when the workpiece has to be securely fixed to perform fitting operations like assembly and marking.
- The type most used are toolmaker's clamps, which are adjustable within a range of about 100 mm but will only clamp parallel surfaces.
- Greater thicknesses can be clamped using C-clamps, so named because of their shape.
- Due to the swivel pad on the end of the clamping screw, the C-clamp is also capable of clamping surfaces which are not parallel.
- Care should be taken to avoid damage to the surfaces by the clamp.



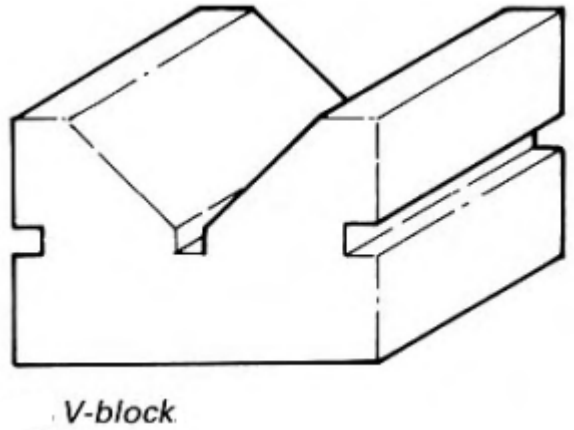
Toolmaker's clamp

C-clamp

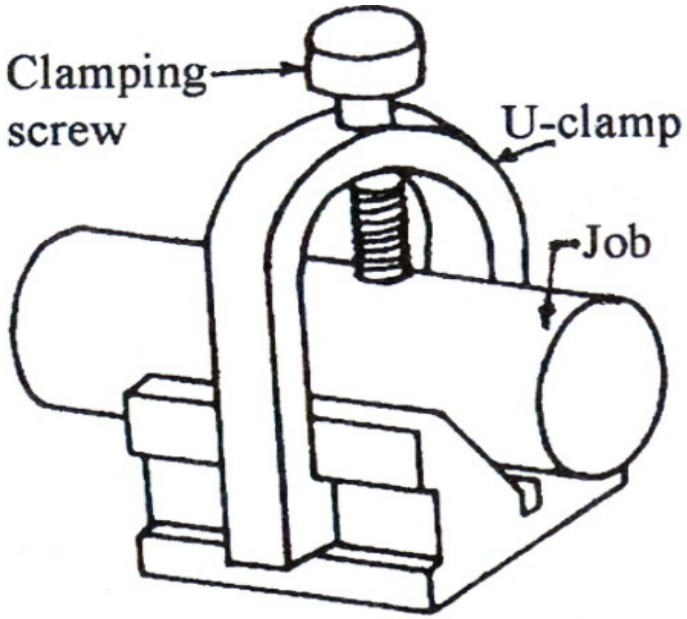
Workpiece holding devices

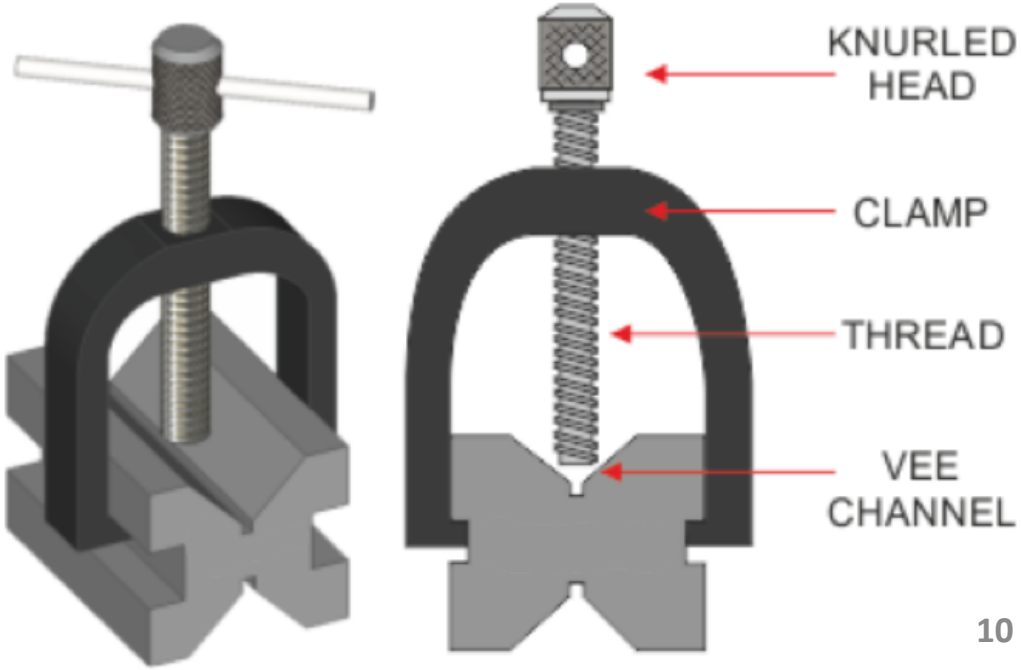
3. V-block

- A V-block or Vee block serves as a very useful tool to support the circular workpiece (job) during marking of measurements or for measuring operations.
- It usually works in conjunction with a U-clamp.
- The V-block is a rectangular or square block with a V-groove on one or both sides, opposite to each other.
- The angle of the V is usually 90^{o}.



V-block

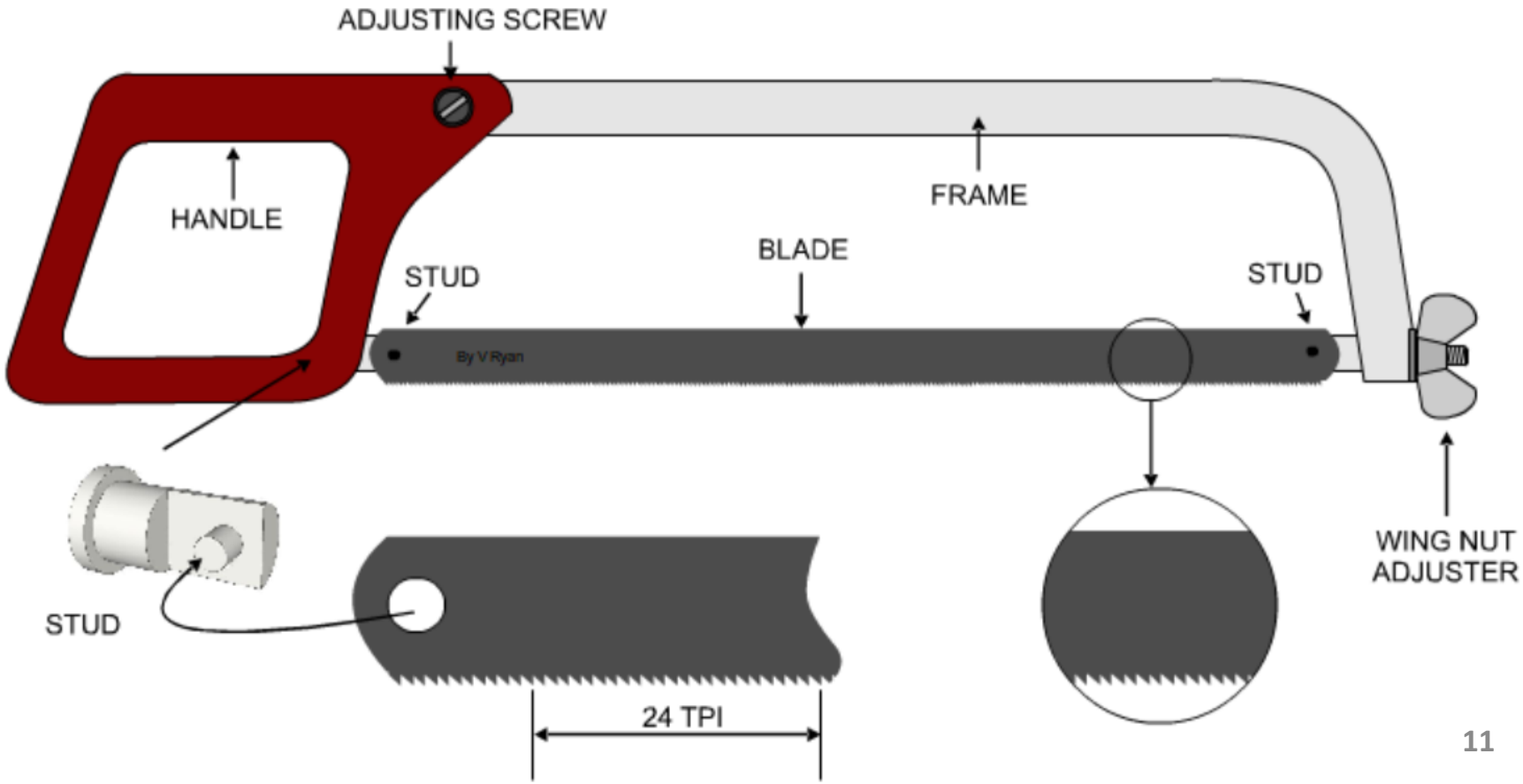




Cutting tools

1. Hacksaw

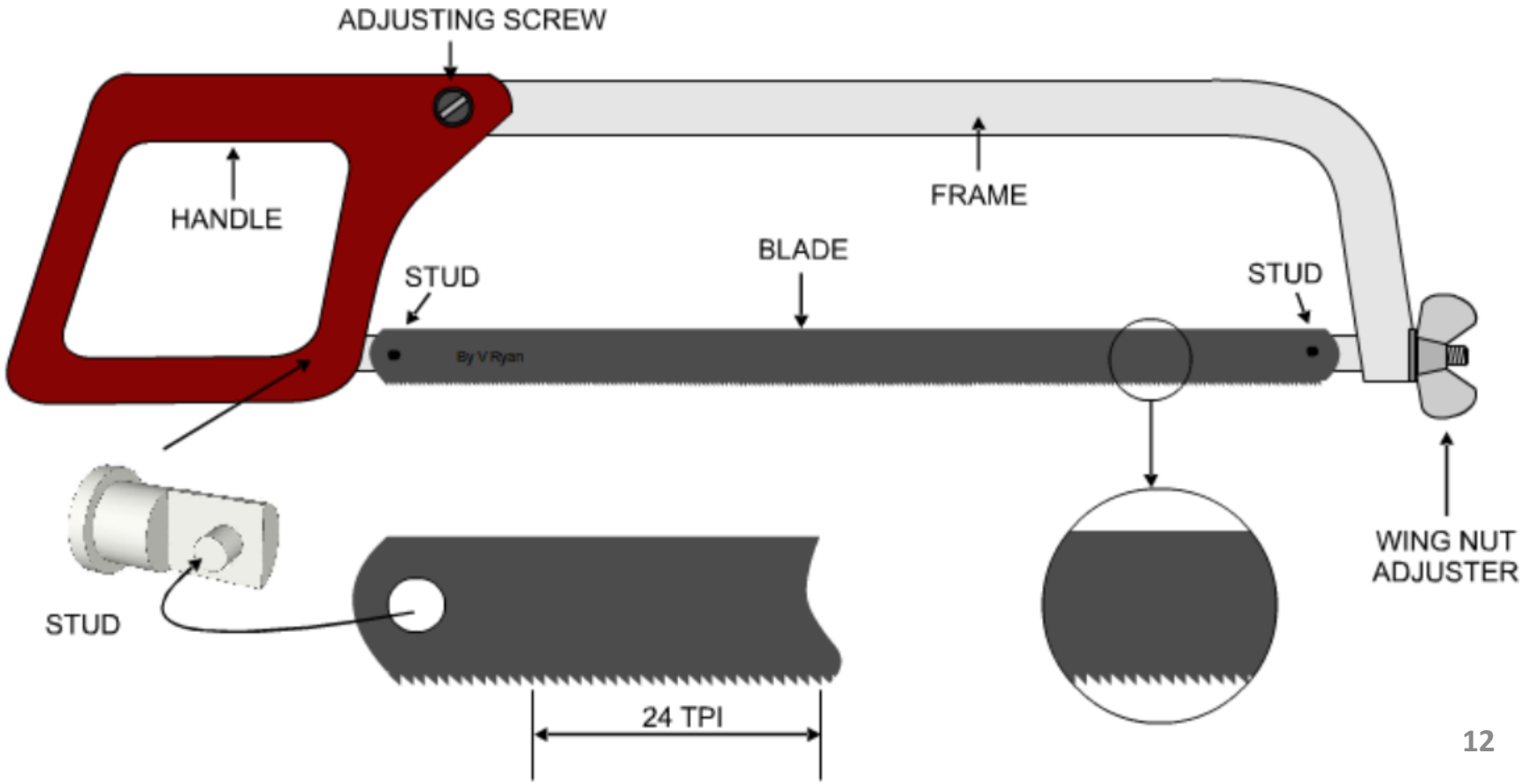
- The hacksaw is used for cutting metal by hand.
- It consists of a frame which holds a thin blade, firmly in position.
- The hacksaw blade fits into a hacksaw frame on two holding pins, one of which is adjustable in order to tension the blade.
- The blade is fitted to the frame with the teeth pointing away from the handle.
- Blade is correctly tensioned by turning the wing nut to take up the slack and then applying a further three turns only.



Cutting tools

1. Hacksaw

- A loose blade will twist or buckle and not cut straight, while an overtightened blade could pull out the ends of the blade.
- The standard hacksaw blade is 300 mm long × 13 mm wide × 0.65 mm thick.
- The blade has a number of cutting teeth.
- It is available with 14, 18, 24 and 32 teeth per 25mm (one inch), i.e. for every 25 mm length of blade there are 14 teeth, 18 teeth and so on.
- A hacksaw blade should be chosen to suit the type of material being cut, whether hard or soft, and the nature of the cut, whether thick section or thin.

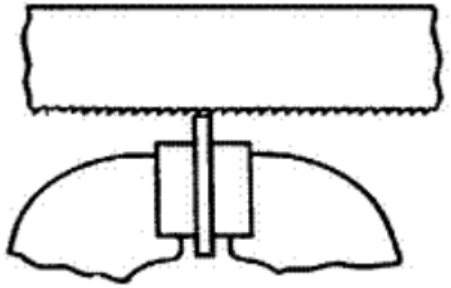


Cutting tools

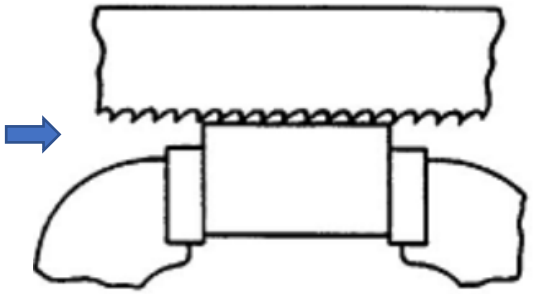
1. Hacksaw

- Two important factors in the choice of a blade are the pitch (distance between each tooth) and the material from which the blade is made.
- When cutting soft metals, more material will be cut on each stroke and this material must have somewhere to go.
- The only place the material can go is between the teeth, and therefore if the teeth are further apart there is more space for the metal being cut.
- The largest space is in the blade having the least number of teeth, i.e. 14 teeth per 25 mm.
- The opposite is true when cutting harder metals. Less material will be removed on each stroke, which will require less space between each tooth.
- If less space is required, more teeth can be accommodated in the blade, hence more teeth involve in cutting, which results in less time and effort for cutting.
- During the cutting process there should be at least 3 teeth in contact.

Thin sections more teeth ➡



Thick sections less teeth ➡



Cutting tools

1. Hacksaw

Selection of hacksaw blades ➡

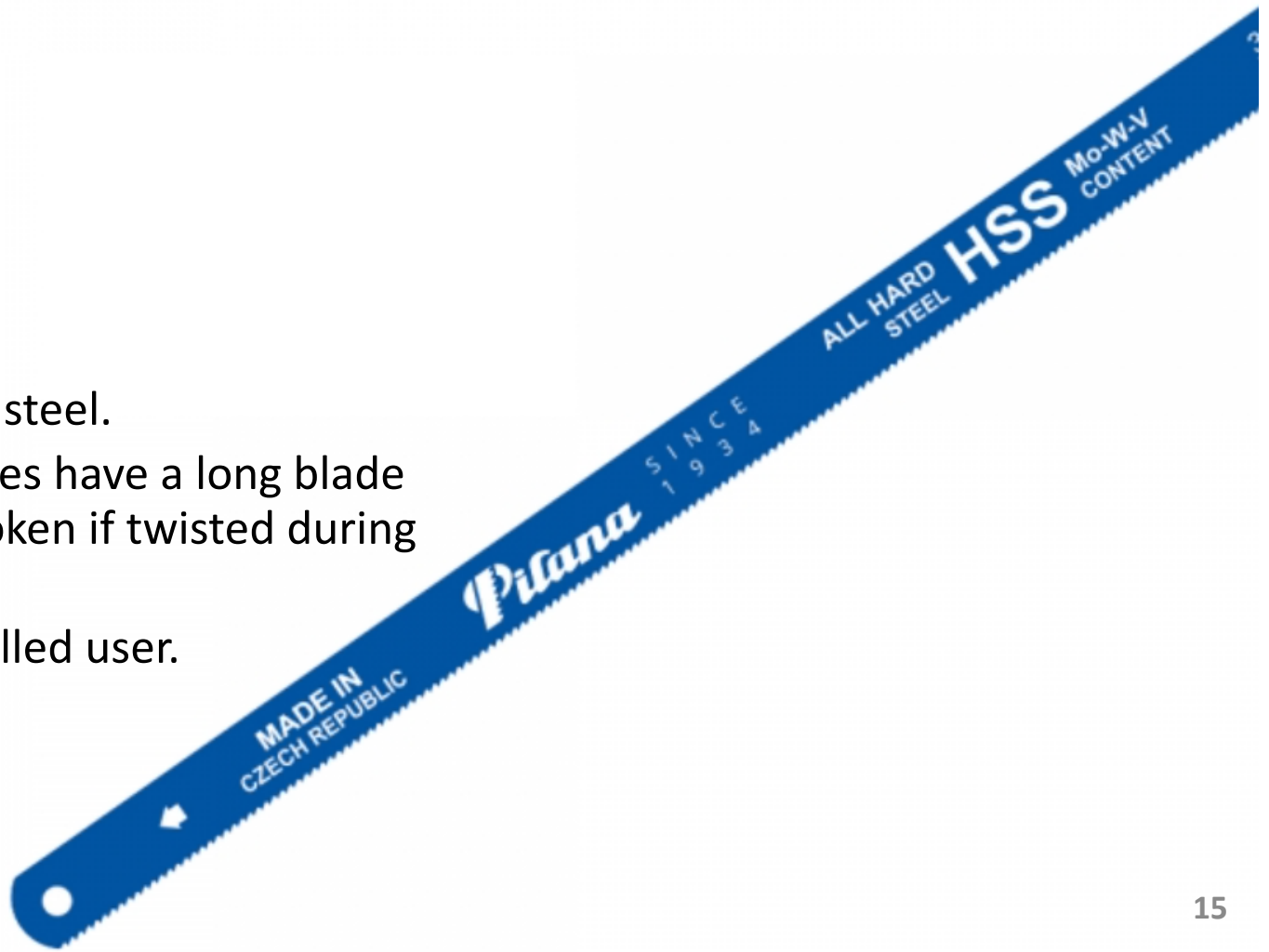
Material thickness (mm)	No. of teeth per 25 mm	
	Hard materials	Soft materials
Up to 3	32	32
3 to 6	24	24
6 to 13	24	18
13 to 25	18	14

Cutting tools

1. Hacksaw

- Three types of hacksaw blade are available:
  - All-hard
  - Flexible
  - Bimetal

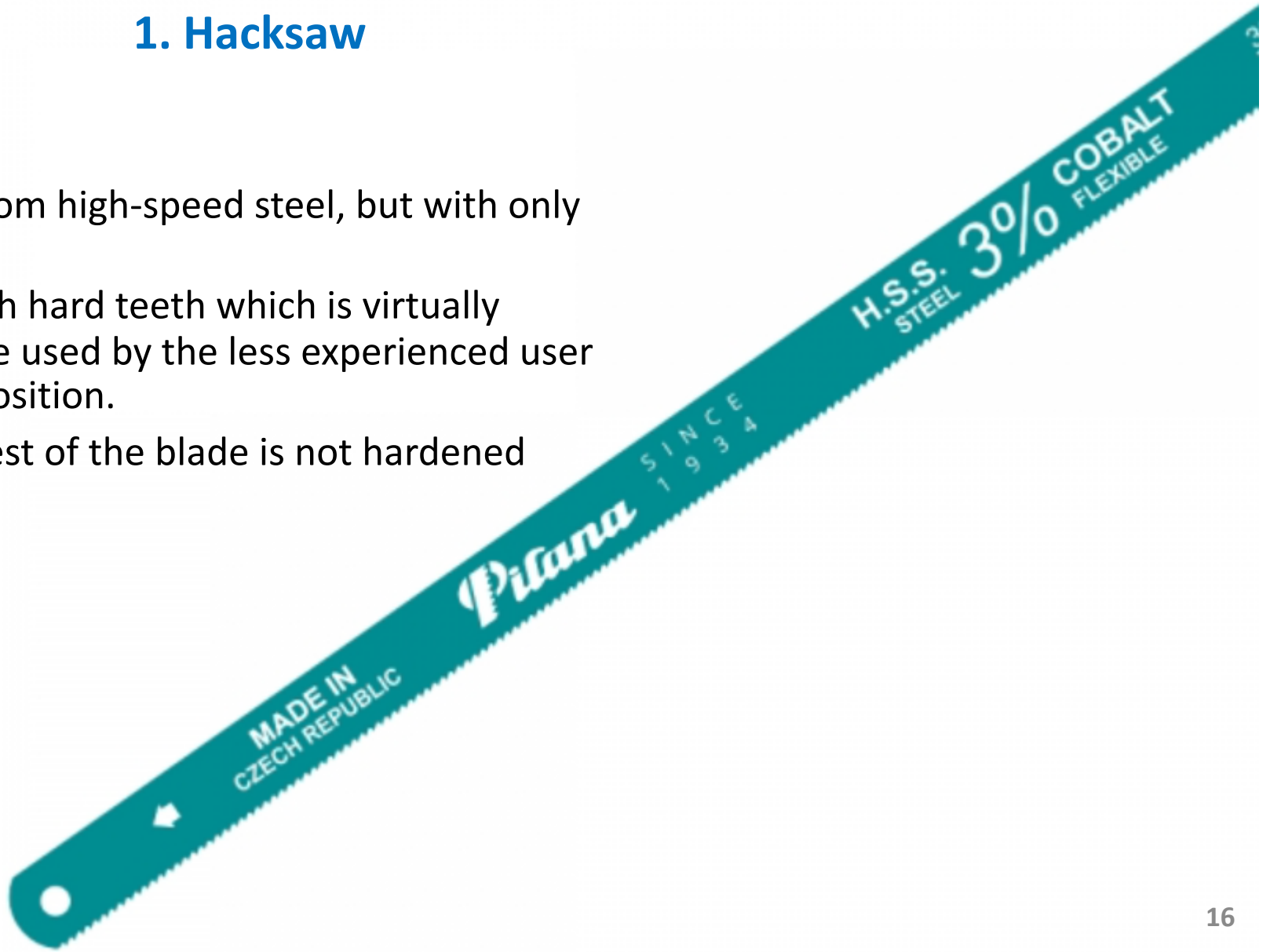
- All hard:
  - This type is made from hardened high-speed steel.
  - Due to their all-through hardness, these blades have a long blade life but are also very brittle and are easily broken if twisted during sawing.
  - For this reason they are best suited to the skilled user.



Cutting tools

1. Hacksaw

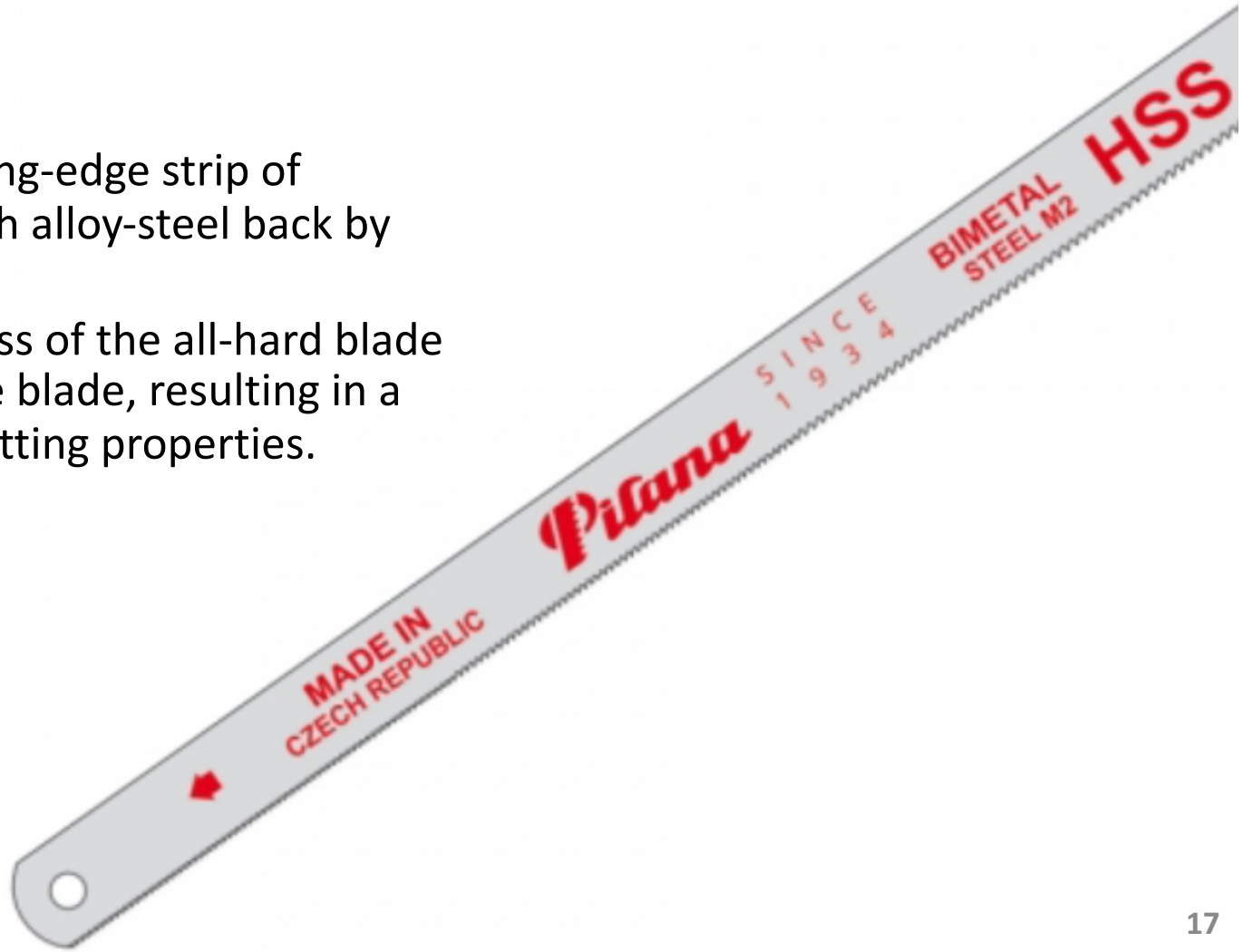
- Flexible:
  - ➢ This type of blade is also made from high-speed steel, but with only the teeth hardened.
  - ➢ This results in a flexible blade with hard teeth which is virtually unbreakable and can therefore be used by the less experienced user or when sawing in an awkward position.
  - ➢ The blade life is reduced as the rest of the blade is not hardened other than the teeth.



Cutting tools

1. Hacksaw

- Bimetal:
  - This type of blade consists of a narrow cutting-edge strip of hardened high-speed steel, joined to a tough alloy-steel back by electron beam welding.
  - This blade combines the qualities of hardness of the all-hard blade and the unbreakable qualities of the flexible blade, resulting in a shatterproof blade with long life and fast-cutting properties.



Cutting tools

1. Hacksaw

- **Hacksaw safety tips:**
  - Always wear safety goggles while using a hacksaw.
  - Be sure the hacksaw blade is properly tensioned.
  - Do not brush away chips with your hand; use a brush.
  - Never test the sharpness of a blade by running your fingers across its teeth.
  - Keep saw blades clean, and use light machine oil on the blade to prevent it from overheating and breaking.

- **Before using the hacksaw, take care of the following:**
  - Select the correct pitch for the material you want to cut.
  - Ensure that the blade has the correct tension.
  - Ensure that the blade in not twisted or discolored.
  - Ensure that the teeth must point away from the handle.
  - Ensure that there are no broken or blunt teeth.

Cutting tools

1. Hacksaw

- **Hacksaw blade failures and their causes:**
  - **Fast blunting**
    - ✓ If wrong teeth number is chosen.
    - ✓ If saw blade is not tightened accurately.
    - ✓ If pressure is too high, the teeth go blunt fast.

Hacksaw blade blunting

  - **Teeth breaking**
    - ✓ Tooth pitch is too small (teeth number per 25 mm) while cutting thin elements.
    - ✓ If material is not tightened well.

Teeth breaking

Cutting tools

1. Hacksaw

- **Hacksaw blade failures and their causes:**
  - **Breaking of saw blade**
    - ✓ Cutting material is not tightened properly.
    - ✓ Jammed material while finishing the cut.

Hacksaw blade breaking

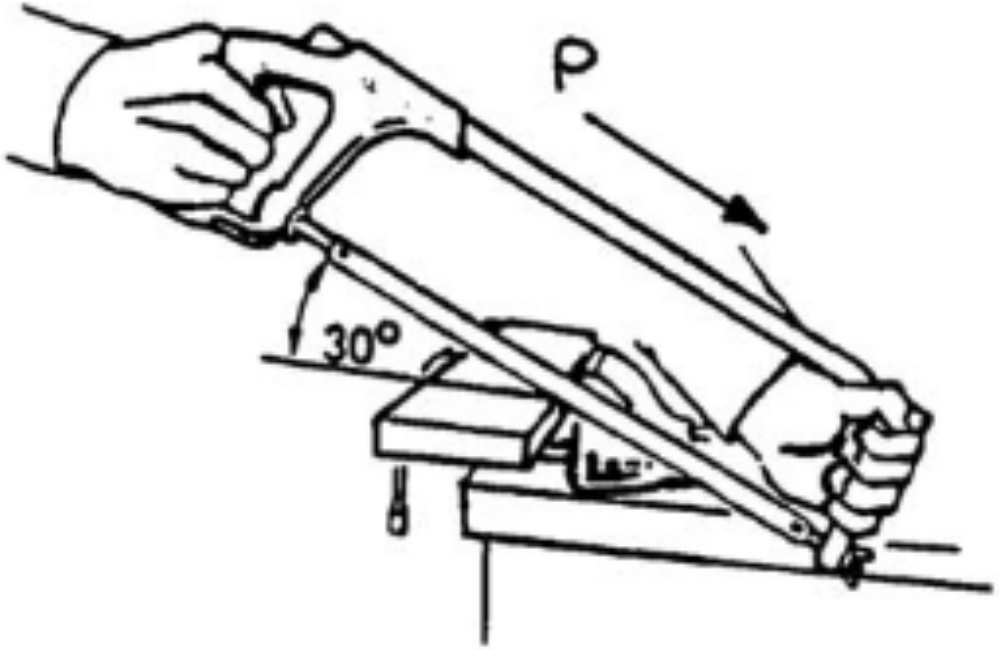
  - **Curved cutting**
    - ✓ Wrong fixing of blade in the frame.
    - ✓ Blade is insufficiently tightened.
    - ✓ Material is insufficiently tightened.

Curved cutting

Cutting tools

1. Hacksaw

- **Cutting with the hacksaw:**
  - Hold the hacksaw properly at an angle of 30^{o} as shown in figure.
  - When cutting, let your body sway ahead and back with each stroke.
  - Apply pressure on the forward stroke, which is the cutting stroke. Pressure should be released on the return stroke.
  - Use the entire length of the blade in each cutting stroke.
  - The usual cutting speed is from 40 to 50 strokes per minute.

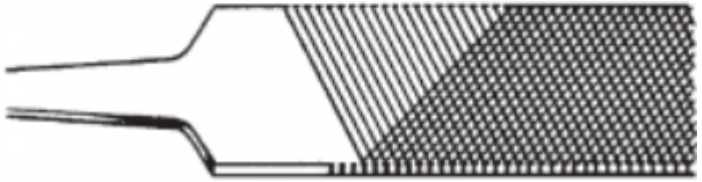


Cutting tools

2. Files

- Filing is one of the methods of removing small amounts of material from the surface of a metal part.
- A file is a hardened steel tool, having slant parallel rows of cutting edges or teeth on its surfaces.
- On the faces, the teeth are usually diagonal to the edge.
- When a file has a single series of teeth cut across its face it is known as ***single-cut file***, and with two sets of teeth cut across its face it is known as ***double-cut file***.
- One end of the file is shaped to fit into a wooden handle.

Single-cut file

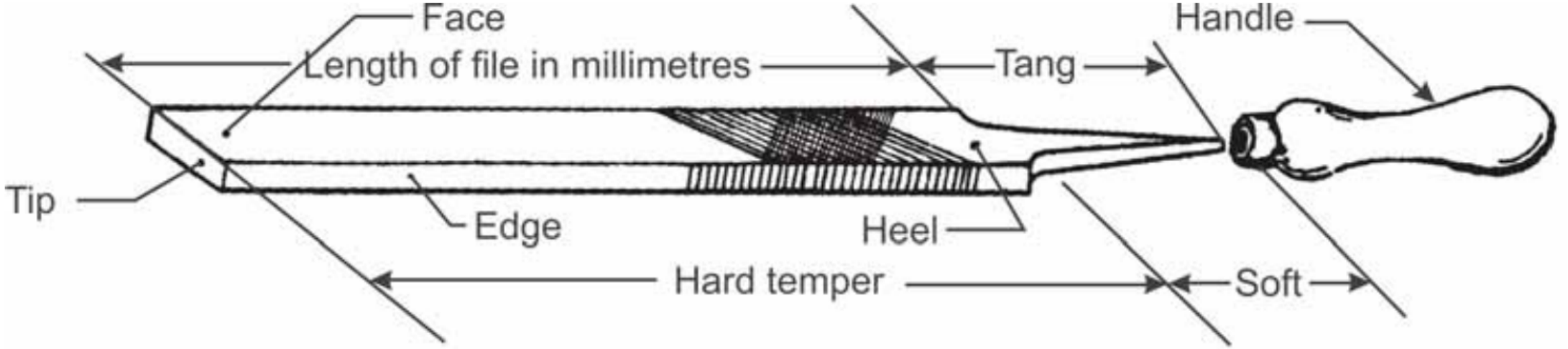


Double-cut file

Cutting tools

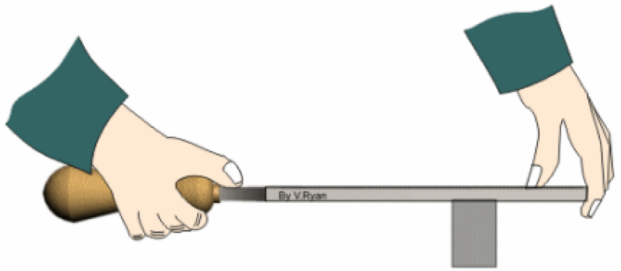
2. Files

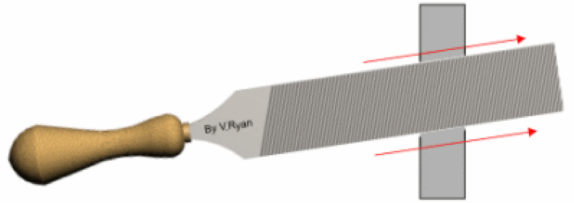
- The **tang** is the pointy end where a wooden or plastic handle is attached.
- At the base of the tang is the **heel**. This is where the body of the file begins.
- The next section is the belly or **face**, where all the cutting action happens.
- The **edges** of a file can be smooth or have teeth. Smooth edges are also called safe edges.
- Opposite the tang is the **tip**. The tip is the end that you point at the work.
- Size of a file is specified by its length. It is the distance from the tip to the heel, without the tang.
- Files for fine work are usually from 100 to 200 mm and those for heavier work from 200 to 450 mm in length.



Cutting tools

2. Files





Types of files

- **Hand file**
  - ✓ The hand file is for general use, typically on flat surfaces.
  - ✓ It is rectangular in cross-section, parallel in width along its length, but tapers slightly in thickness for approximately the last third of its length towards the tip.
  - ✓ It is double-cut on both faces, single-cut on one edge and is plain on the second edge.
  - ✓ The plain edge with no teeth is known as the ‘safe’ edge and is designed to file up to the edge of a surface without damaging it.
  - ✓ The taper in thickness enables the file to enter a slot slightly less than its full thickness.

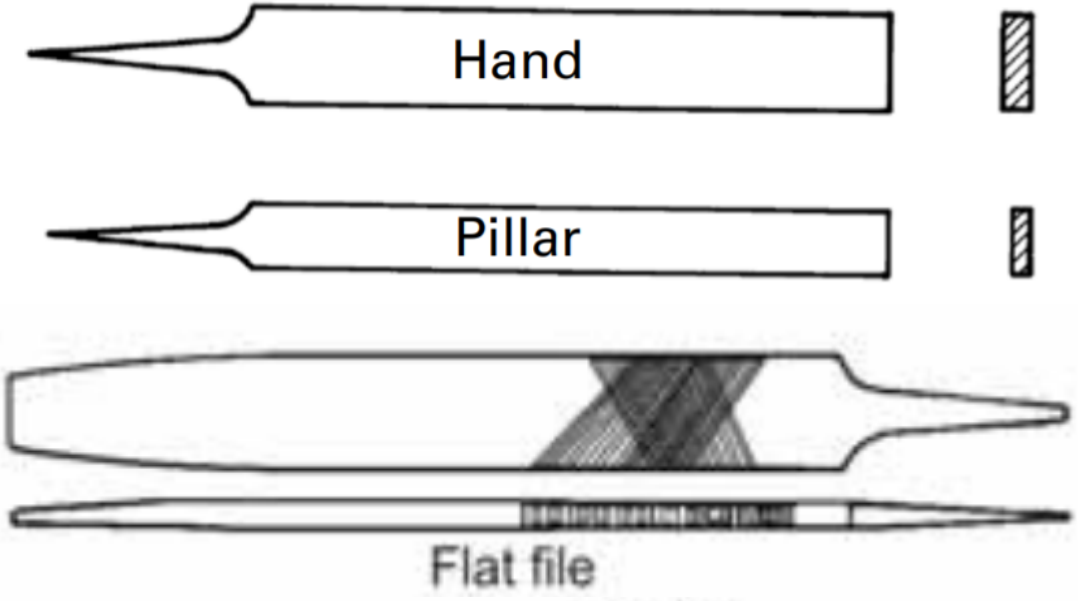
Cutting tools

2. Files

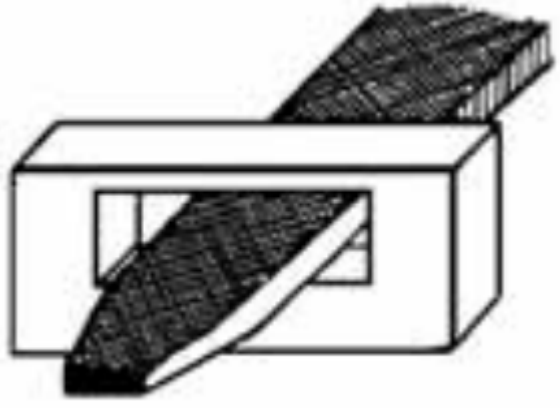
Types of files

- **Pillar file**
  - ✓ This file has the same section as a hand file but of a thinner section.
  - ✓ It is used for narrow slots and keyways.

- **Flat file**
  - ✓ The flat file is also for general use, typically on flat surfaces.
  - ✓ It is rectangular in cross-section and tapers in both width and thickness for approximately the last third of its length towards the tip.
  - ✓ Both faces are double-cut and both edges single-cut.
  - ✓ The tapers in width and thickness enable this file to be used in slots which are narrower than its full width and thickness and which require filing on length and width.



Flat file



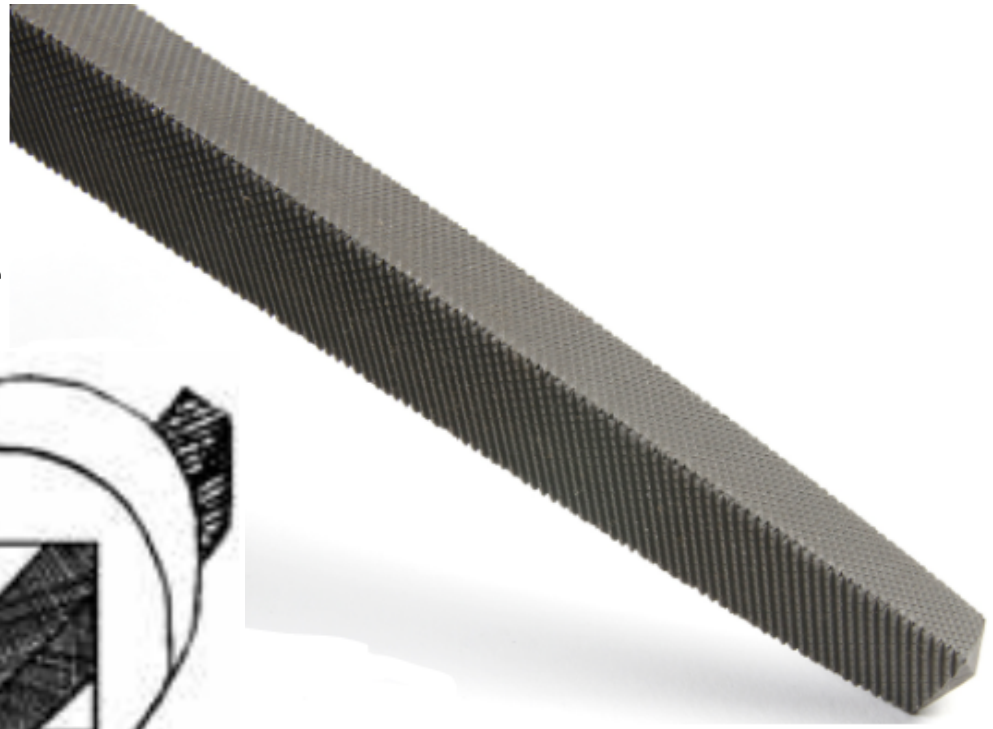
Flat file

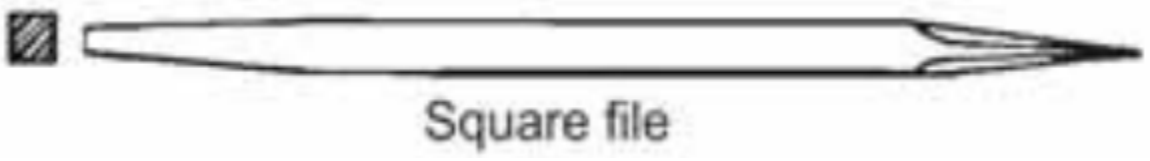
Cutting tools

2. Files

Types of files

- **Square file**
  - ✓ The square file is of square cross-section, parallel for approximately two-thirds of its length, then tapering towards the tip.
  - ✓ It is double-cut on all sides.
  - ✓ This file is used for filing keyways, slots and the smaller square or rectangular holes with 90° sides.





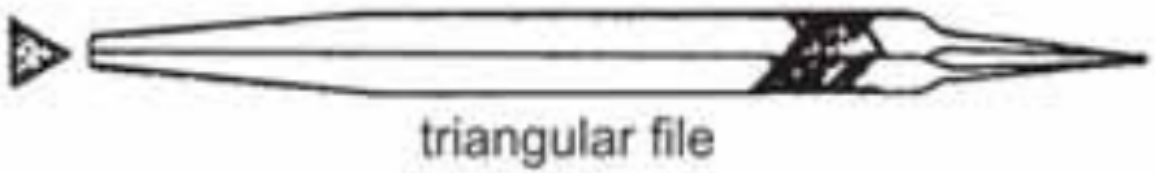
Square file

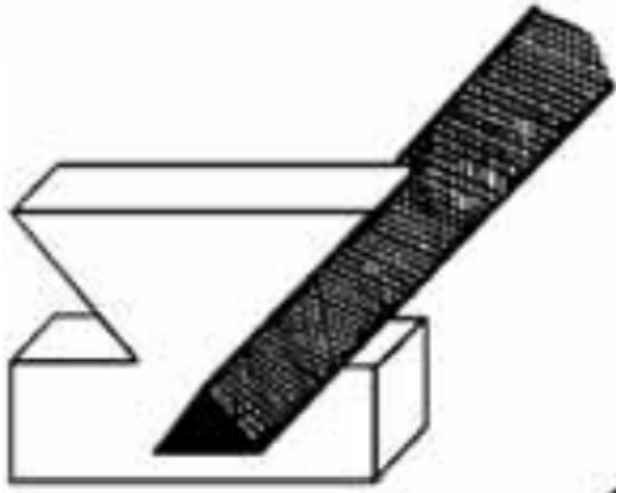
Cutting tools

2. Files

Types of files

- **Three-square file**
  - ✓ The three-square or triangular file has a 60° triangle cross-section, parallel for approximately two-thirds of its length, then tapering towards the tip.
  - ✓ The three faces are double-cut and the edges sharp.
  - ✓ This file is used for surfaces which meet at less than 90°, angular holes and recesses.



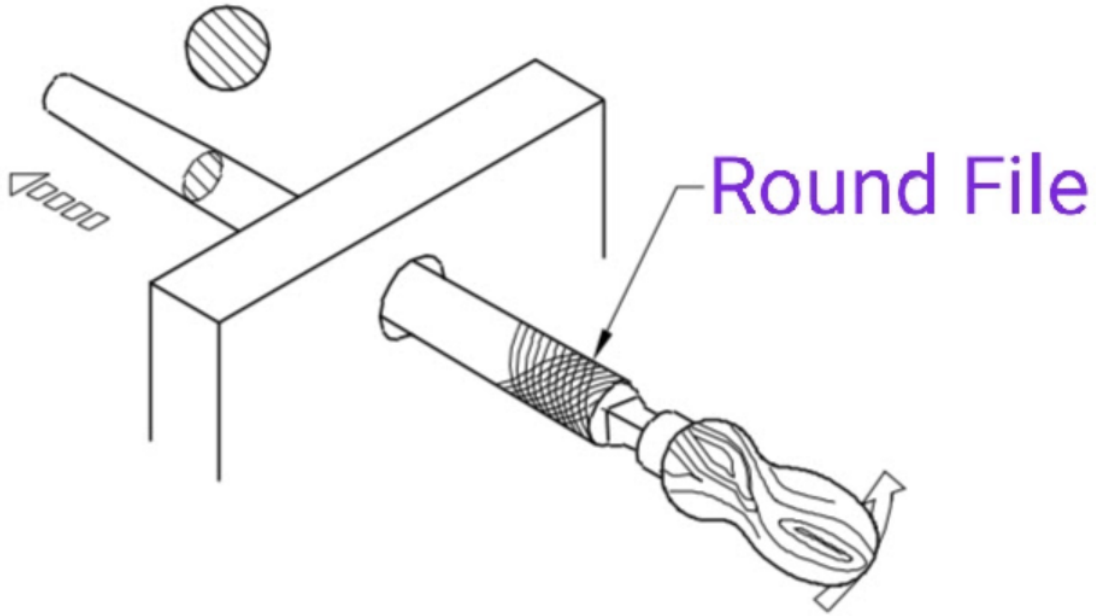


Cutting tools

2. Files

Types of files

- **Round file**
  - ✓ The round file is of circular cross-section, uniform for approximately two-thirds of its length and then tapering towards the tip.
  - ✓ This file is used for enlarging round holes, elongating slots and finishing internal round corners.

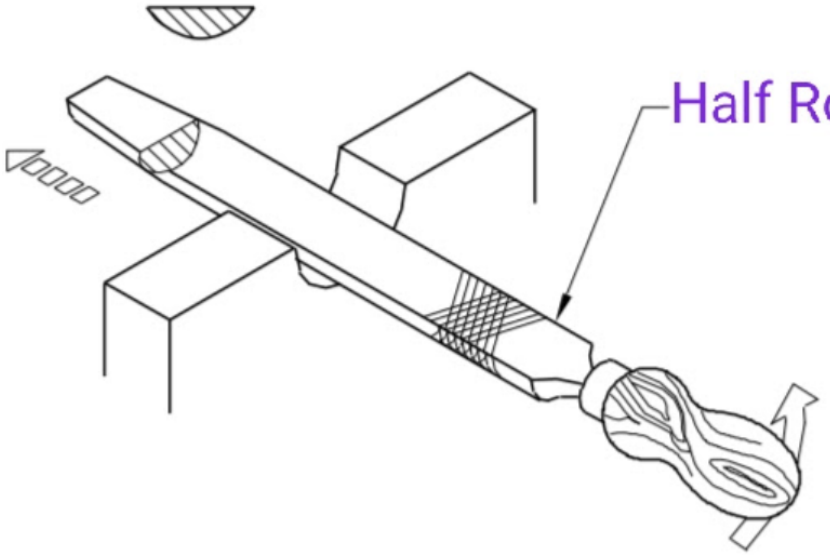


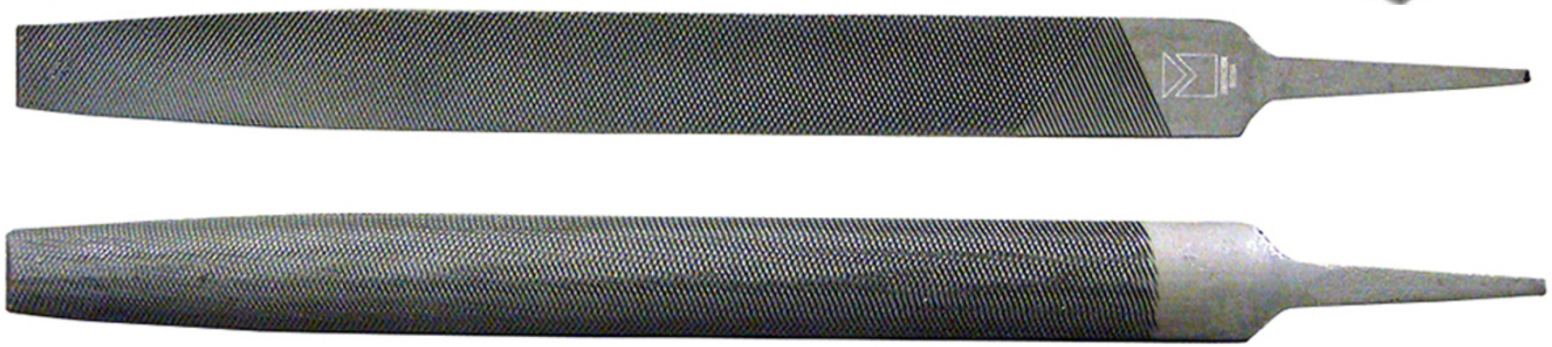
Cutting tools

2. Files

Types of files

- **Half-round file**
  - ✓ The half-round file has one flat and one curved side.
  - ✓ Cross-section is not a semicircle but only about 1/3 of circle.
  - ✓ The cross-section is uniform for approximately two-thirds of its length, then tapers towards the tip.
  - ✓ This is an extremely useful double-purpose file for flat surfaces and for curved surfaces which are too large for the round file.



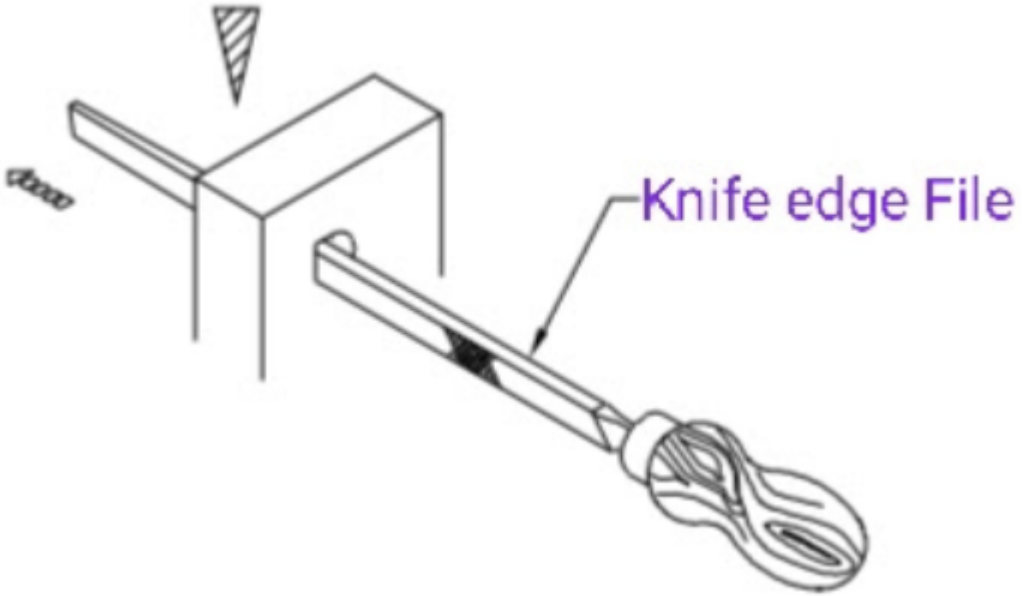


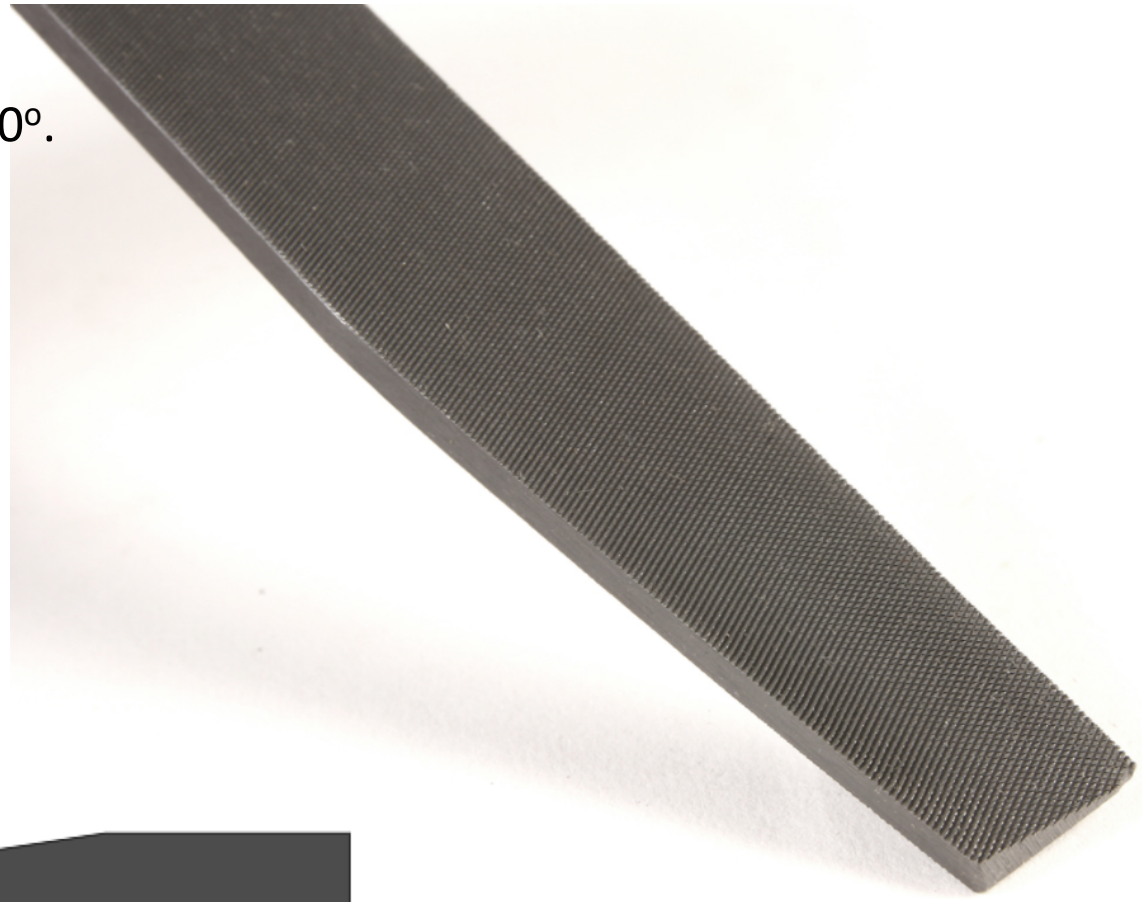
Cutting tools

2. Files

Types of files

- **Knife file**
  - ✓ A knife file has the cross section of a sharp triangle.
  - ✓ It is used for filing narrow grooves and angles above 10°.
  - ✓ These files have one third of their lengths tapered.
  - ✓ They are available with both single and double cuts.



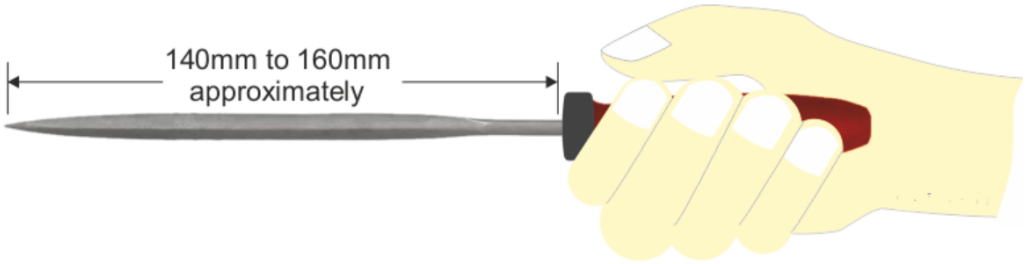


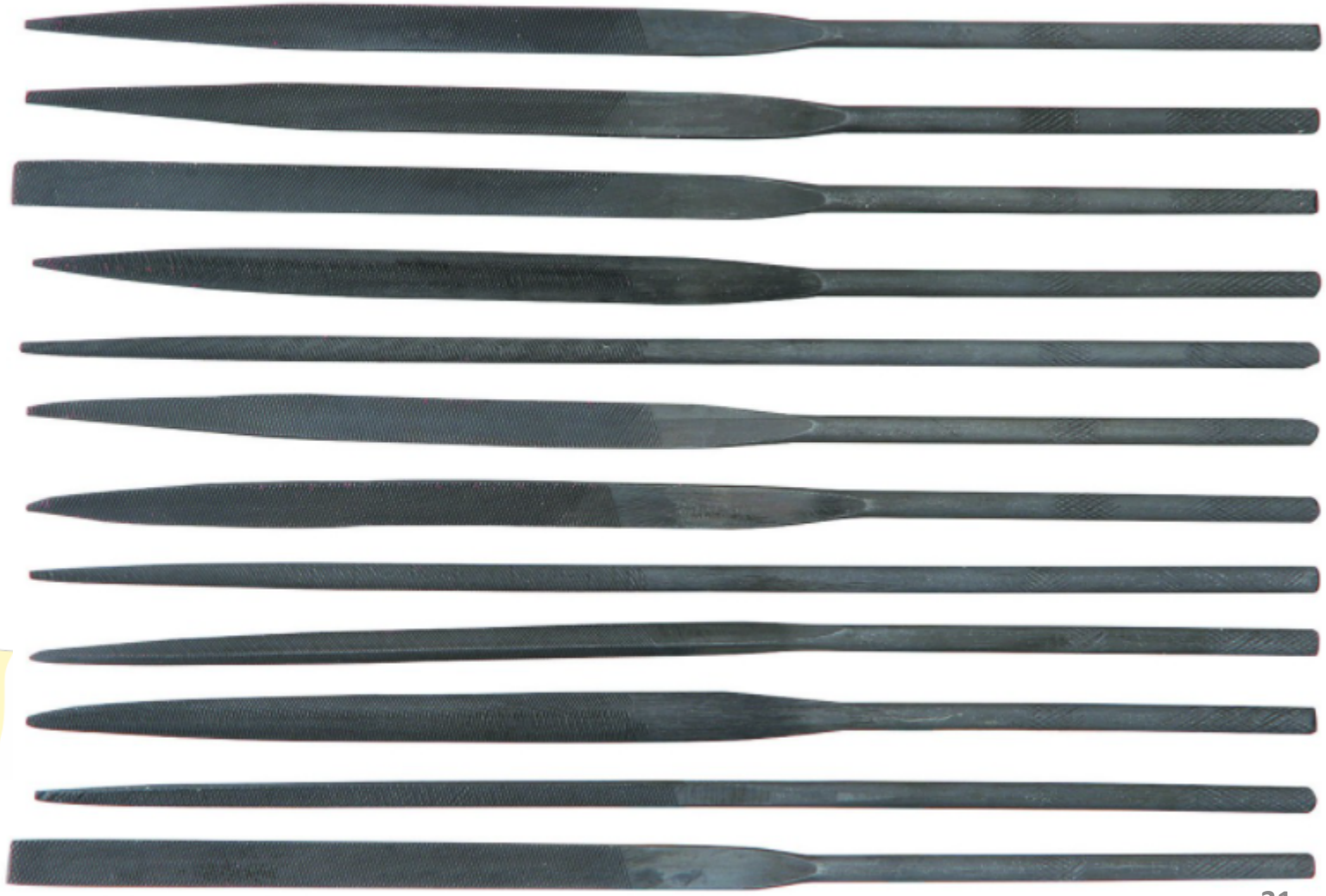
Cutting tools

2. Files

Types of files

- **Needle files**
  - ✓ These are essentially very small and thin versions of the previously described types of file.
  - ✓ They are suitable for very fine work in fitting, where very small amounts of material have to be removed in intricate shapes or in a confined space.



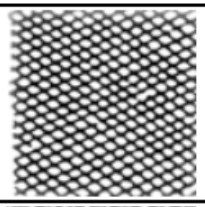
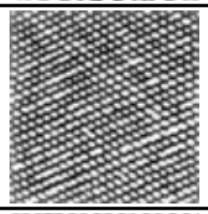
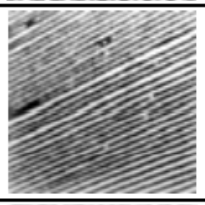
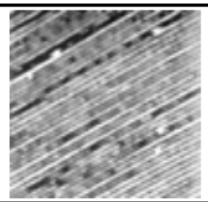
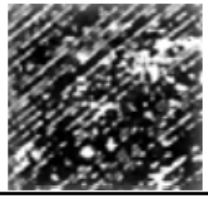


Cutting tools

2. Files

Grades of files

- Previously mentioned each type of file (or shape of file) is also available in a series of different “grades” ranging from rough to smooth.
- Rough grade has wider spaced teeth that give a harsh cut, allowing to take off more material per stroke.
- Smooth grade has finer teeth spaced closer together giving a smooth finish.

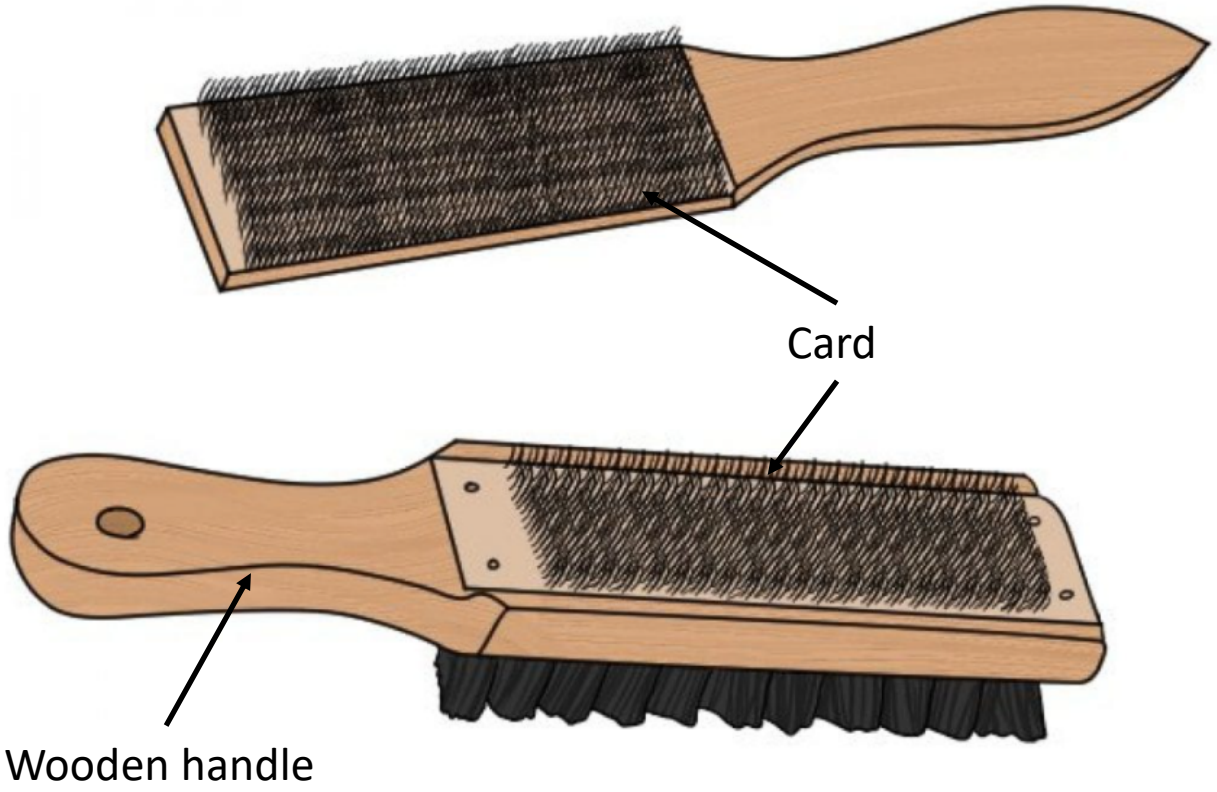
Type	Form	No of teeth/cm
Rough		8
Bastard		17
Second cut		16
Smooth		20-24
Dead smooth		40

Cutting tools

2. Files

File card

- It is a metal brush used for cleaning the files, to free them from filings, clogged in between the teeth.
- A file card brush contains a number of metal bristles set in a rectangle, also known as a ‘card’, which is where the tool gets its name.
- There are two different types of file card brushes available, single and double sided.
- The double sided file card brush contains wire bristles on one side and a brush on the opposite one.



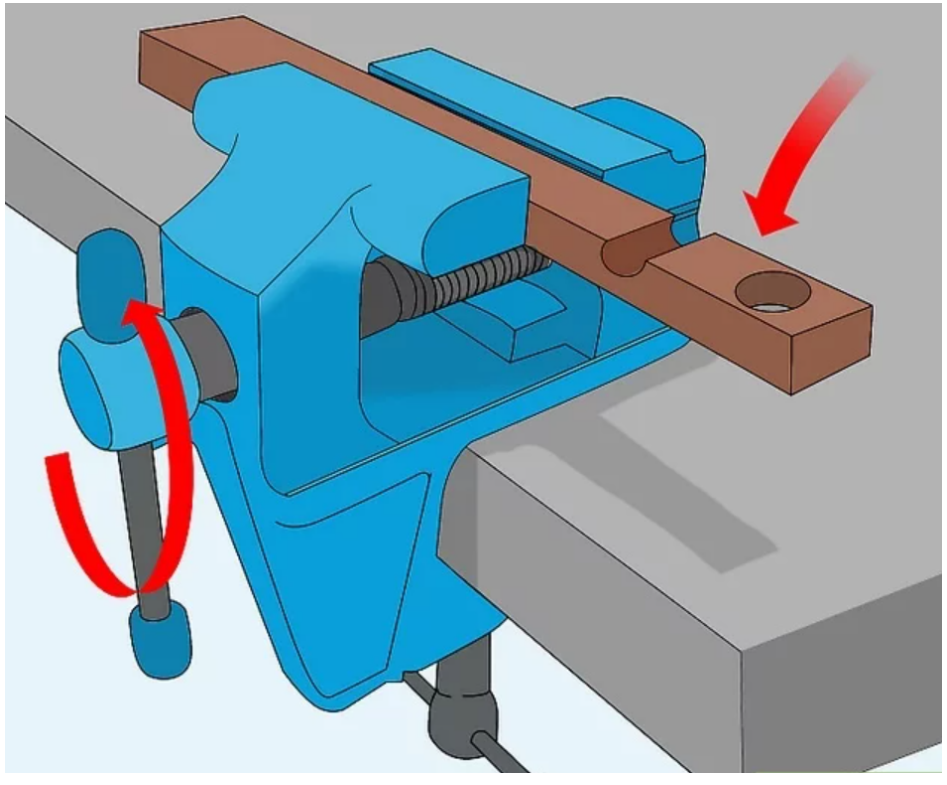
Cutting tools

2. Files

Working with files

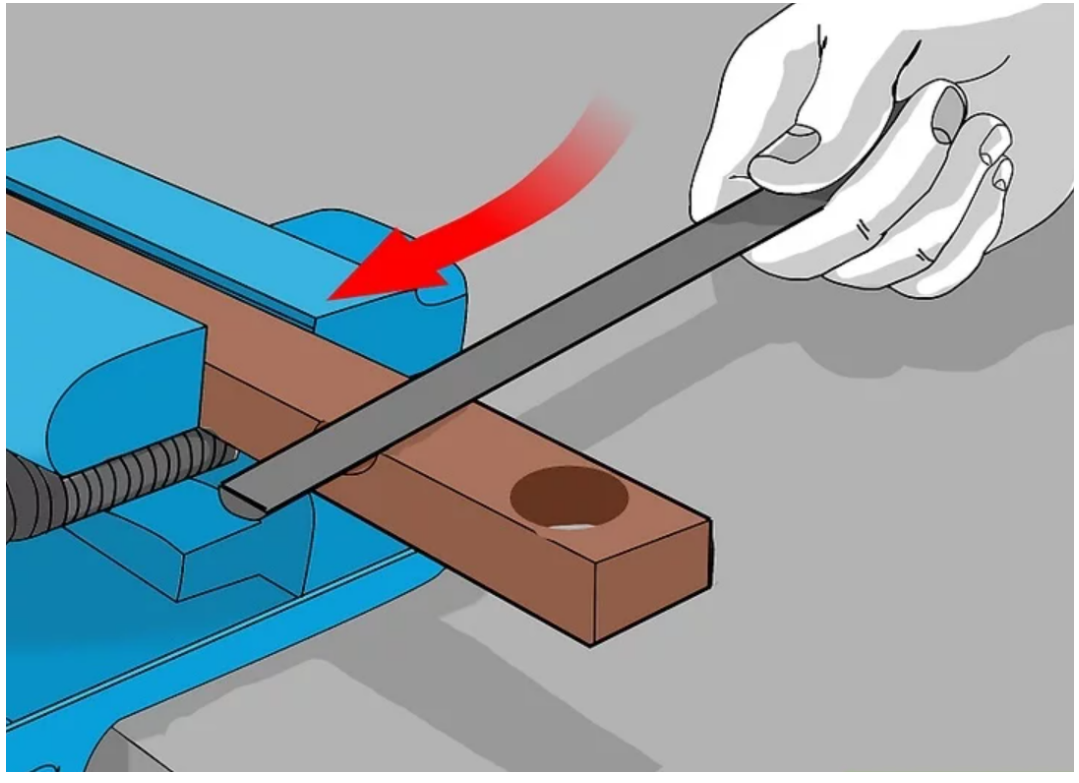
1) Secure the workpiece

✓ It is important to clamp the workpiece with a vise or other clamp to arrest its motion while filing.



2) File in only one direction

✓ Only apply pressure on the forward stroke and lift the file away from the workpiece on the return stroke.



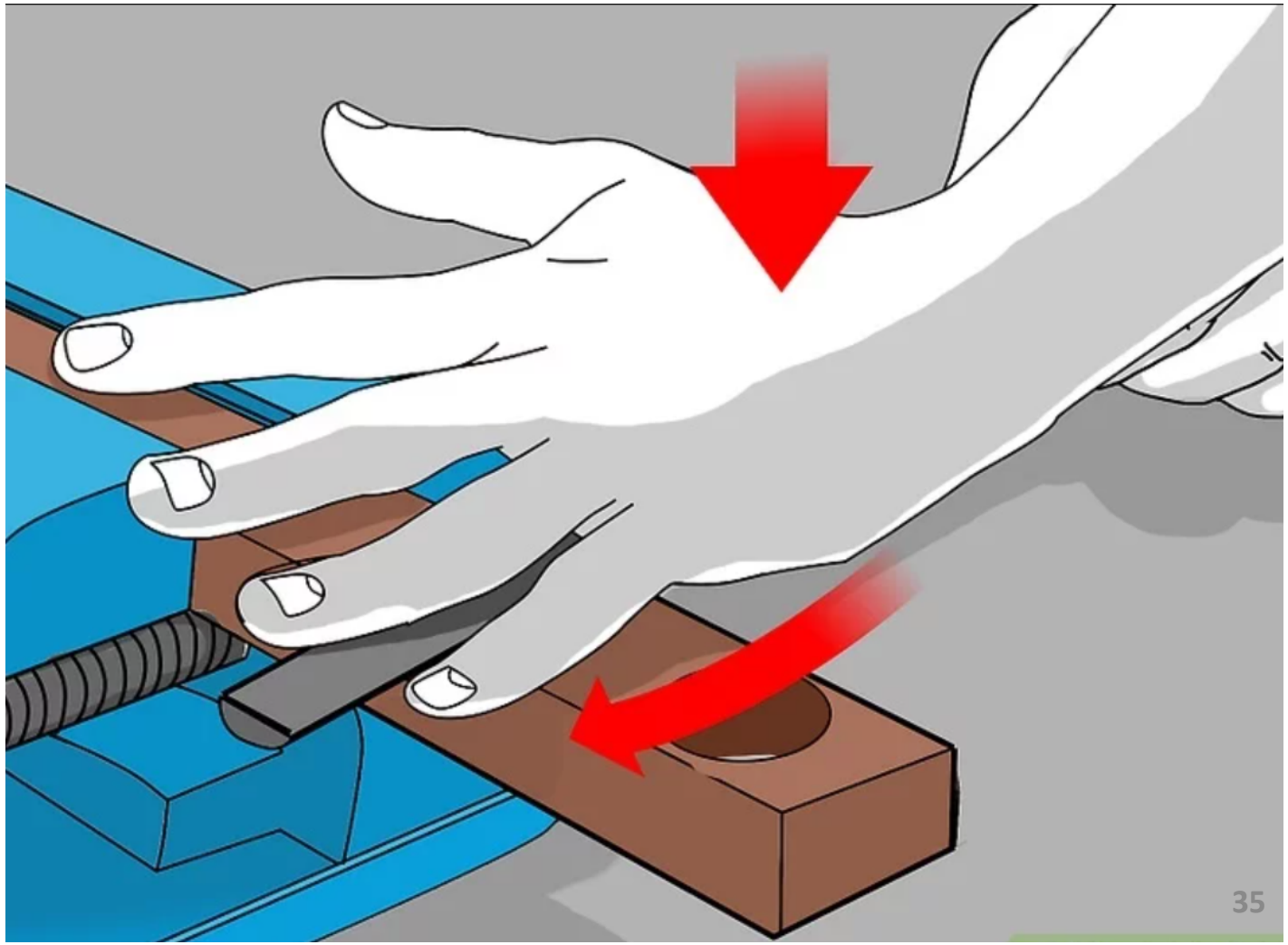
Cutting tools

2. Files

Working with files

3) Cross file to remove material

- ✓ For heavy cross filing, grab the handle of the file with the dominant hand and place the palm of the other hand on the end of the file.
- ✓ Angle the file diagonally to the workpiece and press down firmly so that the file digs in and cuts the metal.
- ✓ Make long, slow strokes away from your body. Lift the file away from the surface on the return stroke to prevent dulling the file.



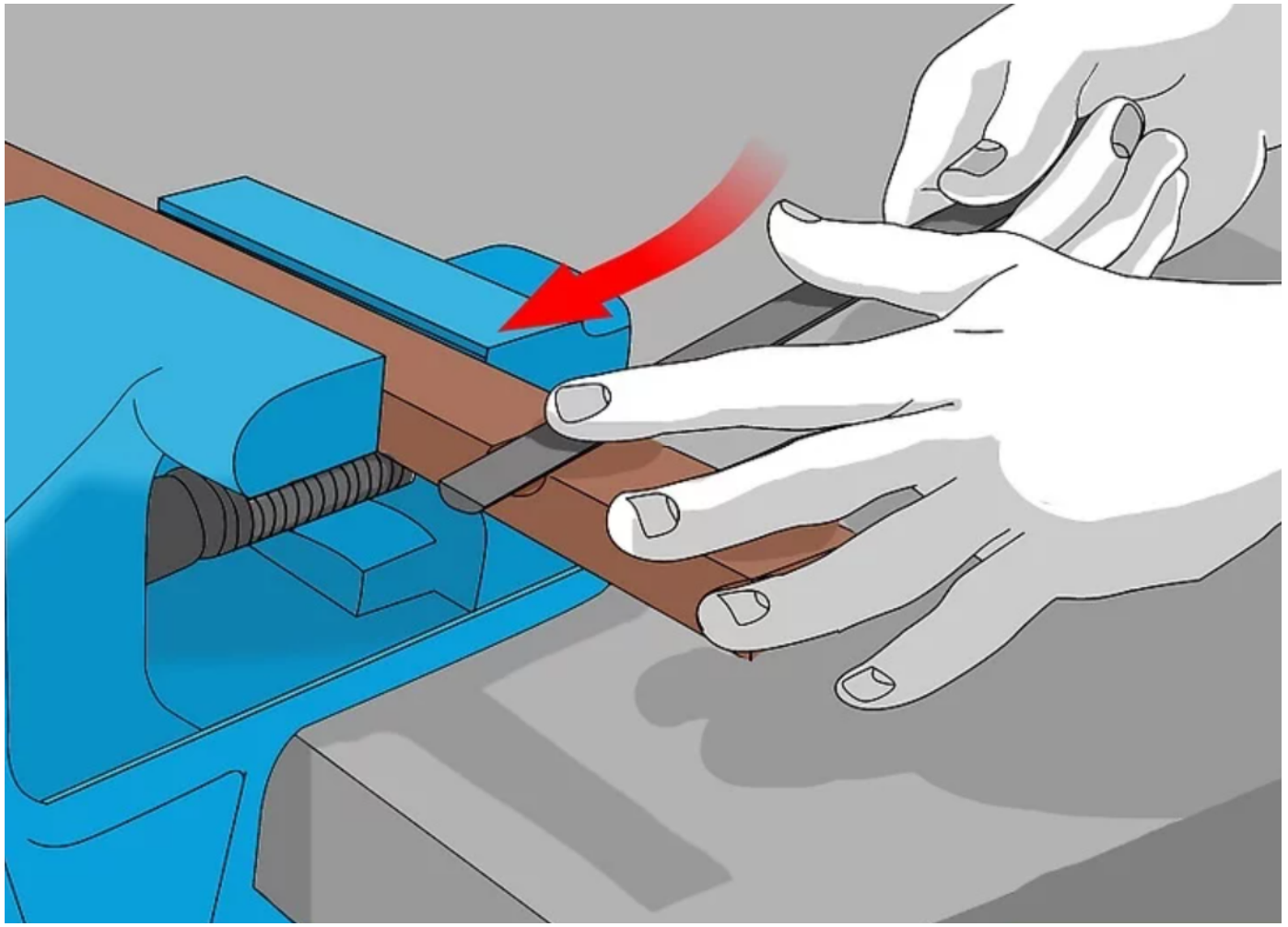
Cutting tools

2. Files

Working with files

4) Straight file for detail work

- ✓ For straight filing, use a small file rather than a large one.
- ✓ Grab the handle of the file with the dominant hand and place the fingers of the other hand on the end of the file.
- ✓ Point the file away from you and press it down firmly on your workpiece.
- ✓ Make long, slow strokes away from your body, and only file in one direction, rather than back and forth.



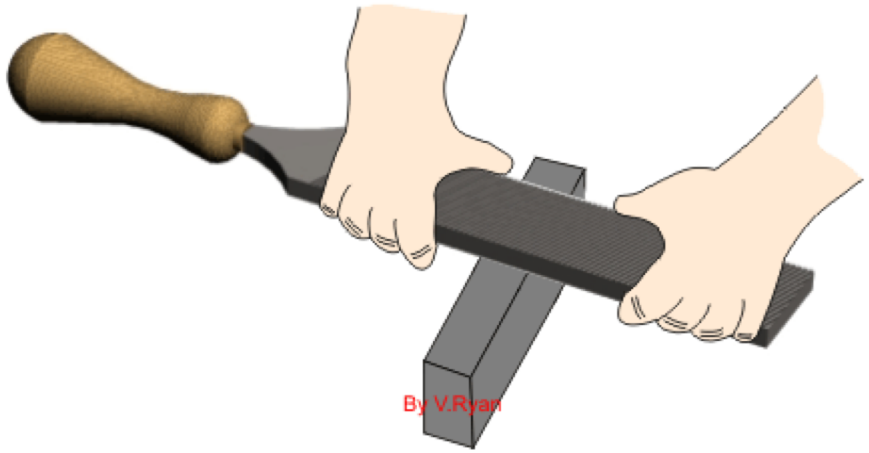
Cutting tools

2. Files

Working with files

5) Draw file to finish a surface

- ✓ Draw filing is done so as to get a very smooth finish.
- ✓ For draw filing, place your hands on either side of the file with a gap slightly larger than your workpiece.
- ✓ Hold the file horizontally and make long, slow strokes away from your body with a firm pressure.
- ✓ Remember to only apply pressure on the forward stroke, and to release the file on the backward stroke.



Cutting tools

2. Files

Taking care of files

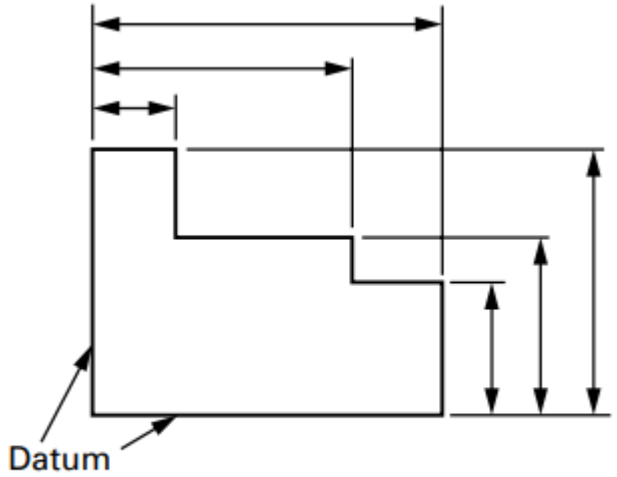
- Never throw files on top of each other in a drawer, as the teeth may be chipped.
- Never knock the file on its edge to get rid of filings in the teeth – instead use a file brush.
- A file brush should be used regularly to remove filings from the teeth, failure to do so will cause scratching of the work surface and inefficient removal of metal.
- Always clean the file on completion of the job before putting it away.
- Do not exert too much pressure when using a new file, or else some of the teeth may break off due to their sharpness – work lightly until the fine tooth points are worn slightly.
- For the same reason, avoid using a new file on rough surfaces of castings, welds or hard scale.
- Always use a properly fitted handle of the correct size – remember, one slip and the tang could pierce your hand.

Marking out

- Marking out is the scratching of lines on the surface of a workpiece, known as scribing, and is usually carried out only on a single workpiece or a small number of workpieces.
- The main purpose of marking out is to indicate the workpiece outline or the position of holes, slots, etc.
  - ✓ If the excess material will have to be removed, an outline is marked for the extent to which hacksawing or filing can be carried out.
- It is important to note that the scribed lines are only a guide, and any accurate dimension must be finally checked by measuring.

Datum

- The purpose of a datum is to establish a reference position from which all dimensions are taken and hence all measurements are made.
- The datum may be a point, an edge or a center line, depending on the shape of the workpiece.
- For any plane surface, two datums are required to position a point and these are usually at right angles to each other.

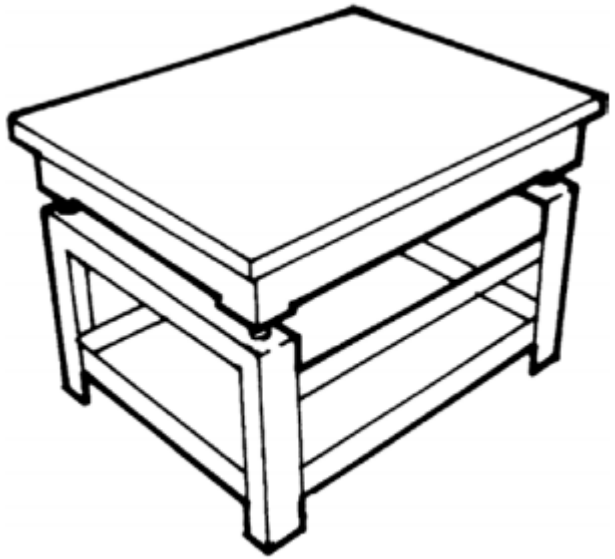


Datum edges

Marking out tools

1. Surface table

- In order to establish a datum from which all measurements are made, a reference surface is required. This reference surface takes the form of a large flat surface called a surface table upon which the measuring equipment is used.
- A surface table or marking table is a heavily build cast iron table used for layout work on all sizes of jobs.
- This table provides a flat surface to mark lines on the workpiece.
- For high-accuracy inspection work, surface tables made from granite are available.

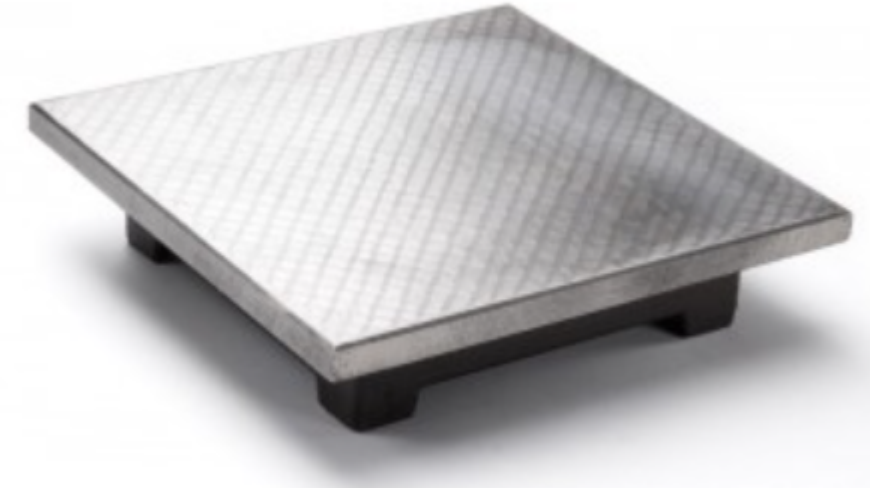


Surface table

Marking out tools

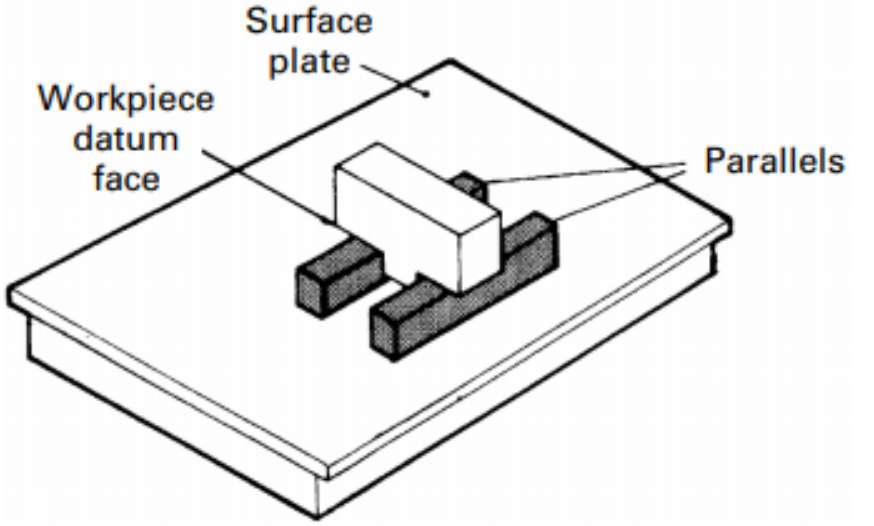
2. Surface plate

- The surface plate is used for testing the flatness of the work piece and other inspection purposes.
- It is also used for marking on small works.
- It is more precise in flatness than the marking table.
- Surface plates are made of cast iron or hardened steel, ground and scraped to the required precision.



3. Parallels

- The workpiece can be set on the parallels to raise it off the reference surface and still maintain parallelism.
- Parallels are made in pairs to precisely the same dimensions, from hardened steel, finish ground, with their opposite faces parallel and adjacent faces square.
- A variety of sizes should be available for use when marking out.

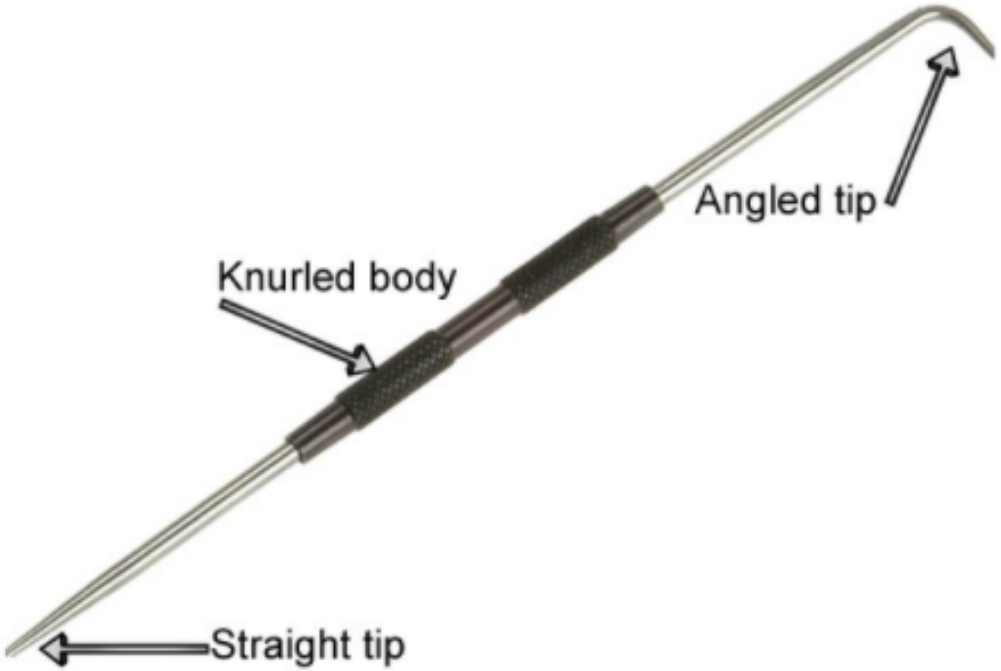


Surface plate and parallels

Marking out tools

4. Scriber

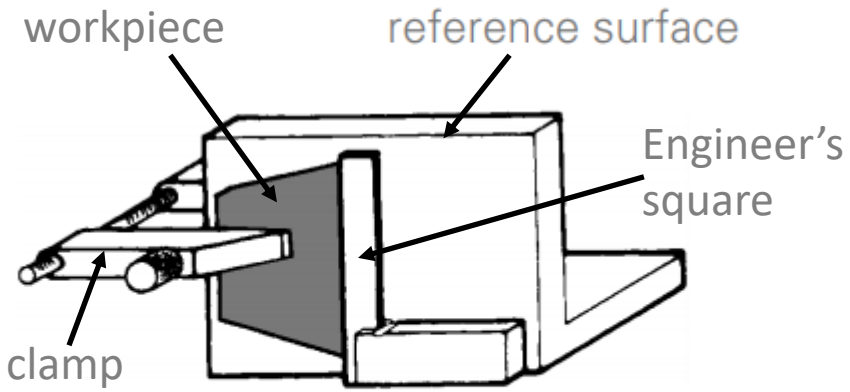
- The scriber is used to scribe all lines on a metal workpiece surface and is made from hardened and tempered steel, ground to a fine tip which should always be kept sharp to give well-defined lines.
- The scribers feature a straight point at one end of the scriber and can have a variety of angled points at the other.
- The angled point allows lines to be marked on the workpiece in confined areas such as inside holes or on the underside of ridges.



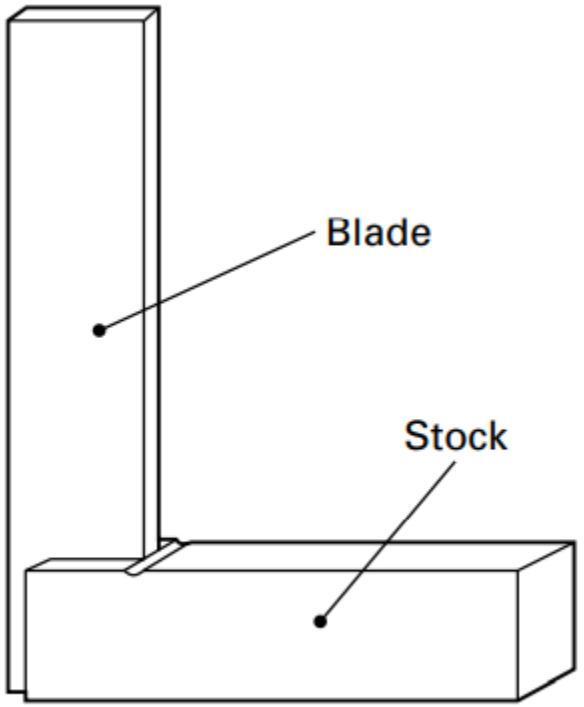
Marking out tools

5. Engineer's square

- It is a tool used during scribing straight lines at right angles to a true surface or testing the trueness of mutually normal surfaces.
- The tool consists of a stock and blade made from hardened steel and ground on all faces and edges to give a high degree of accuracy in straightness, parallelism and squareness.
- It is available in a variety of blade lengths.



Setting workpiece square to reference surface



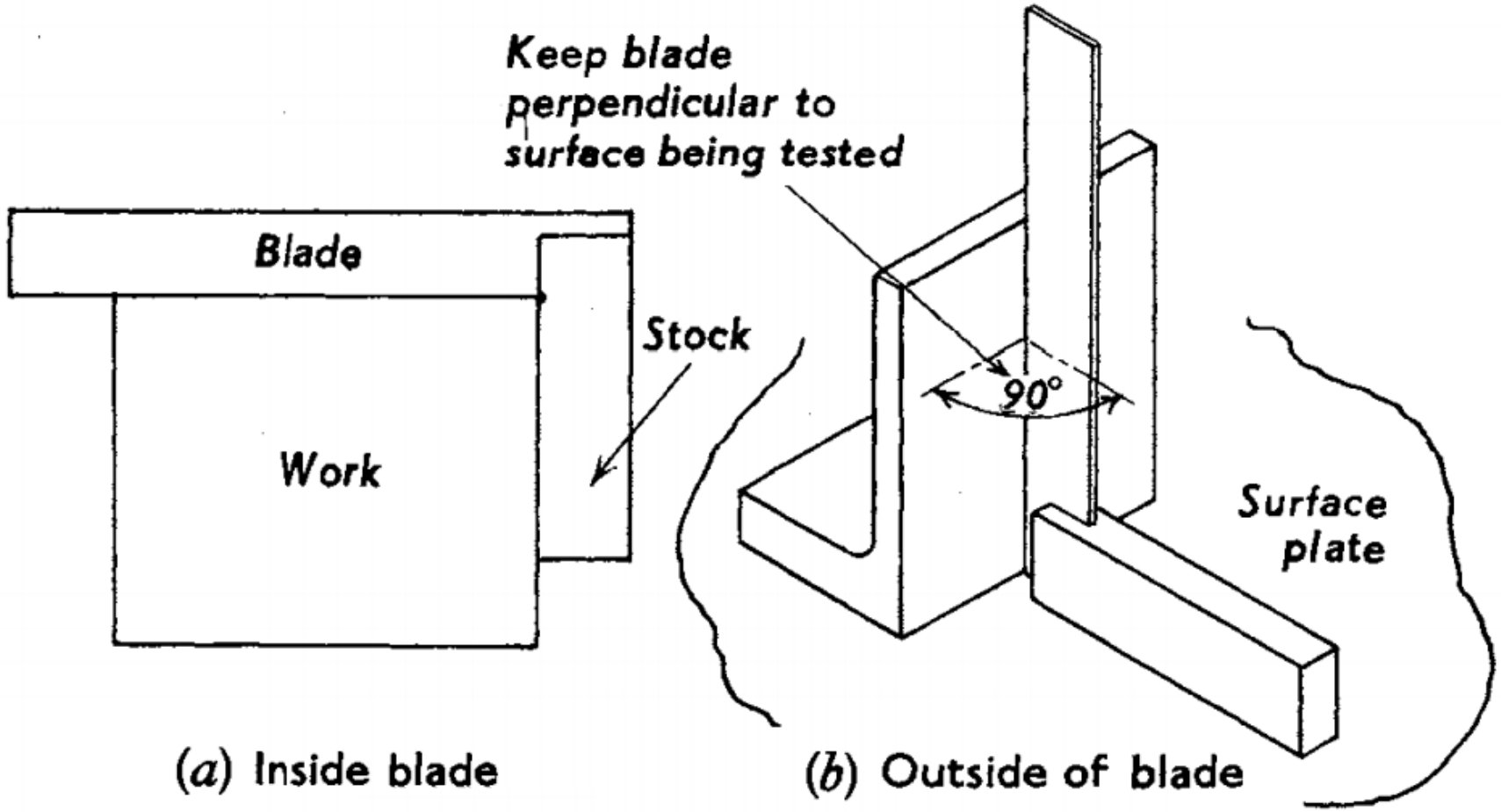
Engineer's square

Scribing line square to datum

Marking out tools

5. Engineer's square

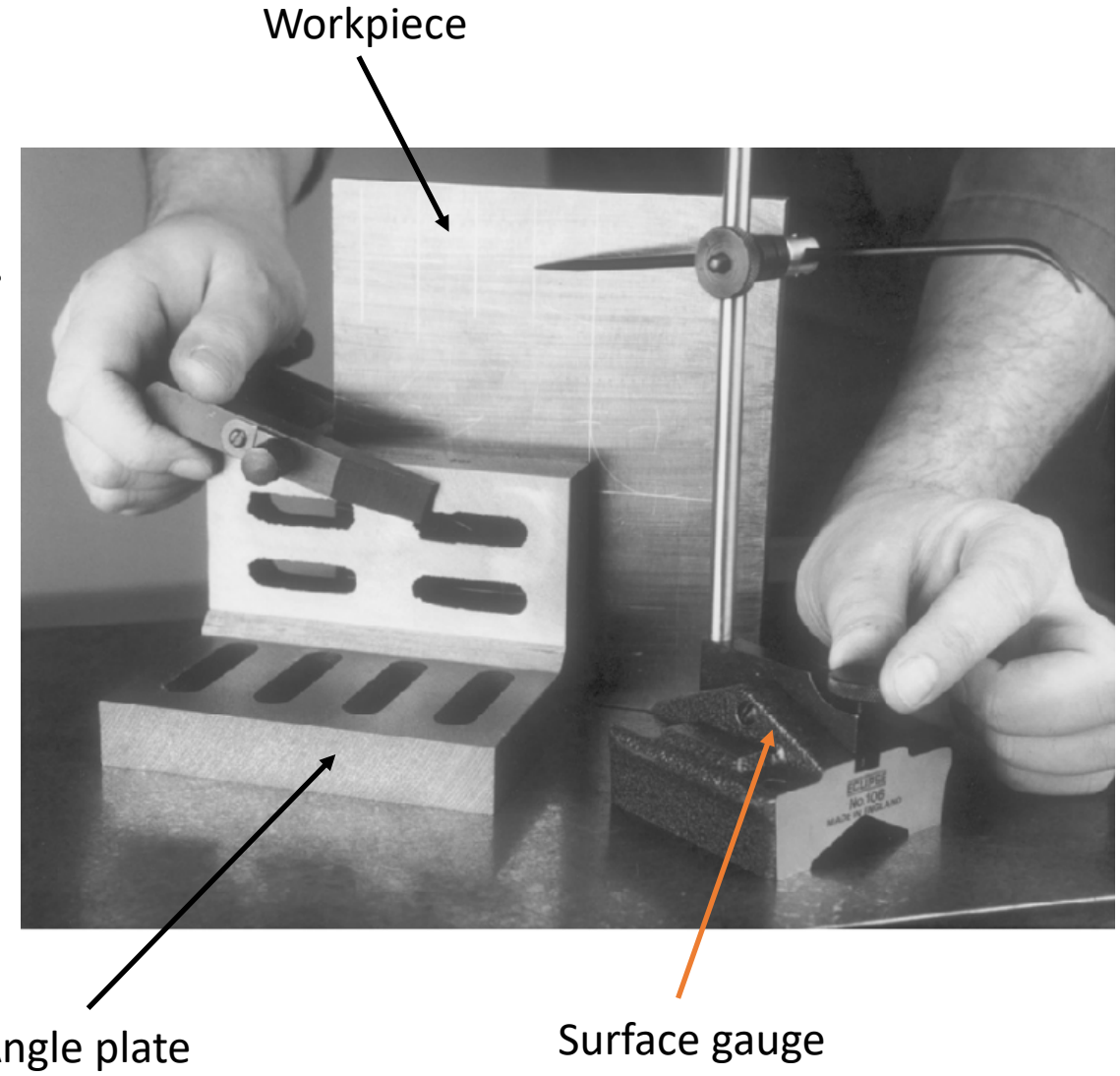
- The illustrations of the use of Engineer's square for internal and external squareness testing are shown.



Marking out tools

6. Angle plate

- When the workpiece has to be positioned at 90° to the reference surface, it can be clamped to an angle plate.
- Angle plates are usually made from cast iron and the edges and faces are accurately machined flat, square and parallel.
- Slots are provided in the faces for easy clamping of the workpiece.
- Angle plates may be plain or adjustable.



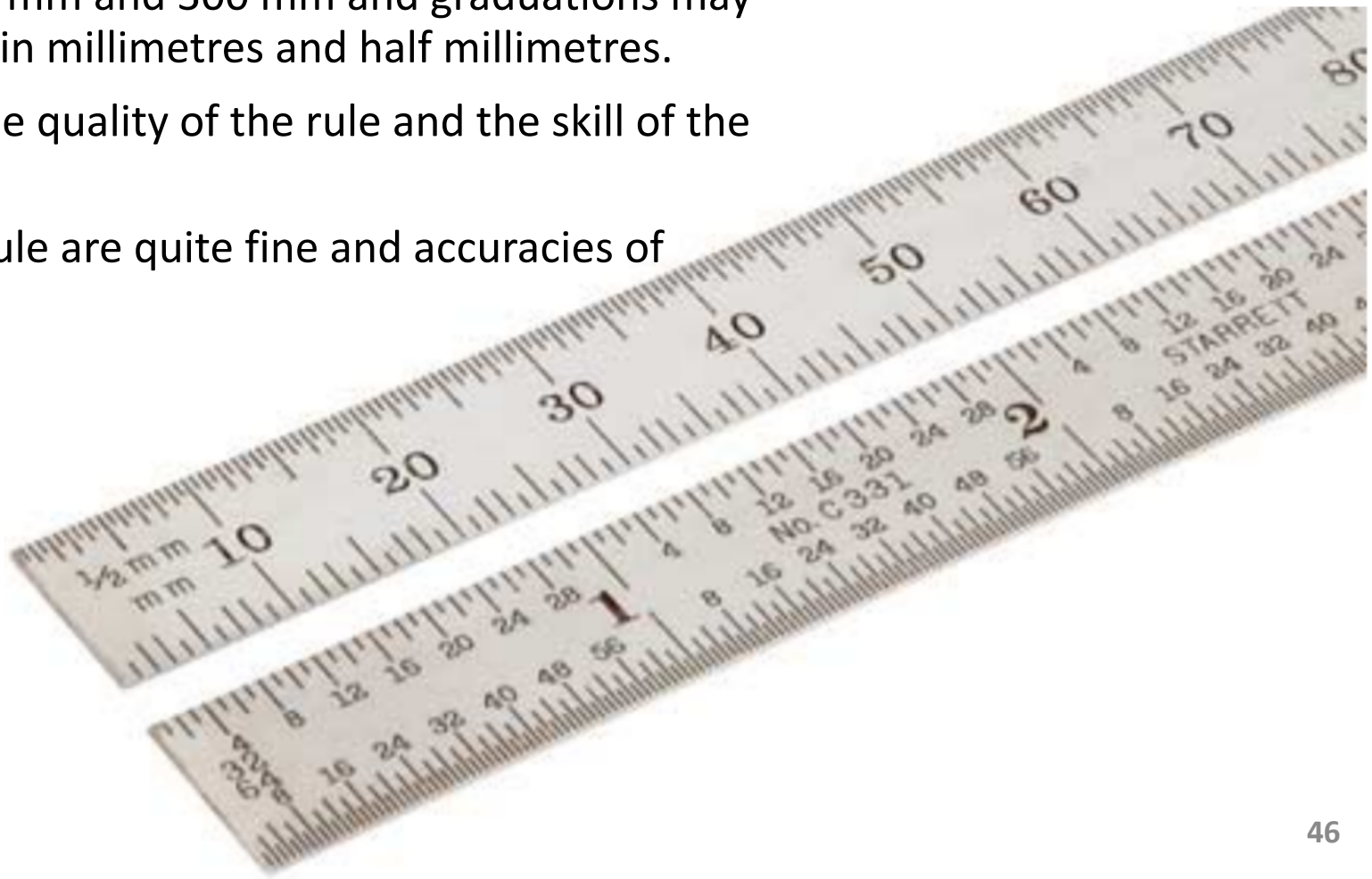
7. Surface gauge

- The surface gauge, also known as a scribing block, is used in conjunction with a scriber to mark out lines on the workpiece parallel with the reference surface.
- The height of the scriber is adjustable and is set in conjunction with a steel rule.

Marking out tools

8. Precision steel rule

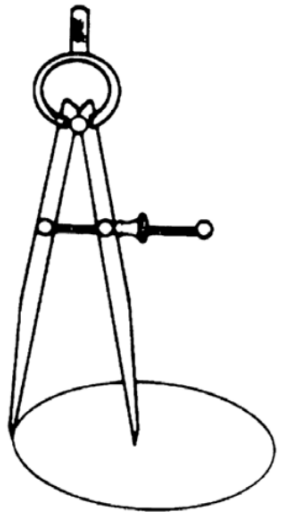
- The simplest and most common linear measuring instrument is the steel rule.
- Steel rules are available in lengths of 150 mm and 300 mm and graduations may be along each edge of both faces usually in millimetres and half millimetres.
- Accuracy of measurement depends on the quality of the rule and the skill of the operator.
- The width of the lines on a high-quality rule are quite fine and accuracies of around 0.15mm can be achieved.



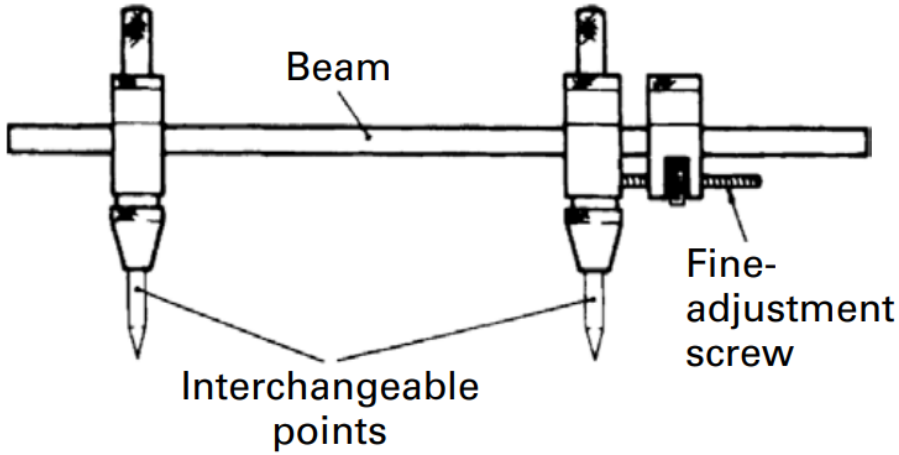
Marking out tools

9. Dividers and Trammels

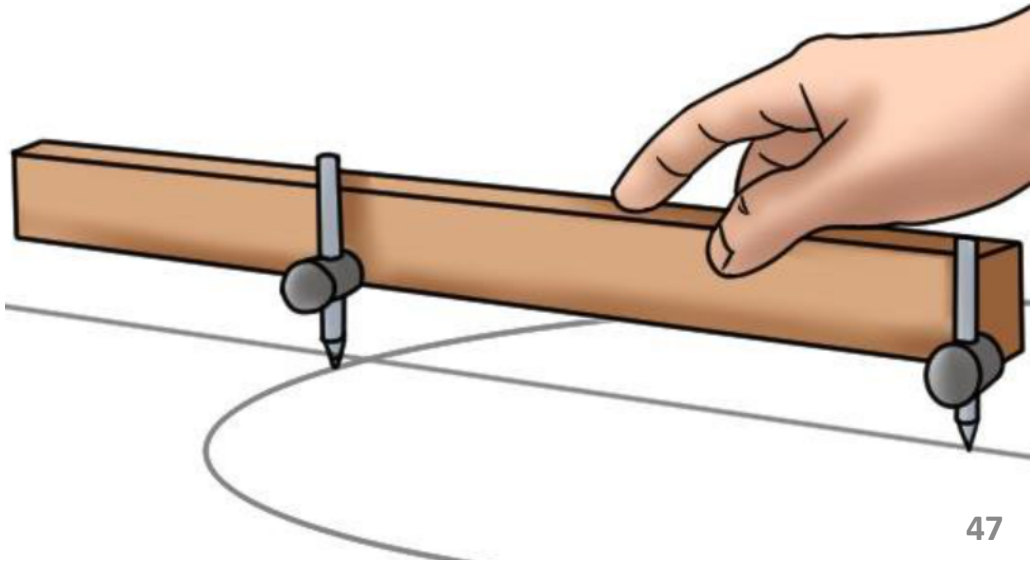
- Dividers are used to scribe circles or arcs and to mark off a series of lengths such as hole centres.
- They are of spring bow construction, each of the two pointed steel legs being hardened and ground to a fine point and capable of scribing a maximum circle of around 150 mm diameter.
- Larger circles can be scribed using trammels, where the scribing points are adjustable along the length of a beam.
- Dividers and trammels are both set in conjunction with a steel rule by placing one point in a convenient graduation line and adjusting the other to coincide with the graduation line the correct distance away.



Dividers



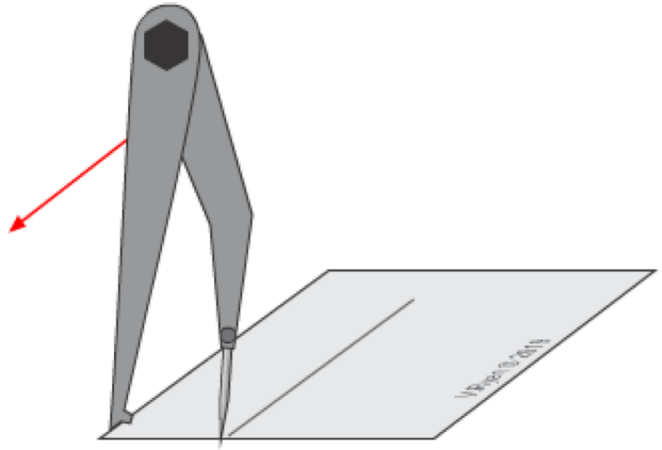
Trammels

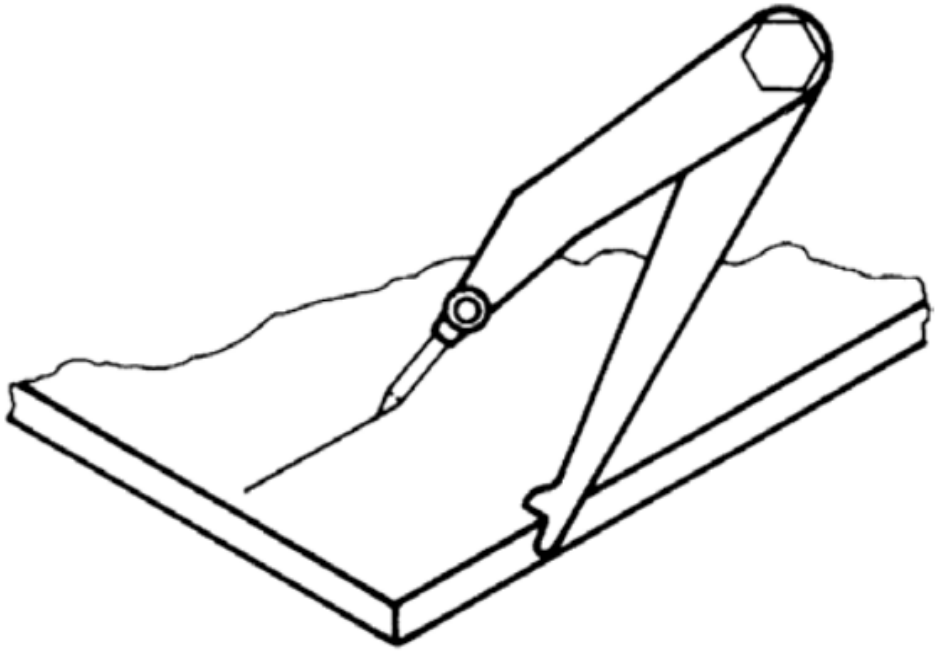


Marking out tools

10. Odd-leg caliper

- This is also called ‘Jenny caliper’ or ‘Hermaphrodite caliper’.
- This is used for scribing (marking) parallel lines from a finished edge and also for locating the centre of round bars.
- These combine a straight pointed divider leg with a caliper or stepped leg.

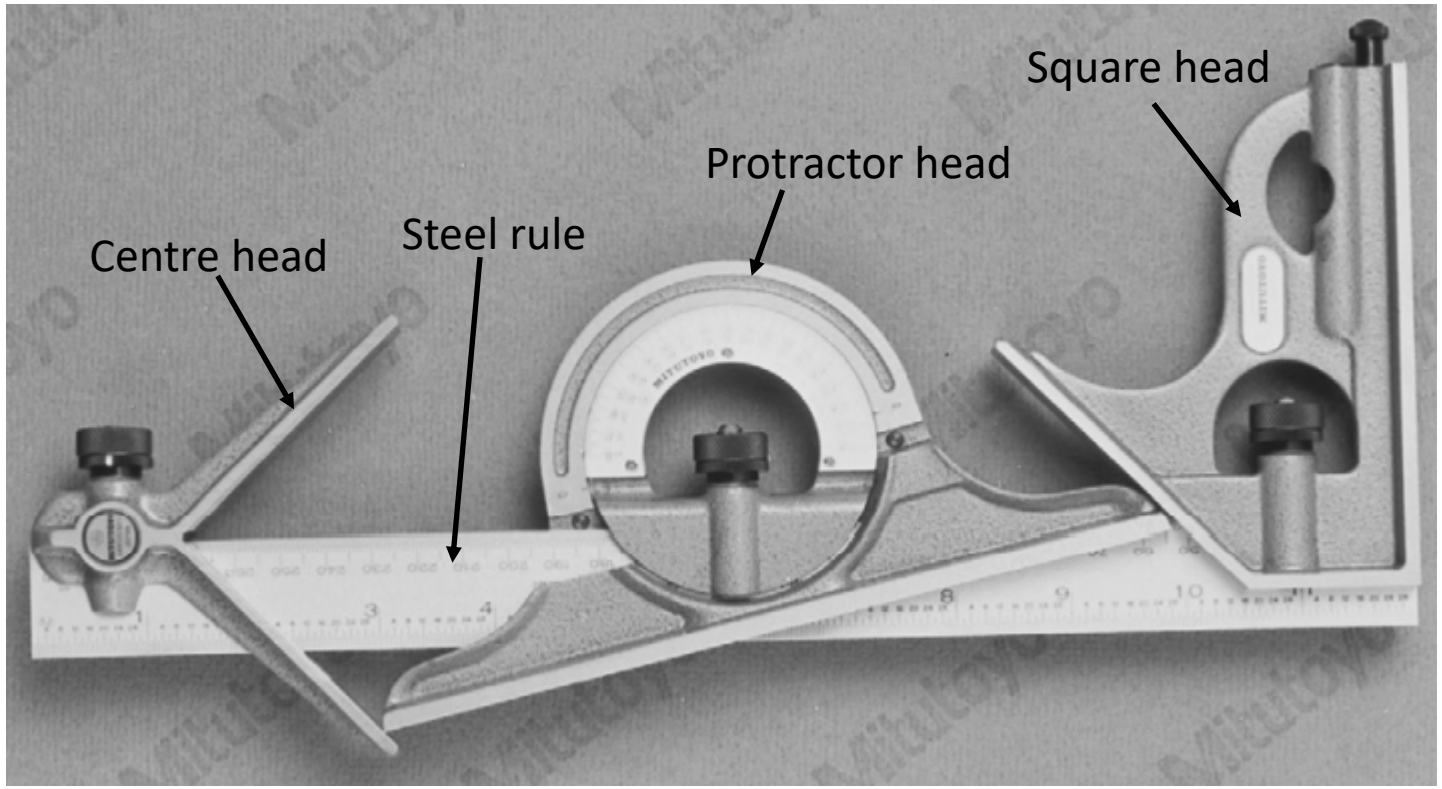




Marking out tools

11. Combination set

- The combination set consists of a graduated hardened steel rule on which any of three separate heads – protractor, square or centre head – can be mounted.
- The rule has a slot in which each head slides and can be locked at any position along its length.

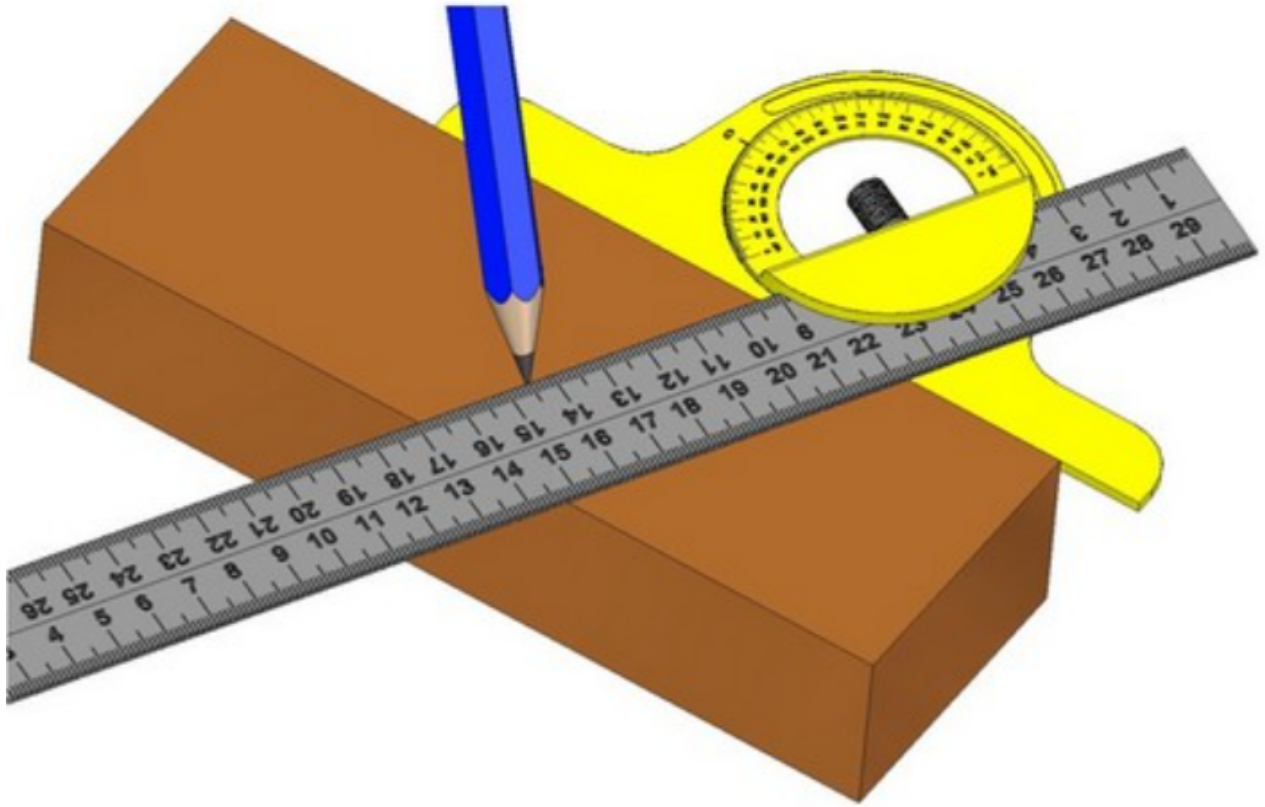


Marking out tools

11. Combination set

Protractor head

- This head is graduated from 0° to 180°, is adjustable through this range, and is used when scribing lines at an angle to a workpiece datum.

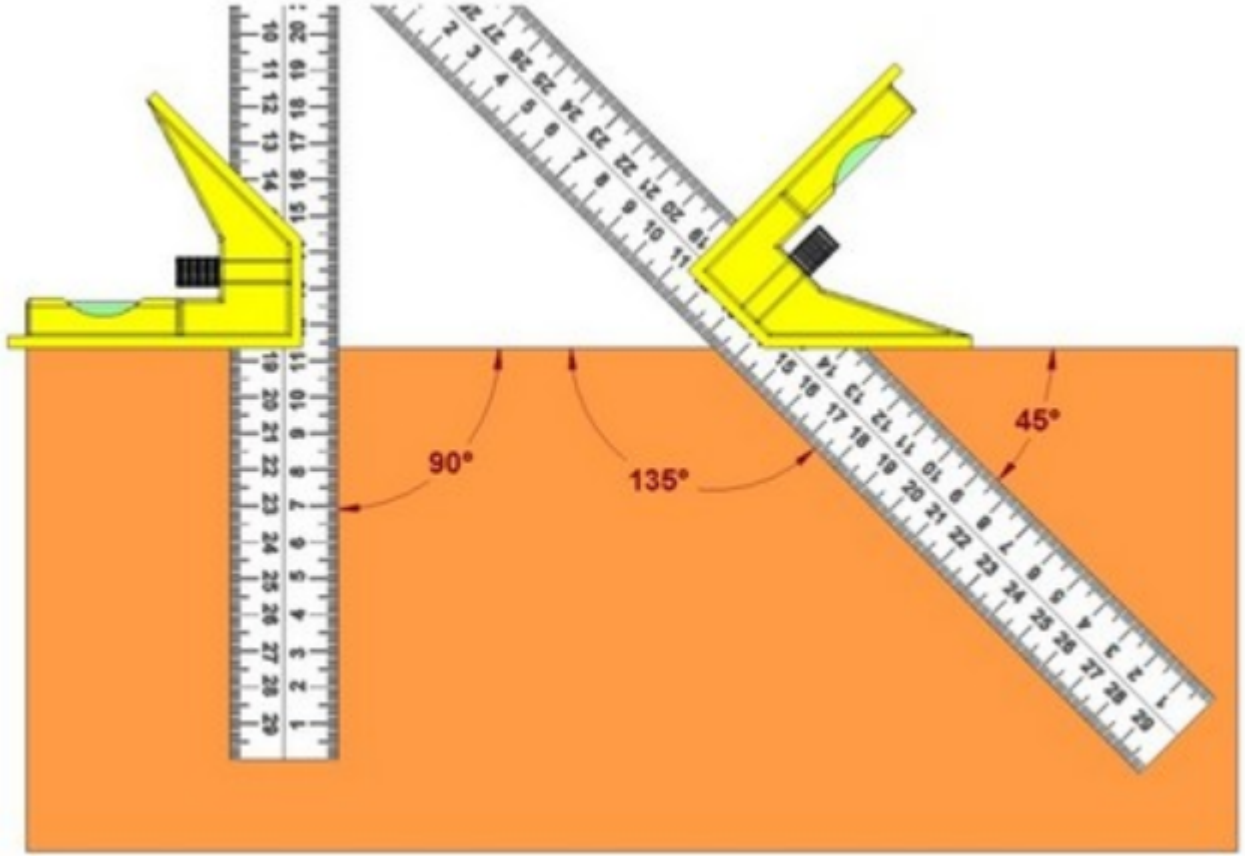


Marking out tools

11. Combination set

Square head

- The square head is designed with a 45° and 90° edge.

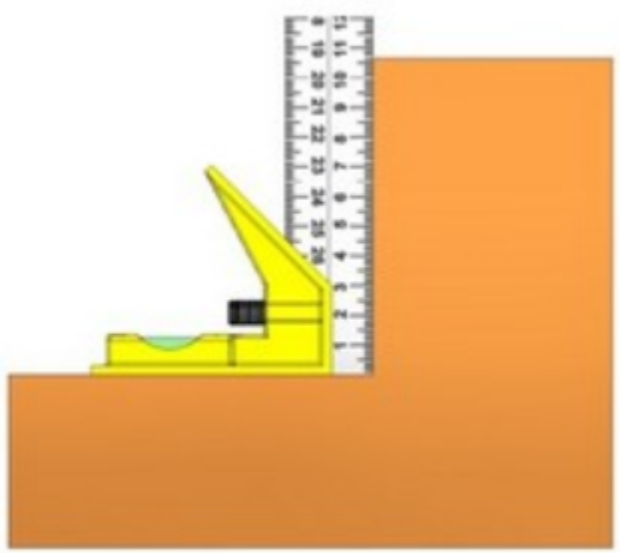


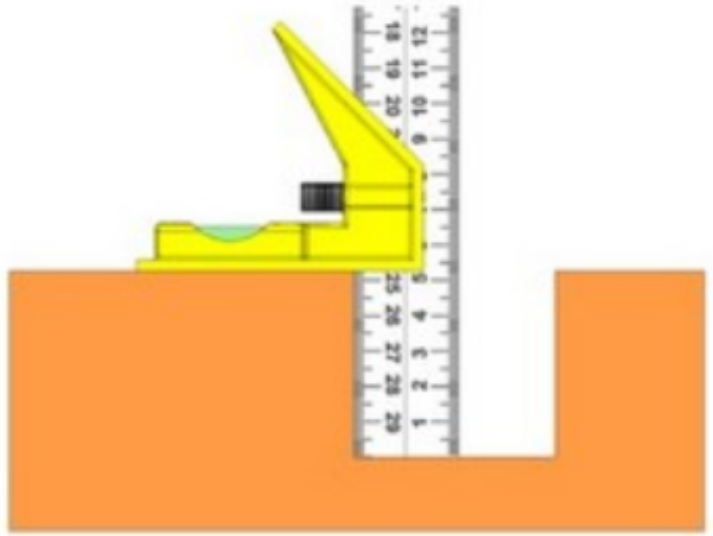
Marking out tools

11. Combination set

Square head

- This head is used in the same way as an Engineer's square, but, because the rule (blade) is adjustable, it is not as accurate.
- A spirit level is incorporated which is useful when setting workpieces such as castings level with the reference surface.
- Turned on end, this head can also be used as a depth gauge.



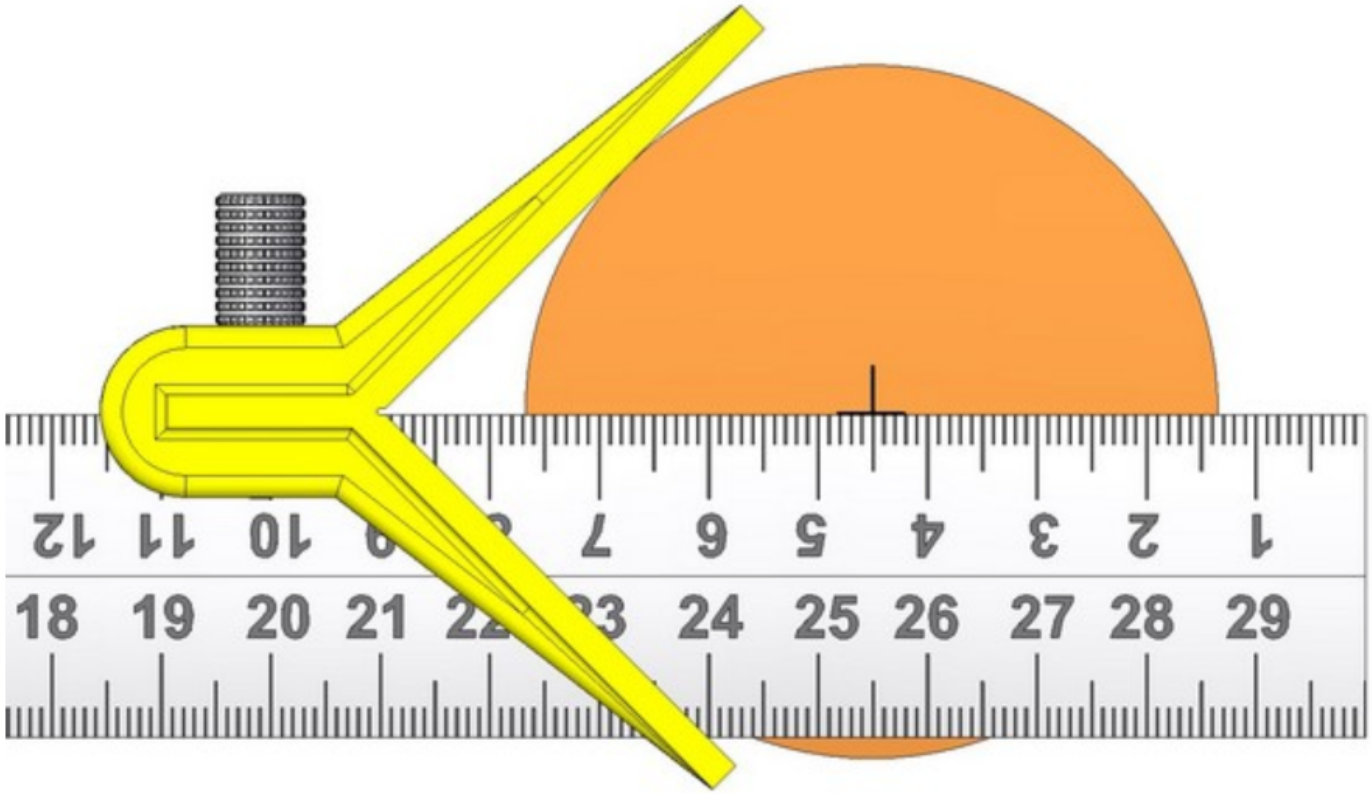


Marking out tools

11. Combination set

Centre head

- With this head, the blade (rule) passes through the centre of the 'vee' and is used to mark out the centre of a circular workpiece or round bar.



Marking out tools

12. Centre punch

- The centre punch is used to provide a centre location for dividers and trammels when scribing circles or arcs, or to show permanently the position of a scribed line by a row of centre dots.
- When a job has been marked out, it is usual to follow along the lines with small dot marks in case the lines themselves become obliterated.
- The centre dot is also used for the purpose of giving a start to drill holes.
- Punches are usually made of cast steel, being hardened and tempered.

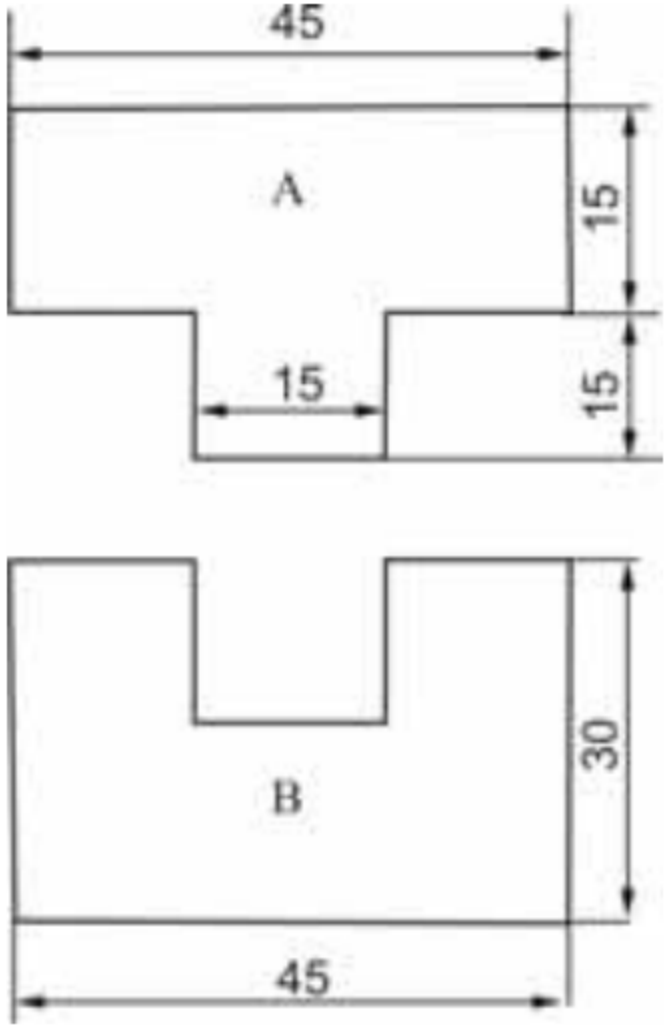
Marking out tools

13. Marking dye

- On surfaces of metal other than bright metals, scribed lines may not be clearly visible.
- In such cases, the surface can be brushed or sprayed with a quick drying coloured dye before marking out.
- This provides a good contrast, making the scribed lines easy to see.
- Alternative to marking dye, wet chalk can also be applied.

A sample of fitting model preparation

Aim: To make a step fitting as shown below.



Material provided for fitting work:

Mild Steel Flat : 32 mm × 50 mm × 3 mm thick. 2 Nos.

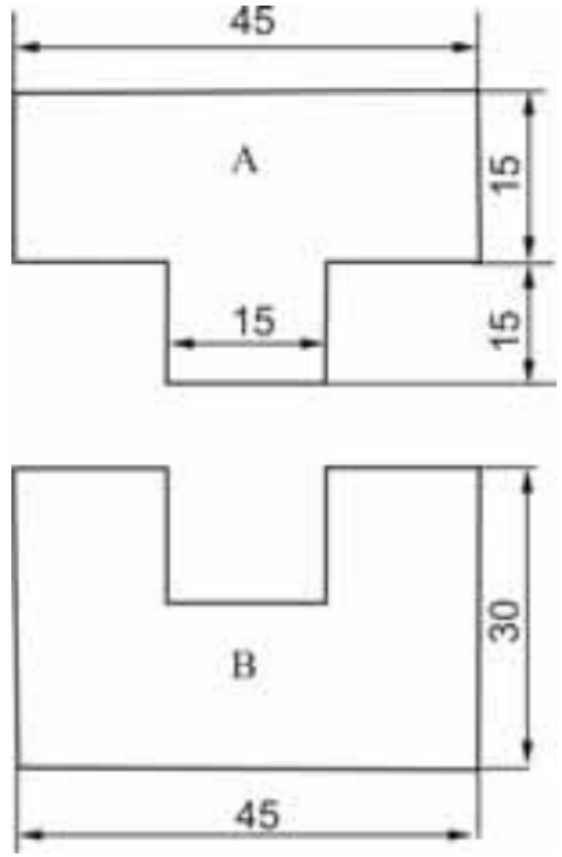
Tools required:

150 mm steel rule, 150 mm Engineer's square,
200 gm ball peen hammer, centre punch, odd-leg caliper,
300 mm hacksaw frame with 300 × 12.7 × 0.65 - 32 TPI hacksaw blade,
250 mm rough and smooth flat files with safe edge,
10 mm square file smooth.

A sample of fitting model preparation

Sequence of operations:

1. The given mild steel flat sizes are checked.
2. The side with 50 mm is filed first with a rough flat file and then with a smooth flat file.
3. The flatness of the side is checked with the help of Engineer's square.
4. The side with 32 mm is filed and its squareness with the other side is checked with Engineer's square.
5. Apply marking dye / wet chalk on any one flat side of the workpiece and allow it to dry.
6. The sides 45 mm and 30 mm and steps are marked with the help of odd-leg caliper and steel rule.

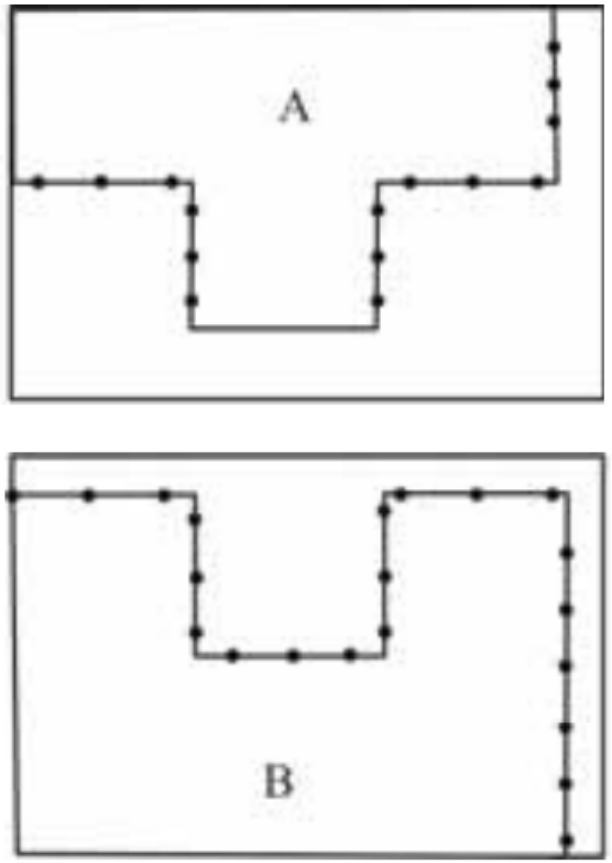


Material provided for fitting work:
Mild Steel Flat
32 mm × 50 mm × 3 mm thick. 2 Nos.

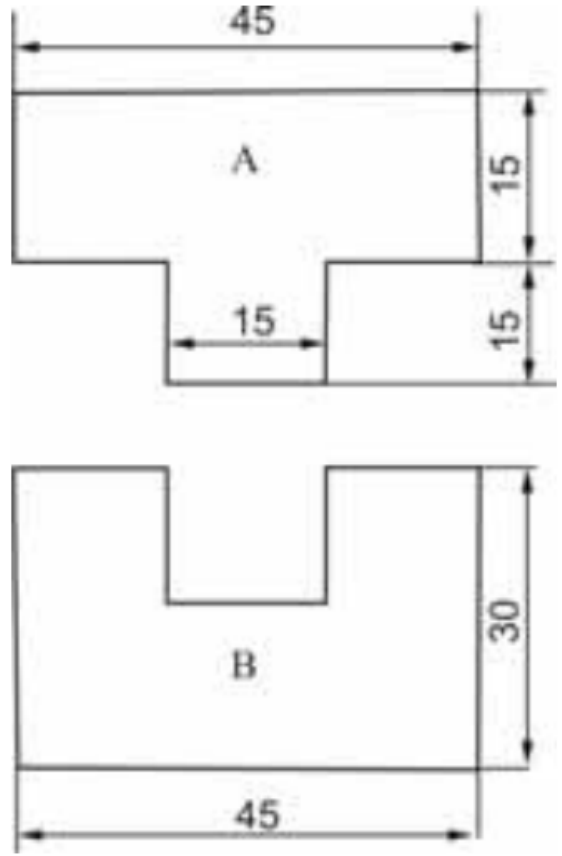
A sample of fitting model preparation

Sequence of operations:

7. Dot marks are punched along the scribed lines using centre punch tool as shown below.



8. With the help of hacksaw blade, cutting is done along the punch dots.

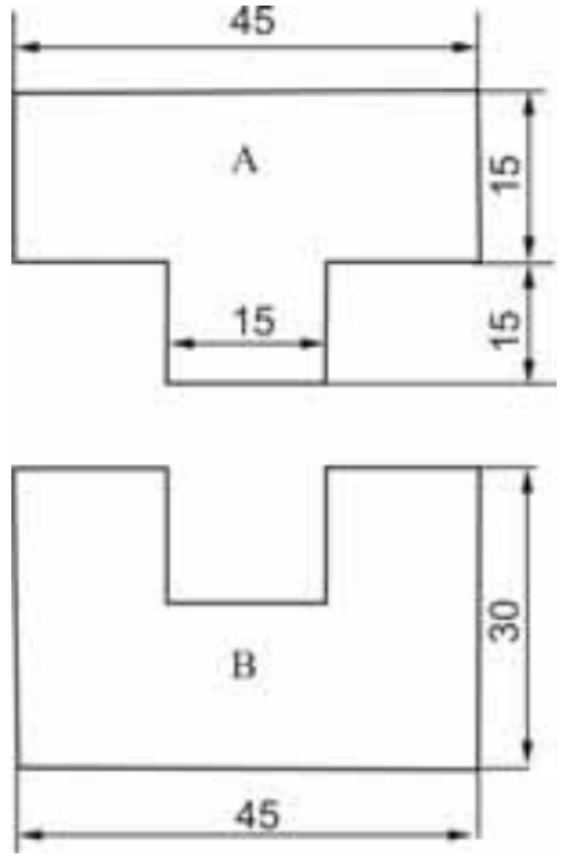


Material provided for fitting work:
Mild Steel Flat
32 mm × 50 mm × 3 mm thick. 2 Nos.

A sample of fitting model preparation

Sequence of operations:

9. Filing is done on all sides of male part A and female part B.
10. Flatness and 90^{o} are checked regularly with appropriate tools.
11. Parts A and B are checked for pairing. Filing is continued till correct matching is achieved.
12. The required fittings are obtained.



Material provided for fitting work:
Mild Steel Flat
32 mm × 50 mm × 3 mm thick. 2 Nos.