Chapter 5

Carpentry hand tools and basic timber joints

Learning objectives

- **5.1** PPE (personal protective equipment)
- **5.2** Carpentry and joinery hand tools
- **5.3** Basic timber joints
- **5.4** Basic workshop equipment
- **5.5** Constructing two small timber projects

Hand tools are the basis for any good tradesperson. Learning how to use hand tools properly and confidently will aid any tradesperson in their day-to-day work. Being able to use hand tools properly will provide the skills and knowledge for the proficient use of handheld power tools which are at the forefront of contemporary woodworking techniques.

In this chapter we detail common timber joints. Construct these joints to practice using the tools outlined in this chapter. You will be able to tell when your hand tool techniques are improving because the quality of the joints will improve.

Personal protective equipment (PPE)

Personal protective equipment (PPE) is the most important 'tool' a tradesperson will use. It will help keep you safe and protect you from being injured while you work by minimising risks to your health and safety. Listed below are the essential forms of PPE you need when working. Always look for the Australian Standard logo so you know the item of PPE meets the relevant standard.

Clothing

Protective clothing includes overalls, work pants, work shorts, high visibility shirts, jackets and hats specifically designed to be used while working in the building industry. They are made of materials that won't burn or melt and can't be easily ripped and provide protection from UV radiation. Essentially, they are much more durable than normal clothing and are designed to protect or shield your body from workplace hazards and injury.

Work boots/shoes

Safety footwear is designed to protect your feet from getting injured and support your body so you can work effectively. It comes in many shapes and sizes with different levels of protection offered for the building industry. This includes various grades of toe cap, reinforcement that provides built-in protection at the front of the boot/shoe. There is a huge range of designs available, some looking like regular runners or traditional leather boots.

Eye protection

Eye protection for the building industry is designed to protect you from hazards such as flying particles, dust and harmful gasses. A range of eye protection is available including goggles and safety spectacles, some with the appearance of designer sunglasses. Made of materials that don't shatter or break easily, all eye protection must be manufactured to the relevant Australian Standard. Eye protection is designed to be close fitting so there are no large gaps between the eyewear and the face so as to not let objects in.

Ear protection

In the building industry, ear protection is necessary when working in or near a noisy environment. The most common protection devices are earmuffs that cover the entire ear or plugs that are inserted into the ear canal. Both are designed to dampen down loud noises so your hearing isn't damaged. The better the quality the device, the better the protection.

Measuring and marking equipment

Four-fold rule

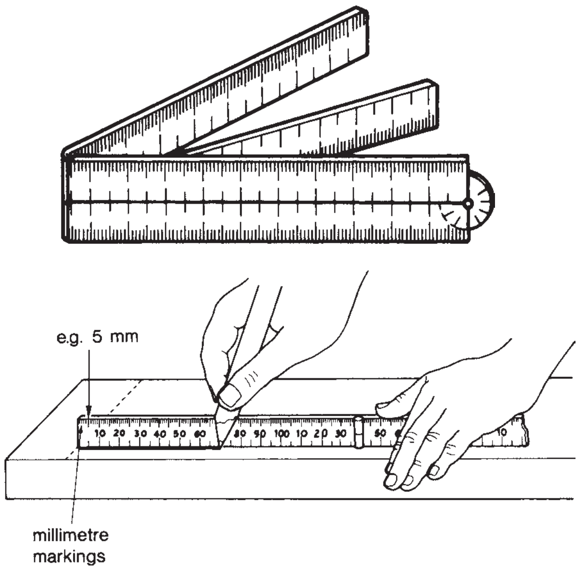
The four-fold rule (or carpenter's rule) is made of boxwood or plastic and is for general use, especially benchwork. It is one metre in length and marked in millimetres. For accurate measuring hold the rule on edge so that the markings will be in contact with the timber.

The four-fold rule can be used for more than just measuring. It can also be used for gauging lines on timber and to determine the size of a gap. For example, generally the thickness of the rule when folded up is 10 mm, which is the same thickness of the plasterboard found on most house walls.

Retractable tapes

Retractable tapes are available in lengths from 2 m to 8 m and are particularly useful for construction work.

Fig. 5.1 Four-fold rule: (a) general view; (b) holding and measuring

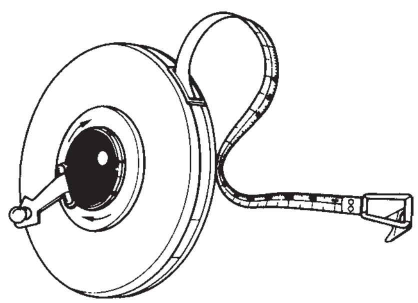


Long fibreglass/steel tapes

Long fibreglass/steel tapes are available in lengths of 20 m and 30 m and are used for measuring on site, setting out and large construction work (Figs 5.2 and 5.3).

Fig. 5.2 Retractable measuring tape

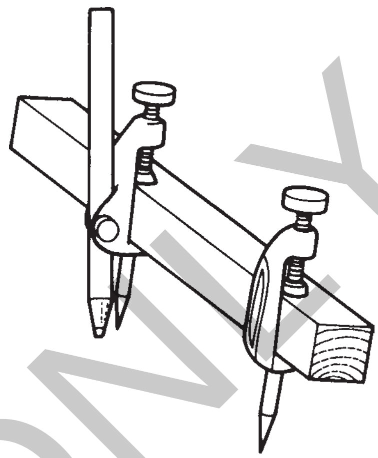
Fig. 5.3 30 m tape



Trammel points

Trammel points can be attached to a wooden bar to form a pair of dividers and are used for stepping off large distances or marking out circles (Fig. 5.4).

Fig. 5.4 Trammel points



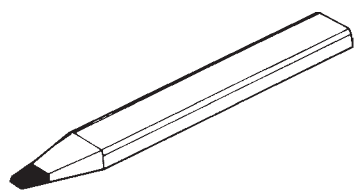
Carpenter's pencil and crayons

A carpenter's pencil has a large flat lead which stays sharp longer, especially when working with rough-sawn timber (Fig. 5.5). The pencil is available in soft, medium or hard grades. Medium is suitable for most purposes.

Generally, carpenter's pencils are red in colour (medium grade) and bricklayer's pencils are green (hard grade). Bricklayer's pencils will not really mark timber but rather dent it because they are so hard.

Lumber crayons are variously coloured markers used for conspicuous marking on rough-sawn timber surfaces.

Fig. 5.5 Carpenter's pencil



Try square

A try square is used for marking lines at right angles to a face or edge and for checking that timber is square (Fig. 5.6). It consists of a stock and a blade which is permanently fixed at 90° to the stock. The size of the square is determined by the length of the blade, which can vary from 100 mm to 300 mm.

For accuracy, try squares must be checked from time to time (Fig. 5.7). This is done by selecting a board with a straight edge and using the try square to mark off a line at right angles. Reverse the square and if the blade of the square coincides with the line it is accurate.

Fig. 5.6 Try square

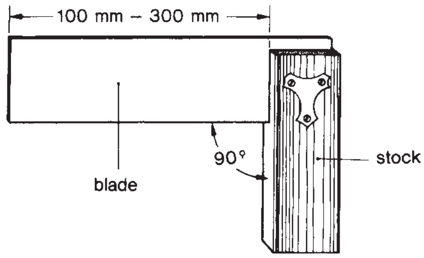
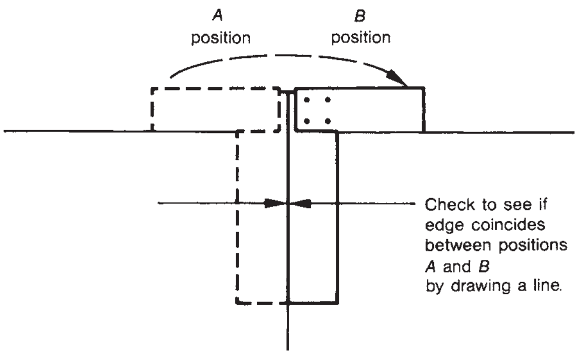


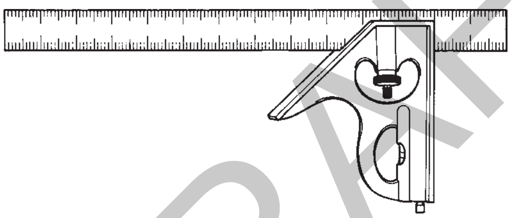
Fig. 5.7 Checking a try square



Combination square

A combination square can be used for the setting of lines at 90° and 45° (Fig. 5.8). The blade is 300 mm long and is adjustable on the stock. Sometimes a level bubble is built into the stock.

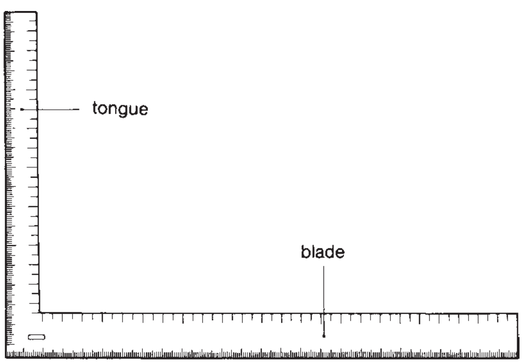
Fig. 5.8 Combination square



Steel carpenter's square

The carpenters' square is used for squaring large sheets of material and for setting out in roofing and stair construction (Fig. 5.9). It has a tongue and a blade, usually 400 mm × 600 mm, marked in millimetres.

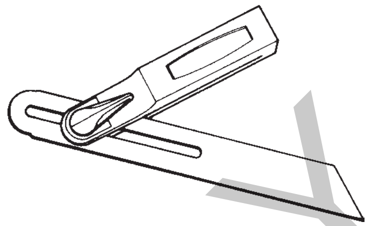
Fig. 5.9 Steel square



Sliding bevel

A sliding bevel is used for the setting of various angles (Fig. 5.10). The blade is adjustable to the stock.

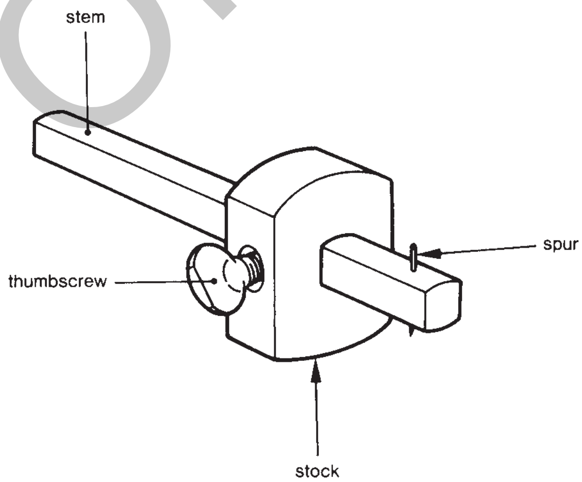
Fig. 5.10 Sliding bevel



Marking gauges

Marking gauges are a group of tools used for marking lines parallel to an edge or a face (Fig. 5.11). The gauge is usually made of beech wood and the stock is adjustable on the stem.

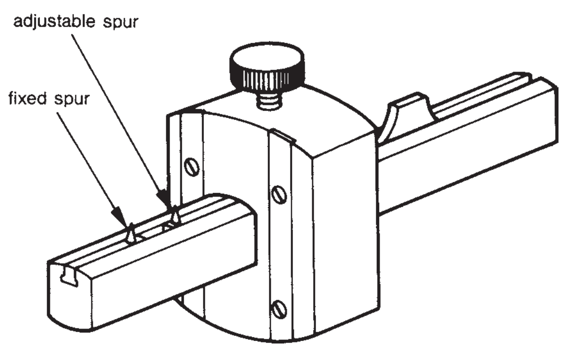
Fig. 5.11 Marking gauge



Mortise gauge

A mortise gauge has two spurs, one of which is movable (Fig. 5.12). It gauges two lines at once and is used mainly in marking out mortise and tenon joints, slip tongues and similar situations.

Fig. 5.12 Mortise gauge



Chalk line reels

Chalk line reels are a convenient way to mark straight lines, mainly on construction work (Fig. 5.13). The string is dusted with chalk, and stretched between two given points. It is then flicked to produce a visual straight line.

Hand saws

Woodworking hand saws are manufactured from high-quality steel, specially formulated and tempered to provide the right degree of hardness and flexibility so that the teeth will maintain their sharp edge but will not break off while in use or when being set and sharpened (Fig. 5.14). A good quality saw, when held by the handle and tip, should bend into a uniform curve and return to a straight line when released. The handle is of wood or plastic moulded to fit the hand comfortably. The best guide to quality is no doubt the reputation of the manufacturer and the price. Saws suitable for professional use may not always be the cheapest initially, but in skilled hands will give many years of faithful service.

In recent years a number of new types of saws have come on to the market to meet the changing needs of the trade; saws not only for use in timber but also for plastic, metal and other sheet materials.

Teeth are formed on the cutting edge of the saw and are shaped according to the purpose of the saw.

Shape of saw teeth

Timber is composed of wood fibres overlapping and lying in the direction of the grain. The saw teeth must sever the fibres cleanly and remove the waste from the saw cut. *Rip saws* are designed for cutting in the direction of the grain: the teeth form a series of chisel points which sever the fibres and the wood crumbles away in front of the teeth in the form of sawdust (Fig. 5.15).

Saws designed to cut across the grain of the timber are shaped like a series of knife edges which sever the fibres in two places, and again between the cuts the wood crumbles away. These are called cross-cut saws (Fig. 5.16).

The angle formed between the face of the teeth and the length of the blade is referred to as the *hook* and is important to the performance of the saw. With a large angle of hook—up to 90° for rip saws—the saw will cut more quickly but the cutting will be harsh and absorb more power. If the face of the tooth is laid back only a few degrees, the cut will be smoother and require less effort.

Fig. 5.13 Chalk line reel

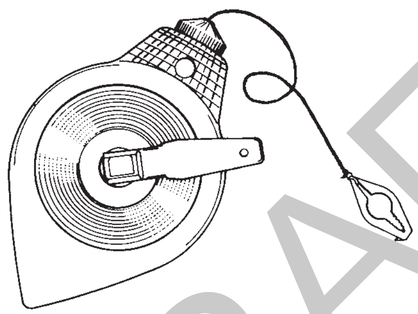


Fig. 5.14 Typical hand saw

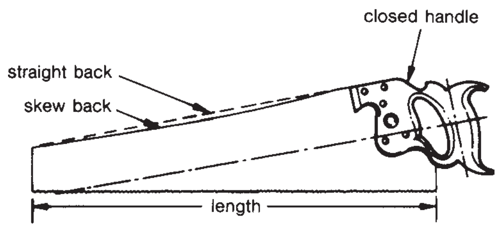


Fig. 5.15 (a) Rip saw teeth; (b) cutting action

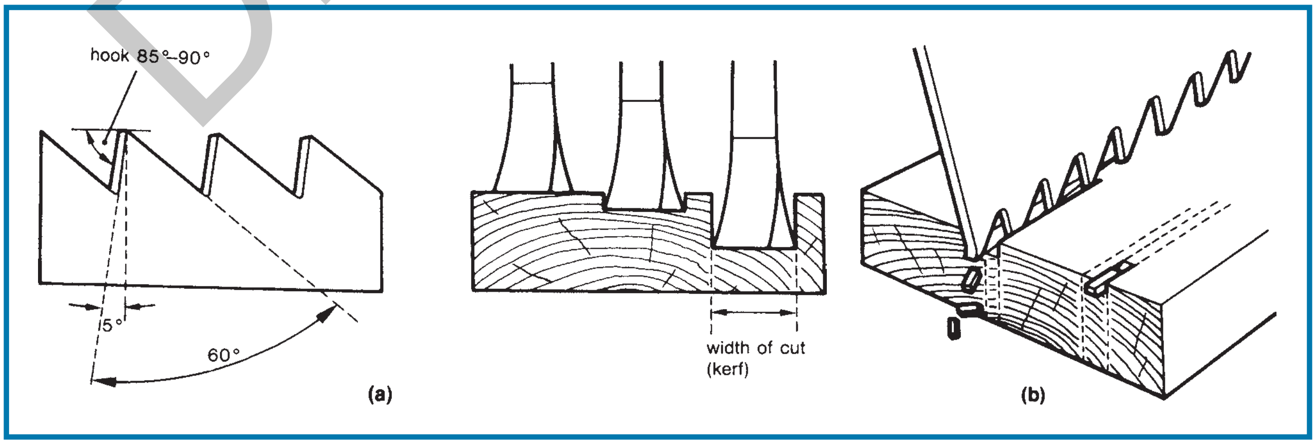
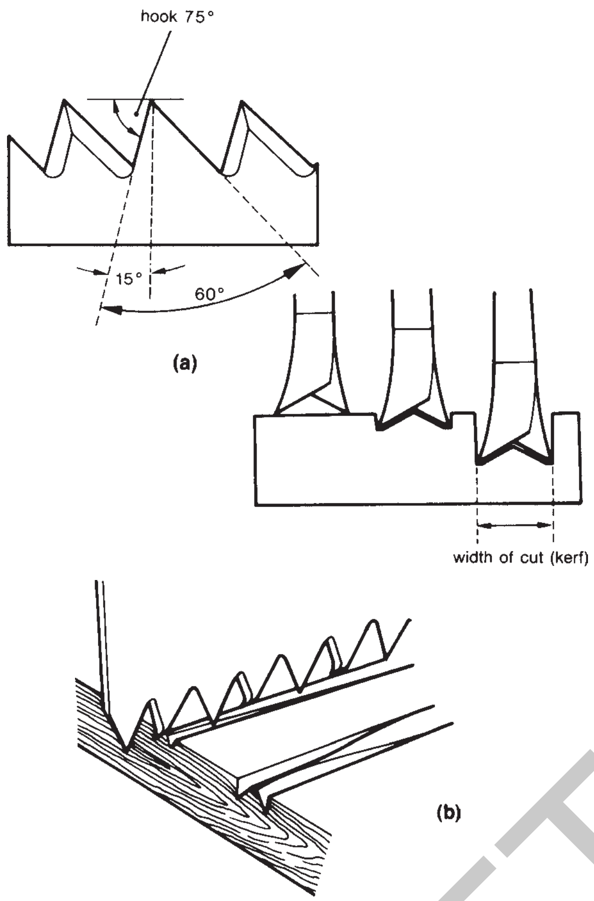


Fig. 5.16 (a) Cross-cut teeth; (b) cutting action



Clearance to the saw blade

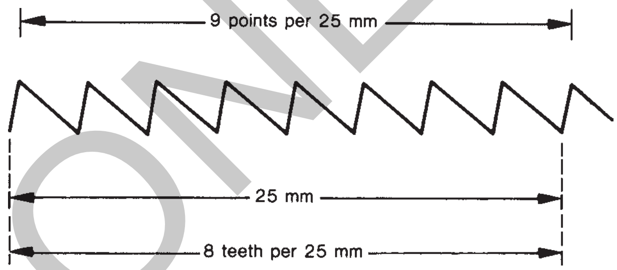
So that the blade will not bind in the saw cut or **kerf**, the teeth of the saw are *set*. This is the practice of bending the top half of each tooth in opposite directions, so that the saw kerf will be approximately 1.5 times the thickness of the blade. Soft green timber will require more set than hard dry timber.

Good quality saws are also *taper ground* which means that the back of the saw blade is thinner than the cutting edge, thus also providing clearance in the cut.

Size of saw teeth

The size of the teeth is expressed as the number of teeth to 25 mm (Fig. 5.17). Sometimes the term 'points per 25 mm' is used, which includes the point at the start and finish of the 25 mm so that eight teeth per 25 mm (8 TP 25 mm) equals nine points per 25 mm (9 PP 25 mm).

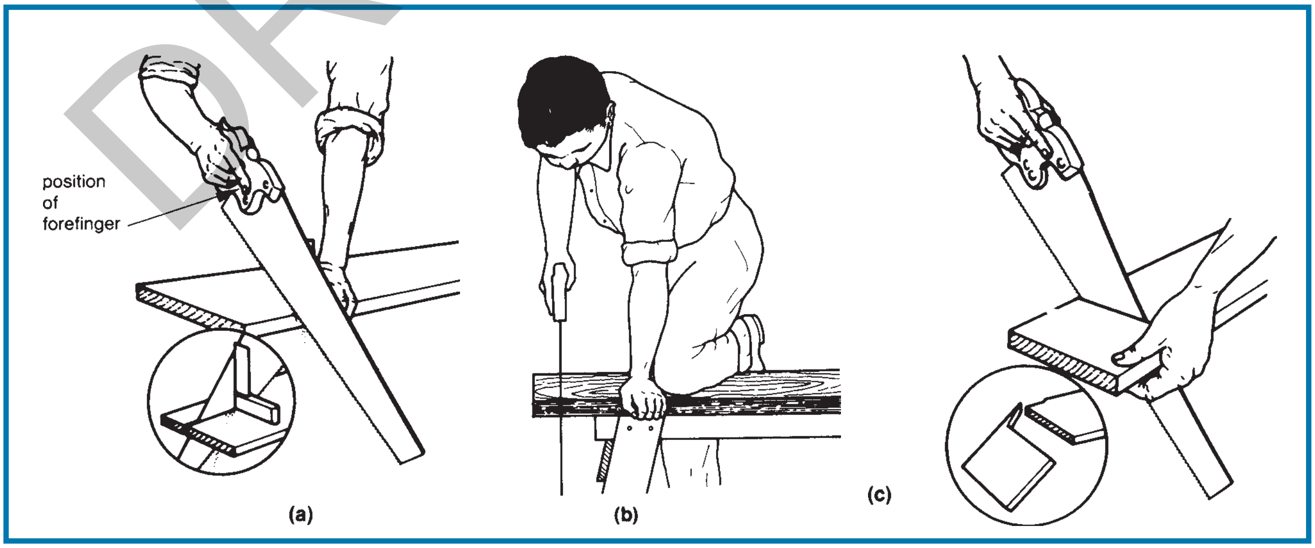
Fig. 5.17 Size of saw teeth



Using hand saws

The correct grip for all saws is shown in Fig. 5.18(a). This helps to relax the hand muscles and gives direction to the saw blade. Timber should be supported on saw stools and the correct stance adopted (Fig. 5.18b). Notice how the saw, the forearm and the shoulder are in a straight line. Commence with the saw at a low angle, in line with the direction of the cut, and use short light strokes. Guide the

Fig. 5.18 (a) Saw grip; (b) stance; (c) supporting the end



saw with the thumb of the other hand. Gradually increase the angle to approximately 45° when **cross cutting**, and 60° when **ripping** (Fig. 5.19).

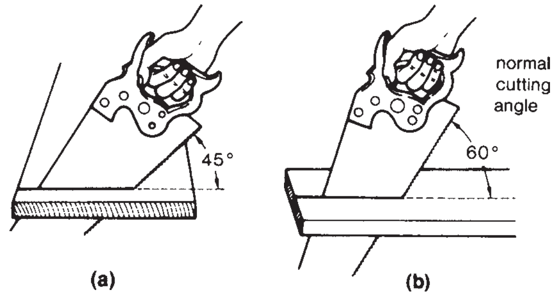


Fig. 5.19 Sawing angles: (a) cross cutting and (b) ripping

Hand saws in general use

Without putting any downward pressure on the saw blade, maintain the stance and continue the cut using the full length of the blade with the arm swinging freely in line from the shoulder. Support the end of the timber so that it will not collapse and splinter at the end of the cut (Fig. 5.18c).

Most saws manufactured in the West have adopted a tooth shape that is 'leaning forward' (Fig. 5.20a). This type of tooth arrangement will cut more aggressively on the forward stroke and will more or less slide across the fibres on the backward stroke. By altering the angle on the front of the tooth, it will cut well both across and along the fibres of the timber. The angle between the teeth is maintained at 60° so that the teeth can be sharpened by using a triangular saw file.

Another tooth pattern now receiving wide recognition is the *straight tooth* (Fig. 5.20b). This will cut in the same manner both on the forward and backward stroke. It is used on some hand saws and bow saw blades and for cutting across the grain. (Some 'old timers' in the trade may recall seeing this tooth shape on rare occasions; they would refer to them as 'shark tooth'.)

The 'straight' toothing on carpentry saws originally was a Scandinavian type; in modern production this tooth shape is obtained by a grinding wheel (rather than a file) which gives a superior **bevelled** surface and an extremely sharp cutting edge. The precision required in saw toothing is illustrated by the fact that only 0.1 mm to 0.3 mm of the outermost tooth points actually cut into the workpiece. It is the shape of these tiny tooth tips that determines the efficiency of the saw.

Fig. 5.20 (a) Conventional saw teeth and (b) straight saw teeth

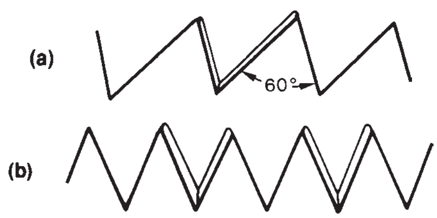


Table 5.1 Common hand saws

Name	*Length (mm)*	*Teeth (25 mm)*	*Purpose*
Rip saw	700	3 to 5	Ripping with grain
Half rip saw	650	5.5 & 6	General purpose, small amounts of ripping and cross cutting
Hand saw	650	7, 8, 9	General purpose, cross cutting
Panel saw	500, 550, 600	10	Light interior fitting and cross cutting

Hard-point saws

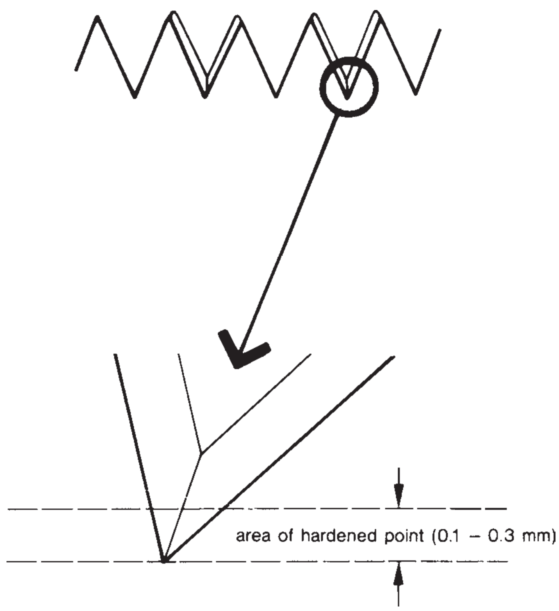
Manufacturers, having produced saws with tooth points shaped for maximum efficiency and to very fine tolerances, and also realising the difficulties of resharpening, have turned their attention to making teeth last so long that they will need resharpening only after considerable time and use.

The hard-point high-frequency hardening was the solution to increasing the lifetime of the tooth points (Fig. 5.21). An extra hardening may seem an easy and natural solution but it is a rather intricate manufacturing process: the steel has to be heated to the exact temperature and then quickly cooled.

Sometimes hard-point saws are criticised on the grounds that they cannot be resharpened. This is only partly correct as they can be resharpened after they have become dull with use (Fig. 5.22), as follows:

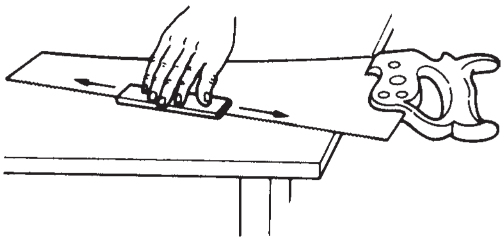
1. Put the saw flat on the work bench and take a fine-grained oilstone with a flat surface.
2. Place the stone so that it rests on the blade and just covers the tooth points.
3. Slide the stone with light pressure from the tip of the saw to the handle twice.
4. Turn the saw and repeat the process on the other side.

Fig. 5.21 Area of hardened point



This process will grind a little off the tip of the teeth that were bent outward during the setting, and will put a neat and sharp edge on the critical 0.1 mm to 0.3 mm of the point. Press only lightly with the stone as it will remove some of the set, and if the saw develops a tendency to jam in the cut, it will have to be reset to give a wider kerf.

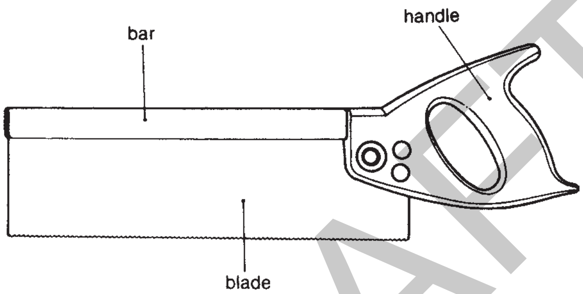
Fig. 5.22 'Sharpening' hard-point teeth



Tenon saw

The tenon saw is used for general benchwork (Fig. 5.23). The blade is straight and parallel, reinforced on the back edge by a bar of steel or brass. Consequently, the saw may sometimes be referred to as a *back saw*.

Fig. 5.23 Tenon saw



The length of the tenon saw is 250 mm, 300 mm or 350 mm, with 11 to 15 teeth per 25 mm. A popular choice for the joiner is a 300 mm by 12 teeth per 25 mm tenon saw. As the saw is used mainly for cross cutting with some ripping operations, the teeth are sharpened with a bevel as for cross cutting, and will provide satisfactory overall performance.

To use the tenon saw, the timber must be held firmly in a bench hook or vice. Grip the saw in the same manner as you would grip other hand saws (Fig. 5.24). Adopt a stance so that the saw cut, the saw and the operator's arm and shoulder are in a straight line. Lift the handle and start the cut with a series of short strokes. Gradually lower the hand and follow the line across the width of the timber until the saw is cutting horizontally. Follow the line down the edge, cutting slightly into the bench hook.

At times, due to misuse, the blade may become buckled and slightly displaced in the back. This can sometimes be corrected by holding the saw around the handle and giving the saw one sharp tap on the back, opposite the buckle, using a block of wood or a mallet. If this does not correct the fault, further attention from a saw doctor must be sought.

Fig. 5.24 Stance for using the tenon saw

Mitre box

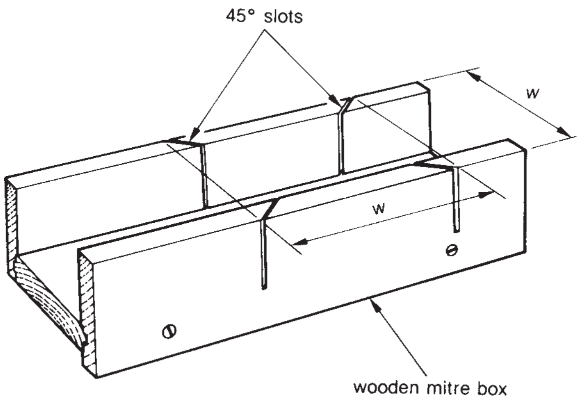
The mitre box is a jig in which timber can be held and cut accurately at an angle of 45°. It is most commonly used for making mitred or scribed joints to mouldings. The simplest form of the mitre box is made up of timber in the form of a three-sided box, with slots cut to guide the saw.

Constructing a mitre box

Material required: 90 × 35 mm pine 1/450 mm, 110 × 19 mm pine 2 /450 mm,
PVA glue, 4/30 mm bullet-head nails, 6/45 mm × 8 gauge countersunk p2 screws

1. Mark the face and face edge of each piece of timber.
2. Gauge a line using the marking gauge 17.5 mm from the edge of the 19 mm pine along its entire length.
3. Mark in 50 mm along the gauged line from both ends of 19 mm thick timber. This mark is where the nails will go.
4. Make a mark 100 mm from each end and in the centre of the 19 mm thick timber along the gauged line and drill a 3 mm pilot hole at these marks for the screws.
5. Tap the nails into the timber at the corresponding marks. Ensure only to start the nails and not hammer them home.
6. Run a bead of glue along both edges of the 35 mm piece of timber.
7. Position the sides of the mitre box along the base and drive the nails home, pinning the sides and the base together.
8. Drive the screw into the corresponding marks.

Fig. 5.25 Timber mitre box



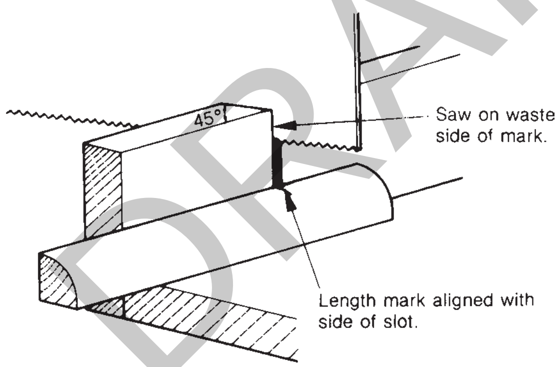
Setting out a 45° angle

The 45° angle is accurately set out as follows:

1. Measure square across the overall width (*w*) of the box.
2. Set off the distance *w* along the length, and form a square.
3. Mark the diagonals of the square across the top edges.
4. Square down the face and cut the slots accurately with the tenon saw.

To use the mitre box, hold the moulding firmly against the back of the box with the length mark aligned with one side of the slot, and the saw on the waste side of the line (Fig. 5.26). Make the cut with a fine saw, preferably a tenon saw, cutting slightly into the bottom of the box.

Fig. 5.26 Using the mitre box



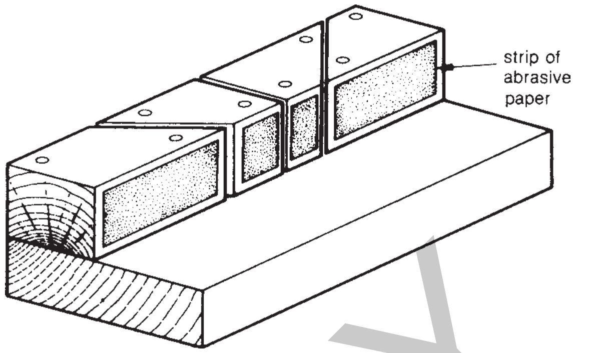
Mitre block

To mitre small mouldings, it is often more convenient to use a mitre block (Fig. 5.27).

This is used in a manner similar to the mitre box. Glue and screw the block together. Mark a 45° angle and cut the slots with a fine tenon saw.

Often timber can be held in the mitre block or box more securely and with less effort if a strip of abrasive paper (say 120 grit) is glued along the back face. A square cut can be included to quickly square the ends of small sections.

Fig. 5.27 Mitre block

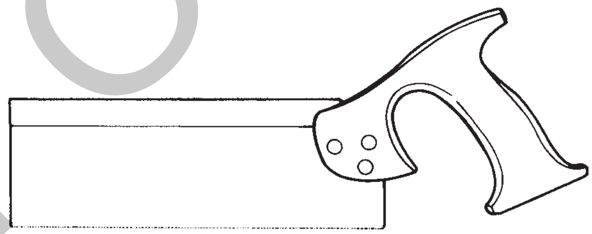


Dovetail saw

A dovetail saw is a smaller version of the back saw (Fig. 5.28). It is used for fine, accurate cutting; largely, as the name implies, for ripping dovetail pins. The length of this saw is 200 mm or 250 mm, with 14 to 16 teeth per 25 mm, sharpened for ripping.

The dovetail saw can have an open wooden handle or a straight handle.

Fig. 5.28 Dovetail saw



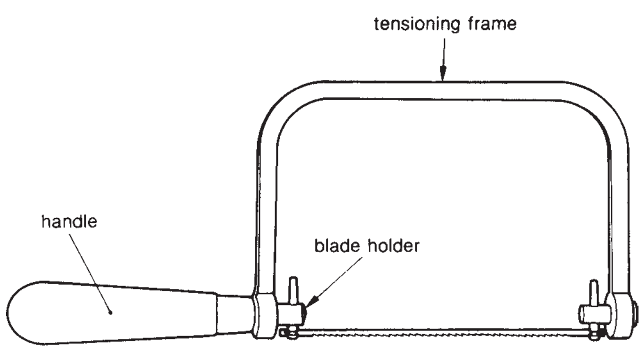
Saws for cutting curves

Cutting to curved lines is now a task more likely to be performed with power tools. A hand saw used for cutting around a curve must have a narrow blade which may have to be held under tension in a spring-loaded frame.

Coping saw

The coping saw is used for cutting around tight curves such as scribing mouldings or when removing waste from dovetail pins (Fig. 5.29). The blades are replaceable. They are approximately 150 mm long and 3 mm wide, and are tensioned in the frame by turning the handle. They can be angled to cut in any direction by twisting the pins holding the blade.

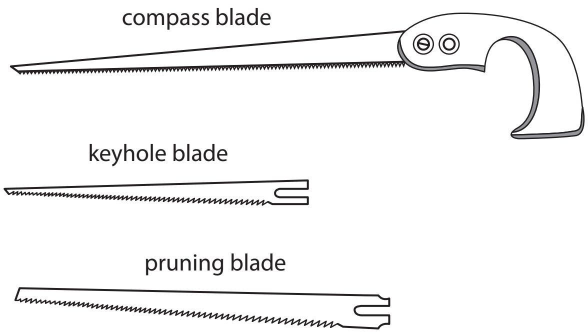
Fig. 5.29 Coping saw



Keyhole saw

The keyhole saw is used for cutting around curves, starting closed cuts (see also the power jig saw), or as the name implies, opening up the straight lower part of a keyhole after the top has been drilled (Fig. 5.30). Traditionally, the keyhole saw was included in a set, consisting of a wooden handle with three blades of different size, which was sold as a 'nest of saws'. The three blades are, from the smallest, the *keyhole blade*, the *compass blade* and the *pruning blade*.

Fig. 5.30 Keyhole saw



The modern keyhole saw has a metal handle with interchangeable blades of different sizes, suitable for cutting timber, plasterboard and light-gauge sheet metal.

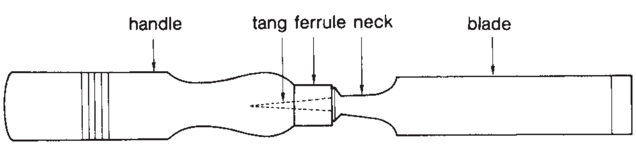
Chisels

Chisels are designed to meet the demands of different operations: some are intended purely for hand use, while others used for heavy work may require the generous use of a mallet. A suitable chisel should be selected for use in each work situation. The size of the chisel is the width of blade, ranging from 3 mm to 51 mm.

The wood chisel is one of the most basic tools in the carpenter's kit, and consists of a straight blade of specially tempered tool steel, attached to a handle of wood or tough plastic. Other chisels in general use are as follows:

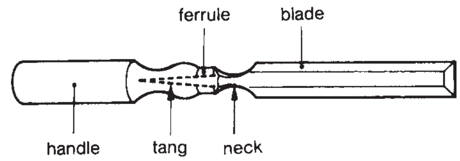
- *Firmer chisel*. This is a general purpose chisel for benchwork or light construction work, where the mallet could be used sparingly. The handle is attached to the blade by the tang and a brass ferrule helps prevent the handle from splitting. Firmer chisels with handles of tough impact plastic material give excellent service under the strain of heavy work (Fig. 5.31).

Fig. 5.31 Firmer chisel



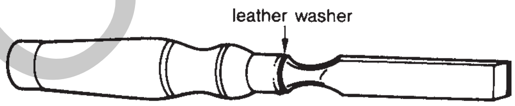
- *Bevelled-edge firmer chisel*. The edges of the blade are bevelled off to reduce resistance to the blade, particularly when paring by hand and working into a corner (Fig. 5.32).

Fig. 5.32 Bevelled-edge firmer chisel



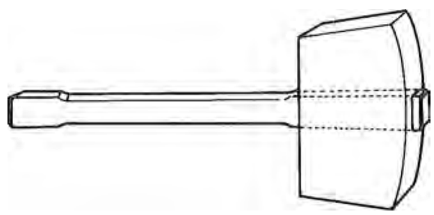
- *Registered pattern chisel*. This is designed for heavy work in hard timber. The main features are a heavy blade, a short thick neck and a leather washer between the shoulder and handle. There is also another ferrule at the top of the handle. The registered pattern chisel is designed to be used with a mallet (Fig. 5.33).
- *Mortise chisels*. These chisels are intended for chopping mortises, using the mallet. Usually they are a socket-type chisel with a thick blade to withstand the heavy use and leverage to which they are subjected.
- *Butt chisel*. This is a short bladed bevelled-edge chisel for accurately fitting hinges and locks.

Fig. 5.33 Registered pattern chisel



The mallet is used for driving the chisel (Fig. 5.34). The weight of approximately one kilogram provides the necessary force without causing damage to the chisel handle.

Fig. 5.34 Mallet



Oilstones

The sharp cutting edge on chisels and other carpenter's edge tools is produced by honing on an oilstone, which is composed of abrasive particles bonded together to form a solid stone (Fig. 5.35a). The length of the stone may vary from 150 mm to 200 mm, and they are usually 50 mm wide by 25 mm thick. **Aluminium oxide** is the most suitable abrasive for obtaining a keen edge on good quality tools.

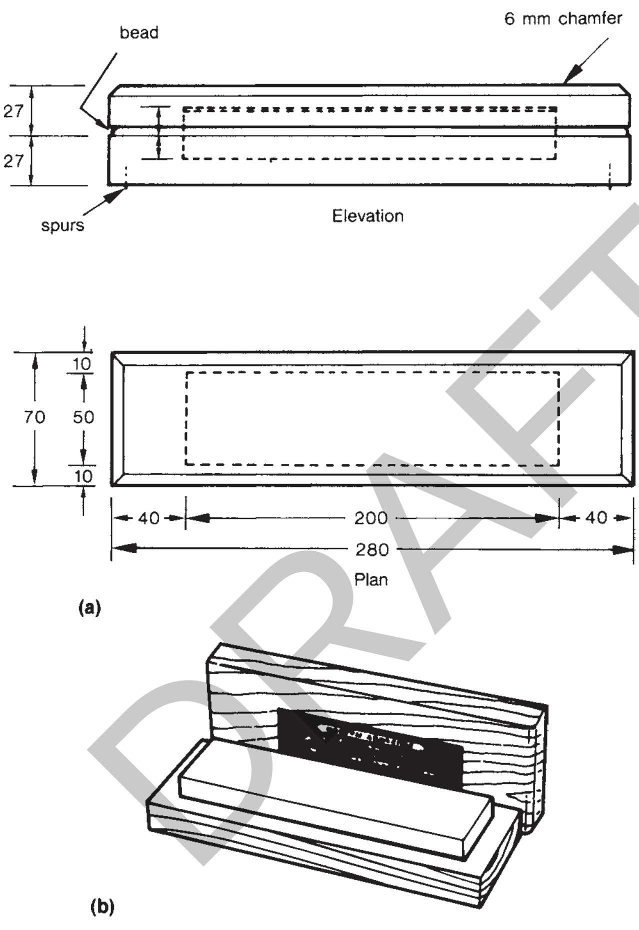
As the name 'oilstone' implies, some lubrication is necessary to reduce friction and float away the waste particles of steel, and to prevent the pores of the stone from clogging up. The simplest way to provide a suitable lubricant is to mix motor oil and kerosene in about equal parts, and reserve it for use on the oilstone only. Special lubricants such as neatfoot oil also can be used.

Stones are available in grades of coarse, medium and fine. The fine stone will produce a sharper edge but the cutting will be very slow. A combination stone with coarse on one side for quick removal of waste, and fine to produce a sharp edge on the other, can be a very useful stone for all occasions.

Natural stones such as the 'Washita' and the 'Soft Arkansas' will give the keenest of cutting edges on quality tools but they are expensive; the cost is hardly warranted except for those who engage in fine hand woodworking. Oilstones should always be housed in a strong wooden case to protect them from dirt and damage (Fig. 5.35b).

Also available are diamond sharpening stones. These are in the shape of an oil stone, but are impregnated with diamond fragments. They are used in the same way as oil stones, however, only water is used as the lubricant. Oil will damage these stones and render them useless.

Fig. 5.35 **(a) Oilstone and (b) oilstone case**



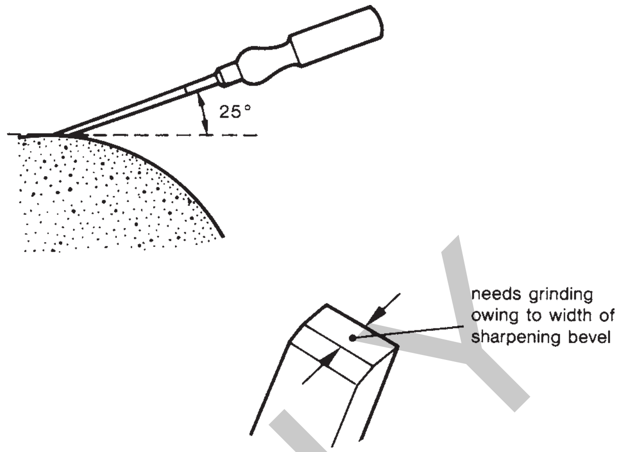
Sharpening chisels

The sharpening and honing of chisels and most carpenter's edge tools involve two angles—a grinding angle and a sharpening angle.

The grinding angle

The grinding angle is made on a grinding wheel, can vary from 25° to 30°, and must be square to the blade (Fig. 5.36).

Fig. 5.36 **Grinding angle**

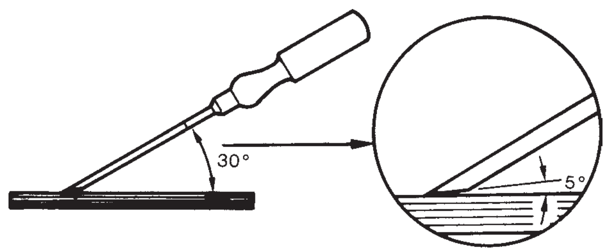


When using a grinding wheel, care must be taken that the chisel does not become overheated by cooling it frequently with water.

The sharpening angle

As only the point of the blade will do the cutting, it is only necessary that the point be sharpened to a keen edge on the oilstone. The sharpening angle will vary from 30° to 35° (Fig. 5.37). At the lower angle the chisel would give satisfactory service on light paring work but in hard timber the edge may tend to break away, and sharpening to a greater angle will ensure more reliable service.

Fig. 5.37 **Sharpening angle**



To sharpen the chisel, follow these steps:

1. Spread sufficient lubricant on the oilstone and place the grinding angle flat on the face of the stone. Lift the blade a little, up to 5°, to obtain the correct sharpening angle.
2. With a light pressure, rub the chisel backwards and forwards over the stone, or use a figure-eight motion until a burr, sometimes called a *wire edge*, appears on the back of the blade (Fig. 5.38). A figure-eight motion is used to prevent the stone from wearing unevenly.
3. Turn the chisel over and, holding the back perfectly flat on the stone, rub to and fro until the wire edge is removed (Fig. 5.39). It may be necessary to reverse the blade a couple of times, for a few strokes only, until the wire edge finally comes away. This is often seen left lying on the stone. Wipe the stone down before further use.

The following joints can all be produced using the tools that have already been discussed.

Fig. 5.38 Chisel on oilstone—feeling for wire edge

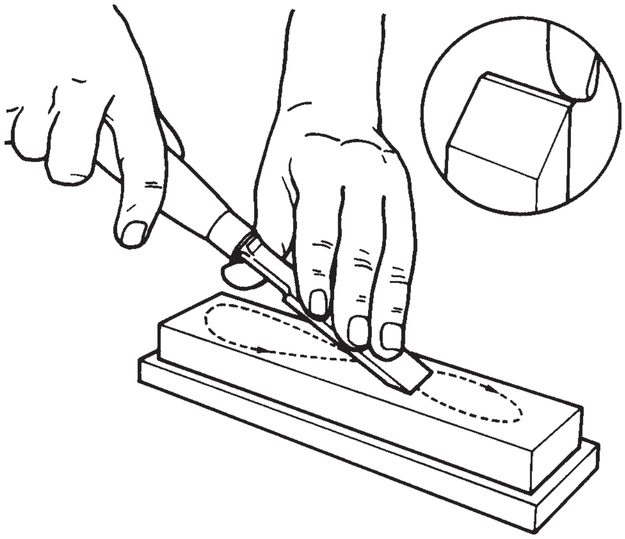
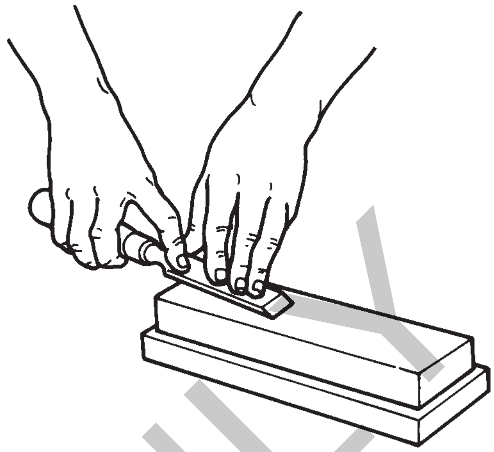


Fig. 5.39 Removing wire edges—turning chisel flat on oilstone

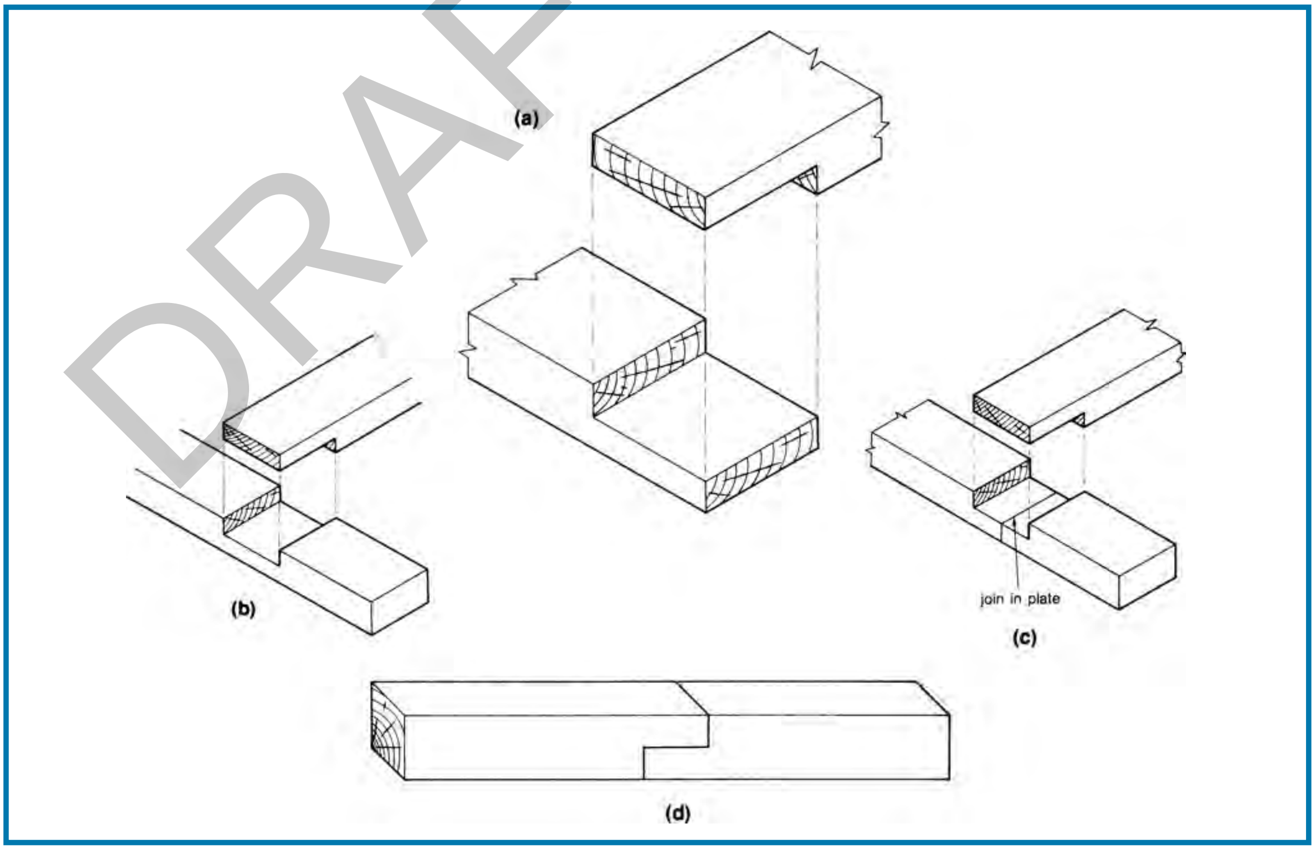


Basic timber joints

Half-lapped/halving joint

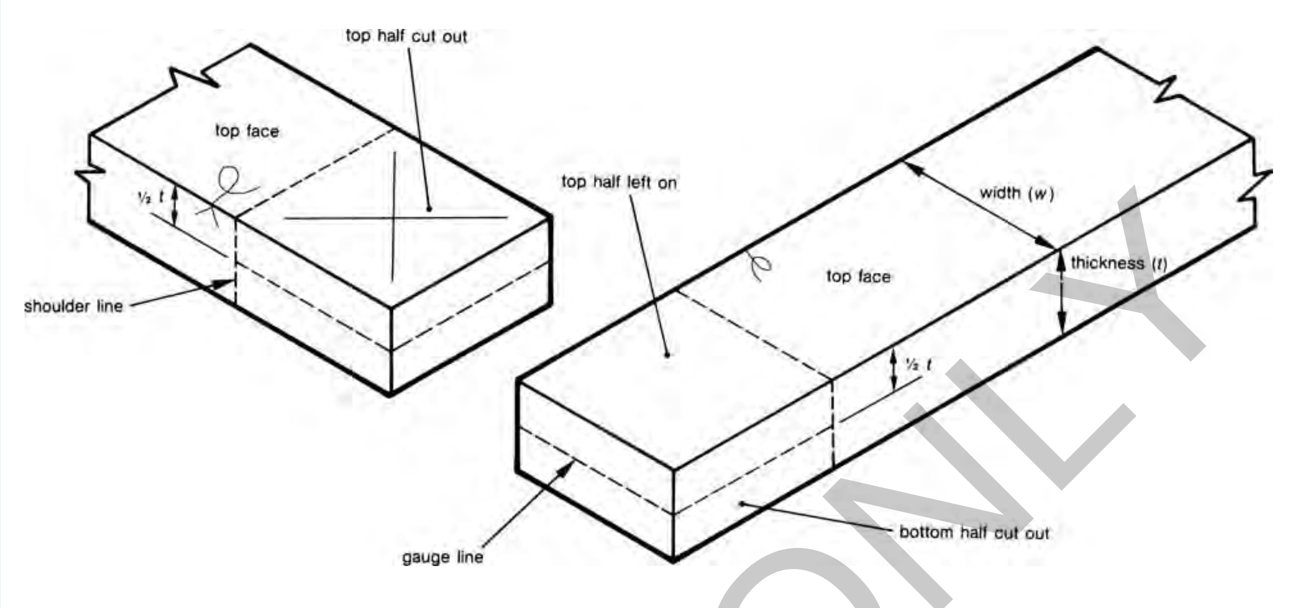
The **half-lapped joint** is one of the most commonly used joints both in detail joinery and construction work and can be referred to as a *scarf joint* when joining timber in length (Fig. 5.40). The setting out of most joints in woodwork requires working from a given face; this is usually clearly indicated by marking the face with distinguishing mark diagram.

Fig. 5.40 Half-lapped joint: (a) corner halving; (b) tee-halving; (c) tee-halving with cut plate; (d) extending timber in length (scarf joint)



Setting out the half-lapped joint

Fig. 5.41 Scarf joint/halving joint setout



The procedure is as follows:

1. Square the ends of the two pieces of timber to be jointed and mark the working faces.
2. Measure back from the ends the distance equal to the width of the material *(w)*, and square the shoulder line around the timber.
3. Set the marking gauge to half the thickness of the material *(t)*, and with the stock of the gauge against the face, gauge around the three sides of the joint on both pieces of timber (Fig. 5.42).
4. Mark the waste half to be cut out with a distinct cross.

Fig. 5.42 Setting marking gauge

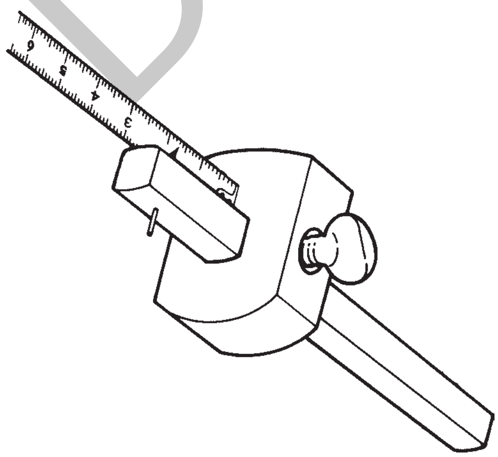
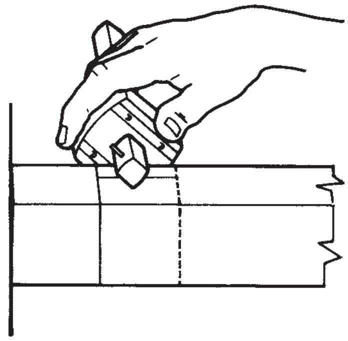


Fig. 5.43 Holding marking gauge



Ensure that both pieces of timber are gauged the same distance from the face so that when the joint is cut out, the amount left on one piece should be the same as the amount cut out of the other, and the face will be flush.

Cutting out the half-lapped joint

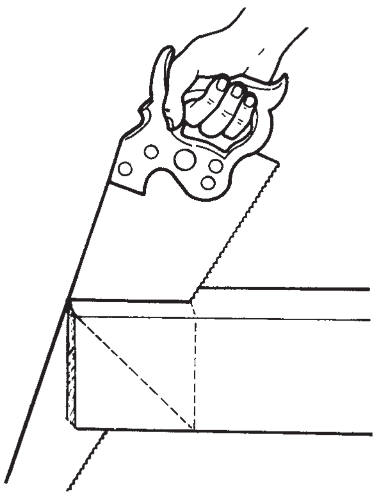
Select a suitable saw. This job involves small amounts of ripping and cross cutting without the need for a high quality finish, so a panel saw would be an appropriate choice.

When cutting away a 'cheek' from the end of the timber as in this case, as well as a number of other joints, the golden rule is, *rip first and cross cut second*. The reason for this is that we can rip slightly beyond the shoulder line and the strength of the joint will not be affected. Then cross cut just up to the first cut. To cross cut beyond the gauge line would seriously reduce the strength of the joint.

Ripping the half-lapped joint

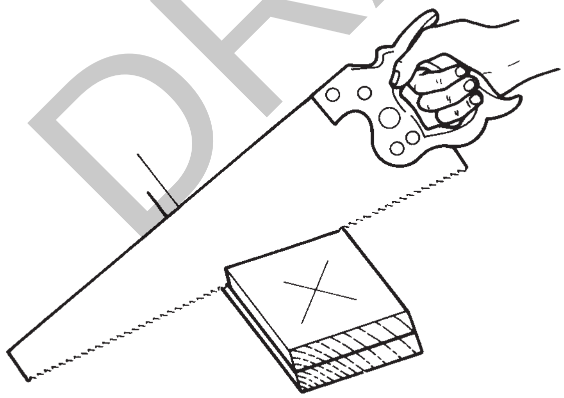
1. With the timber supported on stools rip diagonally on the waste side of the line for half the joint.

Fig. 5.44 Process of sawing—ripping



2. Reverse the timber and continue the cut from the opposite side, taking care to keep on the waste side of the line. Lift the handle of the saw to finish the cut slightly beyond the shoulder line.
3. Lay the timber flat on the stools and make the cross cut on the waste side of the shoulder line, just up to the first cut. Check for accuracy—the shoulder should be a close fit, and the joint should be square and the face flush.

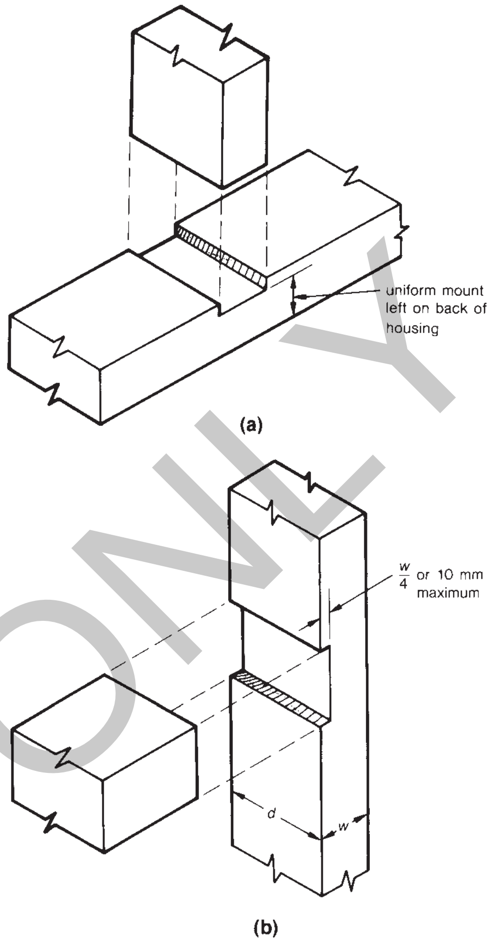
Fig. 5.45 Process of sawing—cross cut up to first cut



Housed joint

The housed joint is also a commonly used joint in all kinds of carpentry work. Fig. 5.46 illustrates an example.

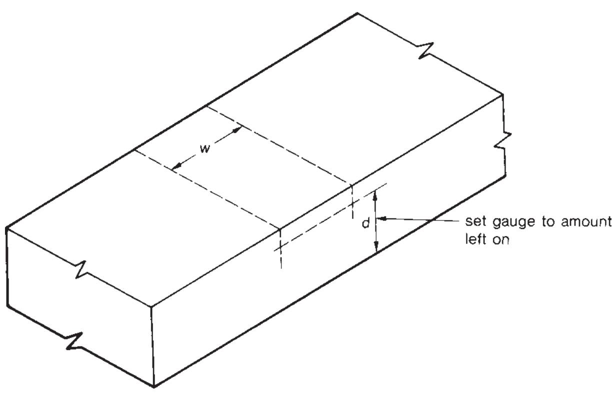
Fig. 5.46 Housed joints **(a)** horizontal **(b)** vertical



To set out the housed joint

1. Locate the position of the housing on the face of the timber and measure the distance equal to the width of the corresponding piece of timber. Square two lines across the depth and partly down the sides. Fig. 5.46 shows the designation of the terms *w* (width) and *d* (depth).

Fig. 5.47 Housed joint setout

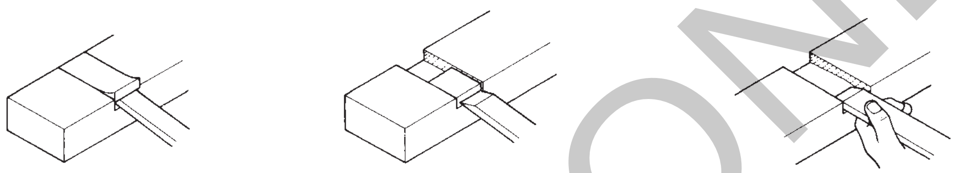


2. Set the marking gauge to the amount left on the timber and gauge the housing from the top or bottom face as the case may be.

Cutting the housed joint

1. Using a hand saw, cut down the sides of the housing, keeping on the waste side of the line and taking care not to cut beyond the gauge line.
2. Using a sturdy chisel, together with a mallet or hammer, work from one side and remove the waste approximately half way across the housing down to the gauge line.
3. Working from the opposite side, remove the remainder of the waste.
4. Paring by hand, smooth the bottom of the housing. Note how the chisel is gripped between the thumb and forefinger, which keeps it under control at all times.

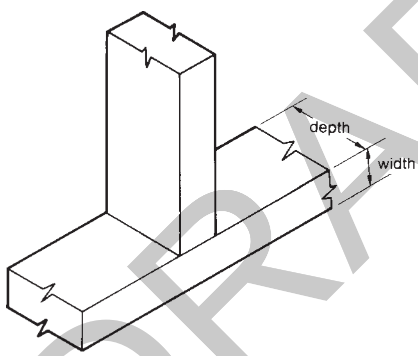
Fig. 5.48 Cutting the housed joint



Butt joint

The **butt joint** shown in Fig. 5.49 is extensively used in timber framing.

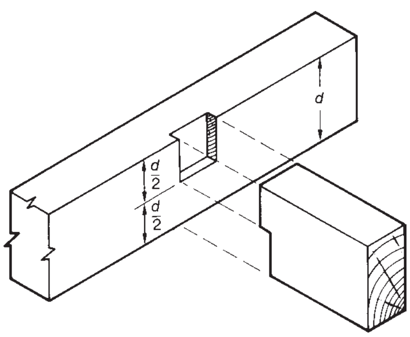
Fig. 5.49 Butt joint



Stopped housed joint

The housing in a **stopped housed joint** does not continue right across the face of the timber; Fig. 5.50 shows an example.

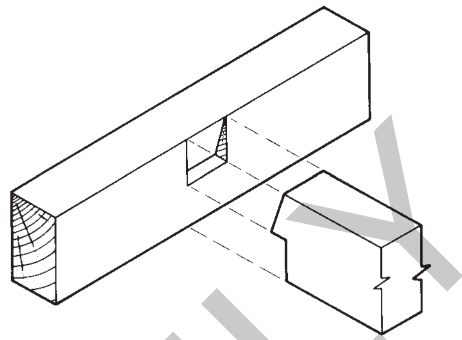
Fig. 5.50 Stopped housed joint



Splayed housed joint

The splayed joint shown in Fig. 5.51 will serve the same function as the stopped house joint.

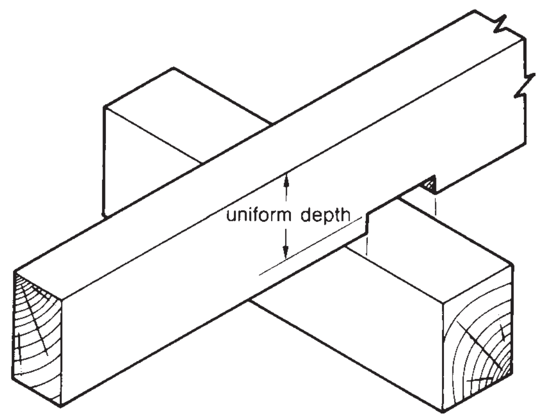
Fig. 5.51 Splayed housed joint



Notched joint

The example shown in Fig. 5.52 is another application to floor framing. The joist has been notched to leave a uniform depth where it will be supported on a timber bearer, or in some cases a steel beam. A modification of the notched joint is the *birdsmouth*.

Fig. 5.52 Notched joint



Intepreting plans

Construct the object pictured in Fig. 5.53(a). The task combines a number of the joints covered in this chapter so far. Read the plans (shown in 5.53b) carefully as some of the measurements need to be calculated.

The timber size required to construct this project is 85 mm × 30 mm.

Fig. 5.53 Joint and hand tool practical exercise: (a) object to be constructed

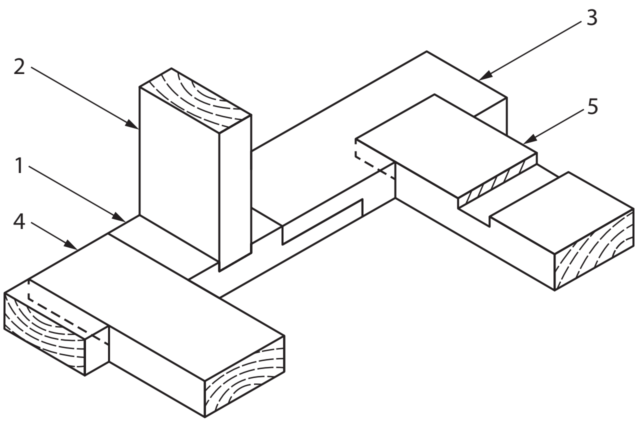
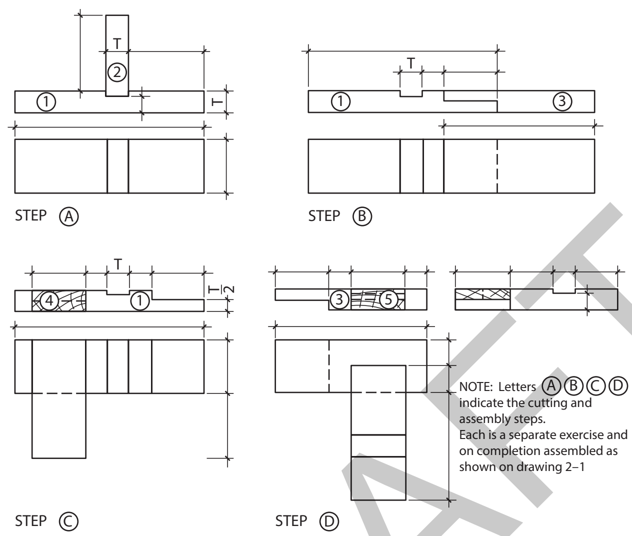


Fig. 5.53 Joint and hand tool practical exercise: (b) plans



Hammers

Claw hammers

Claw hammers are essential equipment for the construction carpenter (Fig. 5.54) and are used, of course, for the driving and extracting of nails (Fig. 5.55). Hammers have a drop forged head with a handle or shaft that may be of wood, fibreglass or steel with a shockproof hand grip, which is very popular. The size of the hammer is expressed as the mass of the head and common units are 450 g, 570 g to 680 g, or, in imperial units, 16 oz, 20 oz or 24 oz. The face of the claw hammer is case hardened and should never be used to strike another hammer or other hard metals, as the hardened face may chip away. For working on construction carpentry, a heavy hammer is the most suitable.

There are many varieties of claw hammers; some with straight claws some curved claws, some larger heads. Make sure you purchase a hammer that is suitable for the type of work you will be doing and that is it not too heavy. Many carpenters end up with tennis elbow because the hammer they use is too heavy.

Fig. 5.54 Claw hammer

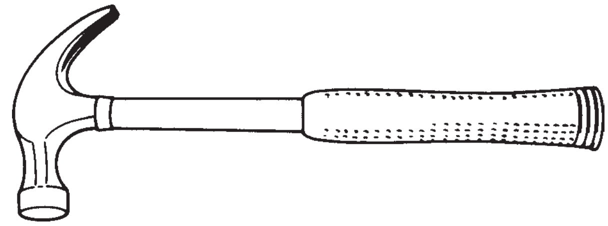
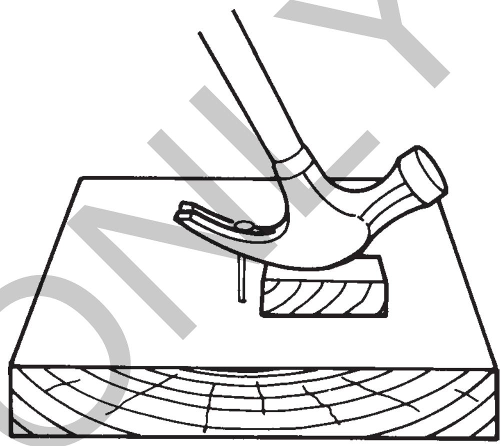


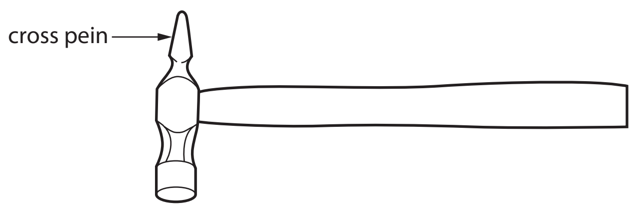
Fig. 5.55 Using claw to extract nail



Warrington hammer

This pattern of hammer is often favoured for light benchwork (Fig. 5.56). It has a tapered cross pein which is used to start panel pins held between finger and thumb. The polished head varies in mass from 100 g to 450 g and is fitted with an ash handle.

Fig. 5.56 Warrington hammer



Nail punches

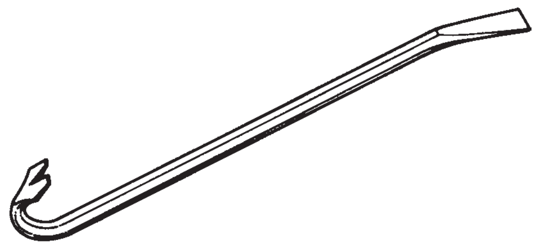
Bullet-head nails, used in most finish work, are punched slightly below the surface with a nail punch which has a concave tip to prevent it slipping off the nail (Fig. 5.57). The diameter of the tip can be 0.8, 1.5, 2.3, 3.3 or 4 mm. Select a tip size approximately equal to the dimension of the nail head.

Fig. 5.57 Nail punch

Pinch bar

Pinch bars are also called *wrecking bars* and are used for demolition work, pulling large nails or for levering building units, such as wall frames, into position. The pinch bar has a claw at one end, and an offset chisel point at the other (Fig. 5.58).

Fig. 5.58 Pinch bar



Bench planes

Bench planes generally refer to a group of planes that are similar to each other in construction but vary in size. Each has a particular function to perform. Fig. 5.59 shows a smoothing plane. Planes in the group are listed in Table 5.2.

Fig. 5.59 The smoothing plane

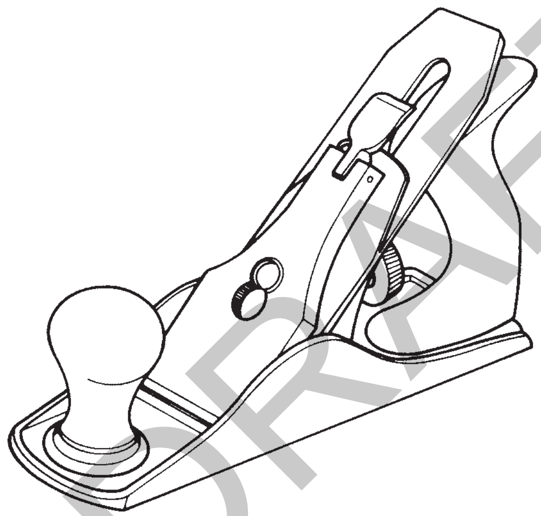


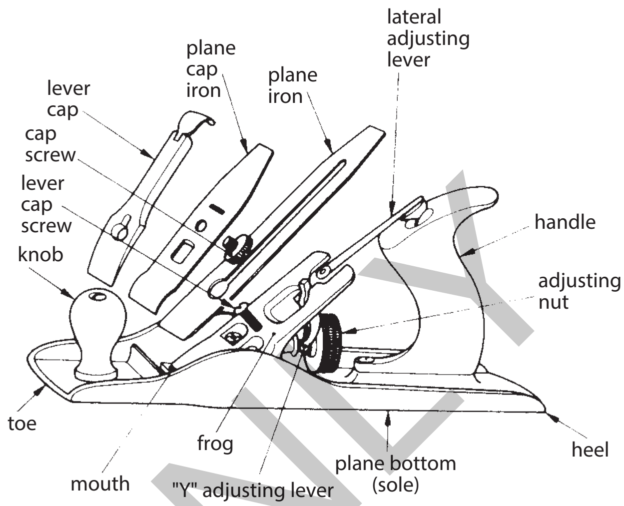
Table 5.2 Types of bench planes

Name	*Length (mm)*	*Blade width (mm)*
Smoothing plane	240 & 260	45, 50 & 60
Jack plane	355 & 380	50 & 60
Fore plane	455	60
Trying plane, or jointer	560 & 610	60 & 65

The term 'fore plane' has now fallen into disuse. It may be regarded as a short trying plane since it is sharpened in a similar manner.

The construction of a bench plane is illustrated in Fig. 5.60.

Fig. 5.60 Exploded view of the bench plane



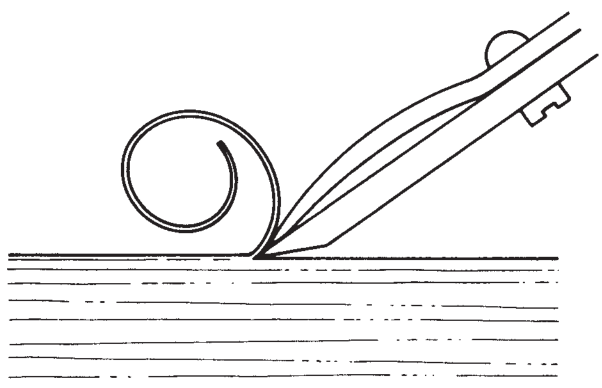
Plane iron

The plane iron consists of two main parts:

1. the *cutting iron*;
2. the *cap iron* or *back iron*.

These are held together by the *cap iron screw*. The cutting iron does the actual cutting and the cap iron is provided to stiffen the cutting edge and prevent vibration and 'chattering' (Fig. 5.61). The cap iron also performs the important function of putting the curl into the shavings so that they will roll out and clear the waste from the mouth of the plane.

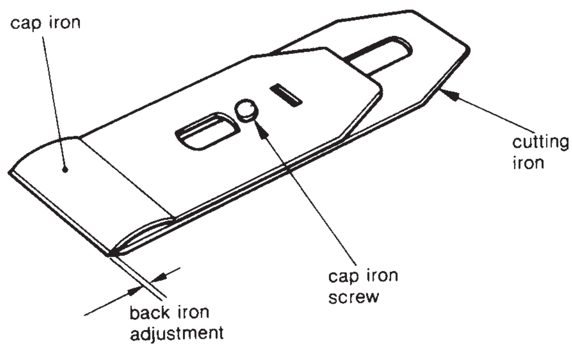
Fig. 5.61 Action of the plane iron



The cap or back iron must fit tightly down on the cutting iron; otherwise the shavings will become wedged in the gap and clog the mouth of the plane.

The distance the cap iron is set back from the cutting edge (Fig. 5.62) depends mainly on the nature of the timber. Difficult curly-grained timber requires the cap iron to be set as close as possible, say 0.5 mm, to the cutting edge and a very fine shaving taken. On milder timber, the cap iron can be set back as far as 2 mm and a heavier shaving taken.

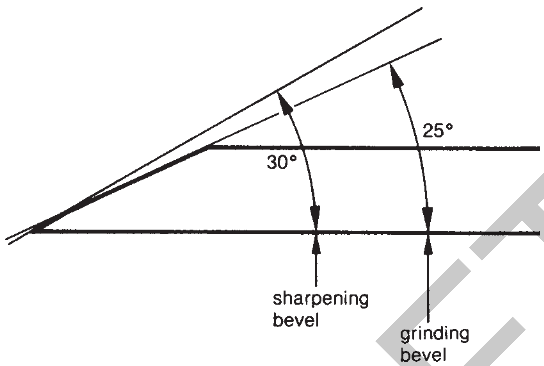
Fig. 5.62 Adjustment of the back iron



The cutting iron, in common with most other edge tools, is sharpened with two distinct bevels (Fig. 5.63):

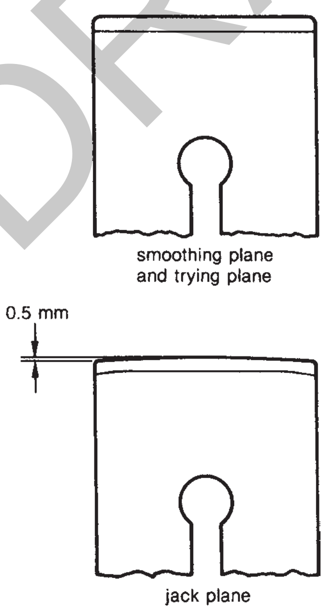
1. the *grinding* bevel (25°)
2. the *sharpening* bevel (30°).

Fig. 5.63 Sharpening angles



The shape of the blade across the face varies (Fig. 5.64); the explanation for this will become apparent when considering the purposes of the bench planes.

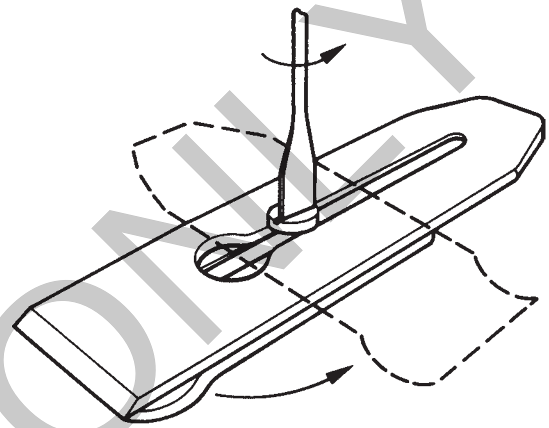
Fig. 5.64 Blade shapes



Grinding the cutting iron

To remove the blade from the plane, lift the lever and remove the lever cap (Fig. 5.65). The plane iron can then be lifted from the body of the plane. Separate the cap iron from the cutting iron by laying the blade flat on the bench and using a large screwdriver to loosen the cap iron screw. Turn the blade over, slide the cap iron back and turn it through 90°. Now slide the cap iron forward and remove the screw through the hole in the blade.

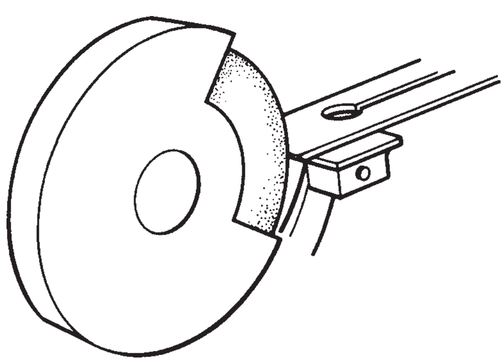
Fig. 5.65 Removing the cap iron



To grind the blade:

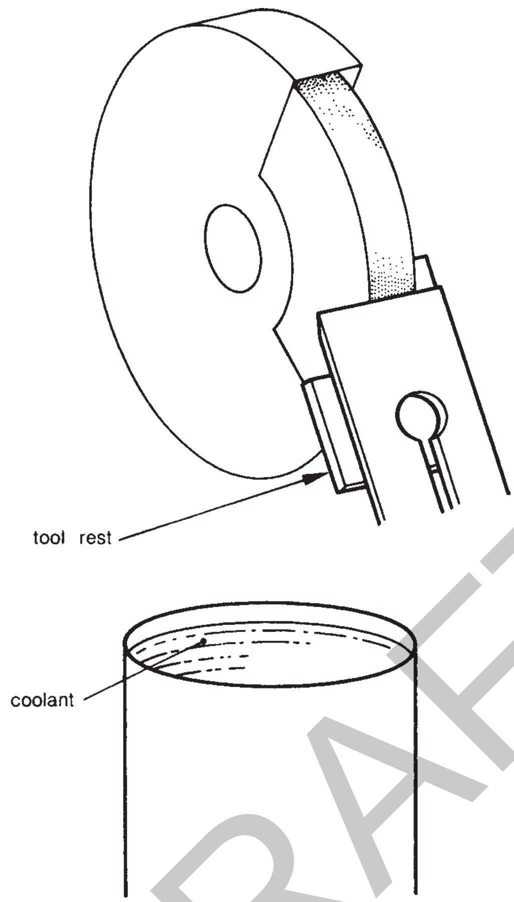
1. Set the tool rest square to the grinding wheel, lay the blade on the rest and, moving it from side to side, grind the edge just sufficiently to remove any gaps. The grind should finish straight and square, or in the case of the jack plane, with a slight camber (Fig. 5.66). Check with the try square.
2. Adjust the tool rest to grind at the correct angle, which is 25°. Lay the blade on the rest and, moving it from side to side, grind it at this angle until the thick edge is almost removed.
3. Hold the edge between the fingers and up to the light; any remaining thick edge will be visible, showing where further grinding is required. However, do not attempt to produce the final cutting edge on the grinder.
4. Tilt the blade sideways and, with just a slight touch, remove the sharp corners if necessary.

Fig. 5.66 Squaring the plane iron



During grinding, it is most important that the blade is kept cool. Keep a container of water nearby and cool the blade frequently. The first sign of overheating is when the surface of the blade turns a light straw colour. Stop immediately and cool the blade. Overheating can ruin a good plane iron as the cutting edge becomes soft due to the loss of temper, and it will not hold a keen edge.

Fig. 5.67 Grinding the bevel



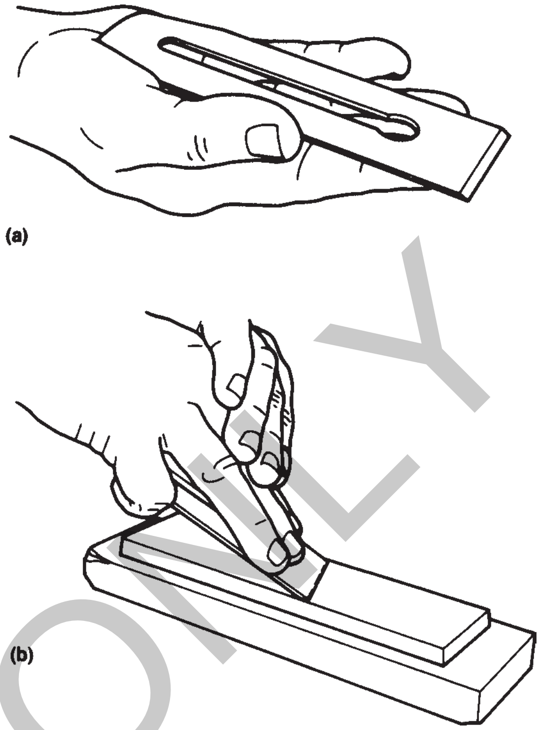
Sharpening the cutting iron

To produce a sharp cutting edge, a fine oilstone, or even better a good natural abrasive stone, is required. Fig. 5.68 shows the way to grip the plane iron to hold it at a constant angle.

1. Rest the grinding angle of the blade on the stone and raise the blade through 5°. Move the blade back and forth using the full length of the stone. Alternatively, move it with a figure-eight motion until a burr appears on the back of the blade.
2. Turn the blade over and, holding the blade perfectly flat on the stone, remove the burr. It may be necessary to reverse the blade for a few strokes to finally remove the burr which will probably be seen left lying on the stone.

Assembly of the cap iron is the reverse of the removal procedure, except that the cap iron is slid *forward* to the required setting from the cutting edge. The blade is then turned over and the screw tightened.

Fig. 5.68 Gripping the plane iron

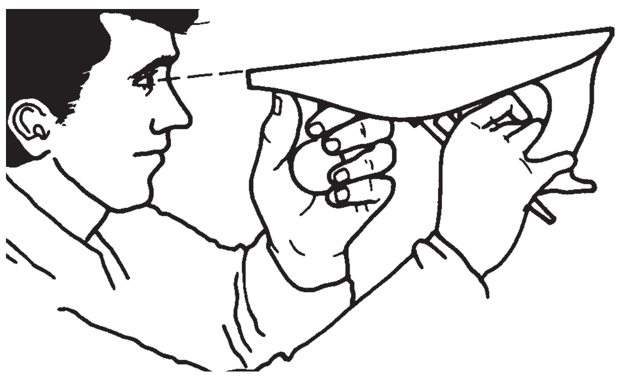


Adjusting the plane for use

Replace the plane iron by placing the cutting edge into the mouth of the plane and resting it on the frog, with the 'Y' adjusting lever and the lateral adjusting lever in the slots provided for them. (Refer to Fig. 5.60 to identify the parts of the plane.) Replace the lever cap and press down the lever to lock the blade in place.

Turn the plane upside down and sight down the sole (Fig. 5.69). If the blade is not visible, turn the cutter adjusting nut (usually clockwise) until the blade can be seen projecting from the mouth. If one corner is projecting more than the other, use the lateral adjusting lever to move the blade sideways until it is projecting uniformly across the full width of the blade. Readjust the projection of the blade to take just a fine shaving. Always commence planing with a fine shaving and, if desired, increase it as conditions permit.

Fig. 5.69 Sighting down the sole



Smoothing plane

The smoothing plane is very often the first plane to be added to the carpenter's and joiner's tool kit. Its function is to smooth off timber, leaving the surface flat and free of planing defects. For this purpose, the blade is sharpened perfectly straight across, with just the corners rounded off to prevent them digging in and leaving small ridges on the surface.

The smoothing plane will be constantly at hand for the joiner, to flush off joints and clean off the face of framing, as in doors, windows, etc. It is also used to remove cutter marks from the surface of machine-dressed timber. Although not primarily intended for planing timber to size, it may sometimes be used for this purpose on short lengths.

The work on which a smoothing plane is to be used should always be held securely against the bench stops or in a vice. In order to smooth a wide surface, plane it in strips commencing from the nearest edge and work across the job until the whole surface is covered. Always plane in the direction of the grain. If necessary, reverse the direction of planing to determine which way produces the best result.

To achieve a satisfactory result with the smoothing plane under all conditions, it may be necessary to adjust the mouth (Fig. 5.70). This is rarely needed to be carried out on a smoothing plane. The amount of adjustment, although very small, can be significant when attempting to produce a smooth surface on difficult curly-grained timber.

Fig. 5.70 (a)–(b) Different mouth adjustments

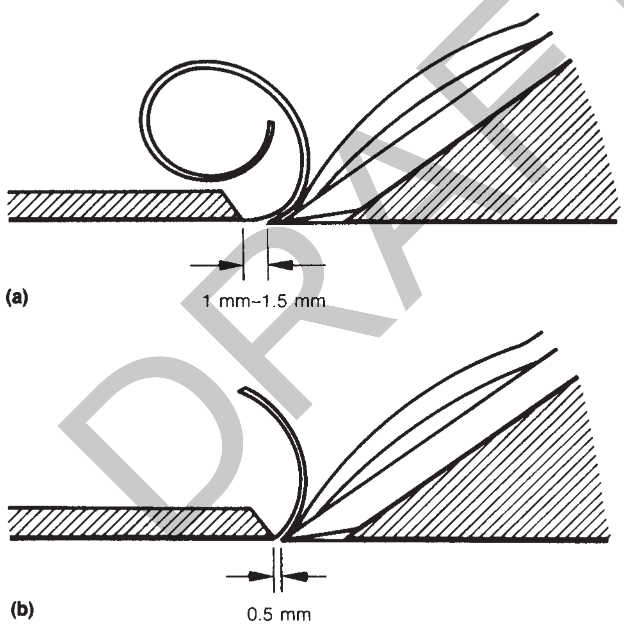


Fig. 5.70(a) shows that when the mouth is adjusted for normal planing, the distance from the cutting edge to the sole of the plane is approximately 1 mm to 1.5 mm. When planing difficult timber, the tendency is for the shaving to split and tear away in front of the cutting iron. Closing further the mouth of the plane (Fig. 5.70b) means that the sole is holding down the timber closer to the front of the cutting iron, preventing the shaving from lifting and breaking away. It naturally follows that if the mouth of the plane is closed up, only a very fine shaving can be taken—a thicker shaving would only become wedged in the narrow mouth. So if a coarser shaving is to be taken, open the mouth.

To adjust the mouth opening, first remove the plane iron. Then loosen the two screws securing the frog and move the frog backwards or forwards by turning the frog adjusting screw. Tighten the screws when the correct setting is obtained.

In summary, to produce a smooth flat surface with the smoothing plane under difficult conditions, it is necessary to:

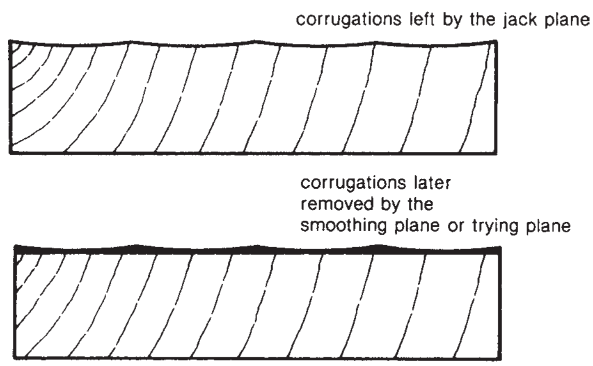
1. have the cutting iron correctly shaped and razor sharp
2. set the cap iron close to the cutting edge
3. close the mouth of the plane
4. take a very fine shaving.

Experience and experimentation will establish the best settings for any particular job.

Jack plane

The jack plane is similar to the smoothing plane and is used to dress timber to its approximate size and shape. The greater length of the jack plane makes it easier to produce a straight flat surface. The blade is sharpened with a slight camber which makes it easier and quicker to remove the waste; however, the surface will be left with a series of corrugations which must be removed later by the smoothing plane (Fig. 5.71).

Fig. 5.71 Corrugations to be removed by a smoothing or a trying plane



If the timber is of a long length, the final truing up may be done with a trying plane.

Trying plane

The longer trying plane makes it most suitable for straightening long lengths of timber, particularly where the carpenter is edge jointing boards, as may be necessary for table or counter tops. The object is to produce a true flat surface. The blade is therefore sharpened straight across with the corners rounded off.

Many experienced tradespeople like to use the heavier trying plane wherever possible, but it must be conceded that much of the work of the trying plane is now being taken over by power tools. However, when accurate joining is required, nothing can equal the trying plane guided by skilled hands.

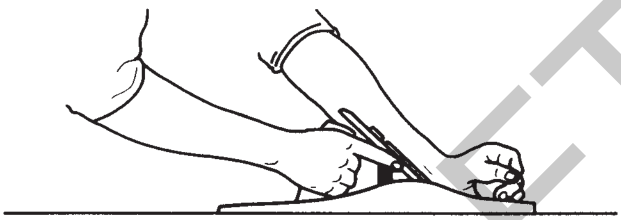
Planing rough-sawn stock to section size

For all those seeking to become skilled in the use of hand planes, this is a basic exercise that should be practised. Note not only the way in which the plane is handled, but the procedure that is followed to reduce the rough rectangular stock to a given sectional size. (Trade terms are often used rather loosely, and differ in some areas. In the workshop, the raw unworked timber may sometimes be referred to as *stock*.)

This is one example of a basic procedure that is followed in the same order whether hand tools or machines are used. The jack plane is the best one to use for this purpose, but practise with the smoothing plane if it is the only one available. Assume for this exercise that a piece of 100 mm × 38 mm rough-sawn Pacific maple, 600 mm in length, is to be dressed to 90 mm × 32 mm finished size. The procedure will be described in four steps; each step will be confined to one of the four sides of the stock to be dressed.

1. Select the best face of the timber to become the face side. Lay the timber flat on the bench with the face side up, and the end against the bench stop. Set the jack or trying plane to take a fine to medium shaving, and grip the handle with the finger lying parallel with the edge of the blade (Fig. 5.72).

Fig. 5.72 Gripping the plane



To commence planing, rest the toe of the plane on the face of the timber and exert a downward pressure. Use the full length of the plane by keeping it parallel with the timber; move it forward maintaining pressure on the front.

As the plane commences to cut, the high spots will be removed first, in short shavings. When the plane is fully supported over the timber, exert forward and downward pressure equally with both hands; towards the end of the stroke, transfer downward pressure to the back to prevent the toe dipping down as it moves over the end of the timber and becomes unsupported. With practice, the distribution of pressure becomes an automatic reaction—pressure on front hand, distribute equally, transfer pressure to back hand (Fig. 5.73).

If the planing is difficult and rough, reverse the timber to see if the grain is running in the opposite direction.

Continue planing in strips across the face of the timber until full shavings are rolling out of the mouth of the plane.

Test the face for accuracy in the following three ways:

(a) Use a straight edge, or the sole of the plane tilted over, to check that the face is straight from end to end (Fig. 5.74).

Fig. 5.73 Three pressure steps: (a) pressure at commencement of stroke; (b) pressure distributed equally; and (c) pressure at end of stroke

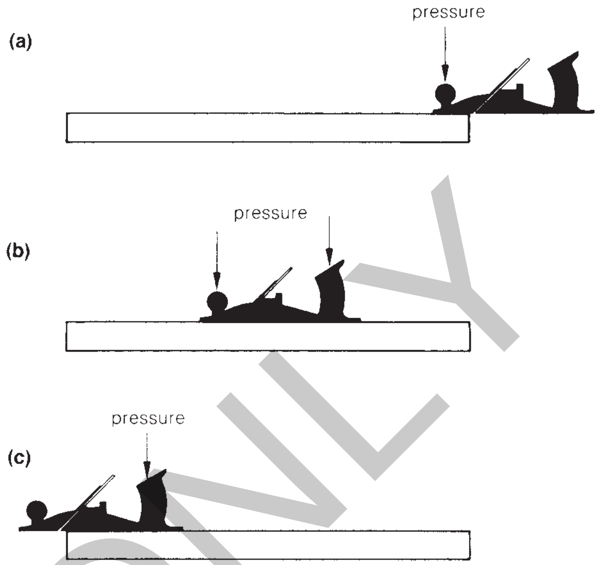
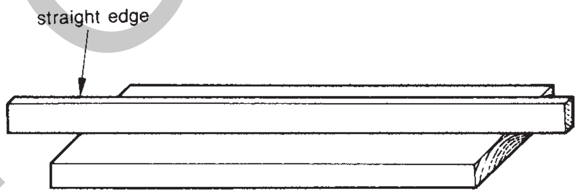
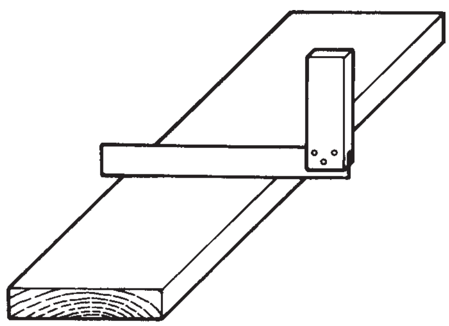


Fig. 5.74 Checking the length for straightness



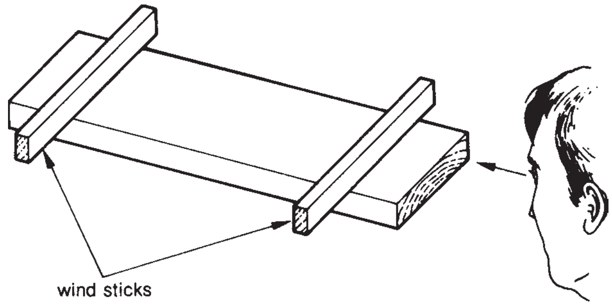
(b) Use a short straight edge or try square to check that it is flat across the width (Fig. 5.75). Hold the timber up to the light; any irregularity can be seen more readily under the straight edge.

Fig. 5.75 Checking the width for flatness



(c) The face could also be twisted or, to use the trade term, be in 'wind.' *Wind sticks* are two short lengths of timber, say 300 mm × 40 mm × 15 mm. Their section size can vary, but they must be parallel. Lay a wind stick square across the timber near each end and sight the two top edges; any wind will be exaggerated, indicating the high corners of the stock (Fig. 5.76).

Fig. 5.76 Checking the face for wind



To remove the wind, take shavings diagonally across the high corners. Check again, and when all is correct, mark the face with the traditional *face mark*—a large 'e' with the tail continued to one edge (Fig. 5.77).

Fig. 5.77 Face mark

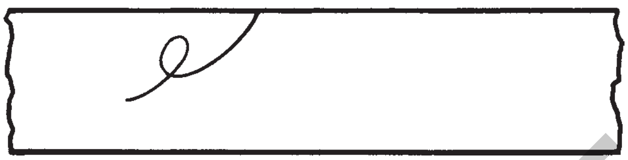
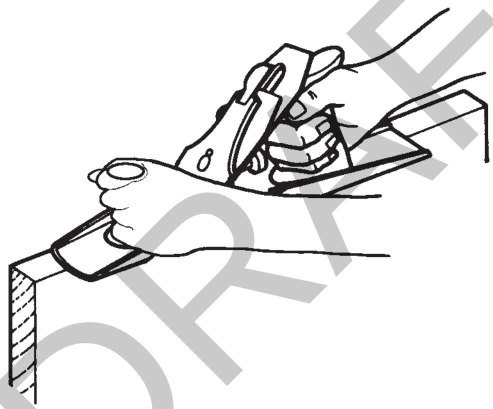
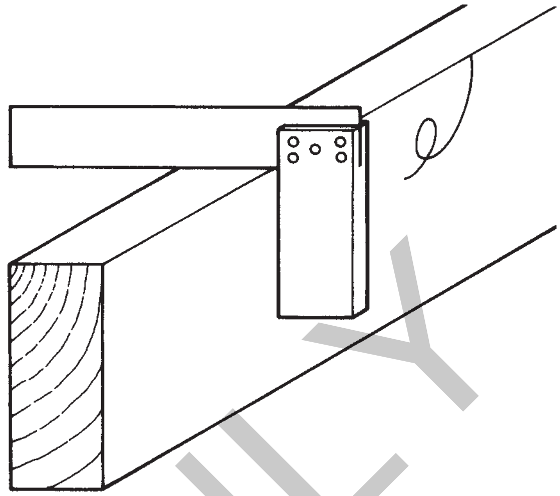


Fig. 5.78 Shooting the edge using a jack or a trying plane



2. The extended tail of the face, mark points to the face edge which must now be planed straight and square to the face side; this is called 'shooting the edge' (Fig. 5.78). To do this, first secure the timber in a vice. Grip the plane as shown in Fig. 5.78. Holding the plane square to the face side, plane the edge, distributing the pressure in a similar manner as for the face side. Test the face edge in the following two ways:
   (a) Use a straight edge to check that it is straight from end to end.
   (b) Use a try square to check that it is square to the face side (Fig. 5.79).

Fig. 5.79 Checking the edge for squareness



If it is not square, move the plane over to take shavings off the high edge only (Fig. 5.80), finishing with a shaving of full thickness. Test again, and when all is correct, mark with the *face edge mark*—a 'V' with the point to the long tail of the face mark (Fig. 5.81).

Fig. 5.80 Correcting the edge

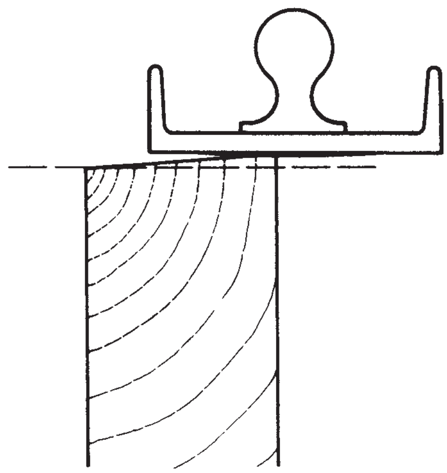
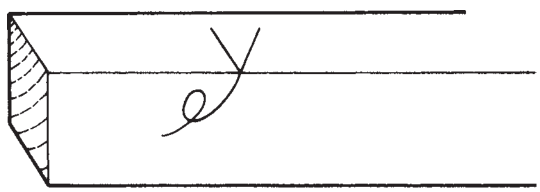


Fig. 5.81 Face edge mark



When preparing the face side and edge, do not lose sight of the fact that the timber must be finished to a given section size; so do not plane unnecessarily with the result that the timber is finished undersize.

3. The timber must now be reduced to the specified width. Set the marking gauge to width, 90 mm in this case, and

with the stock of the gauge to the face edge, gauge the width along the two faces. If there is an excessive amount of waste to be removed in the width, use the rip saw and cut to about a millimetre on the waste side of the gauge line, which is sufficient to smooth the rough edge and finish accurately to size with the jack plane.

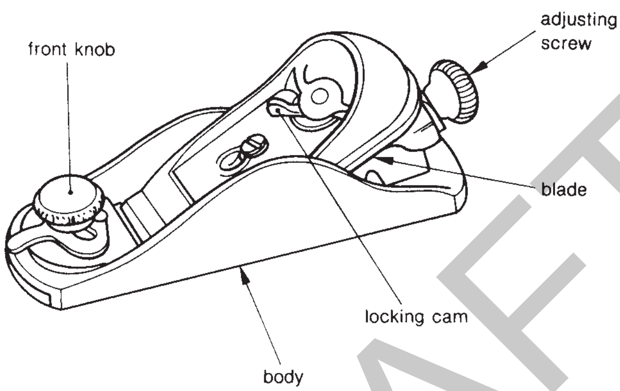
When planing away waste, keep a careful watch on the gauge lines and stop planing when you just start to split the lines.

4. The timber must next be reduced to its specified thickness. Set the gauge to the correct thickness, 32 mm in this case, and with the stock to the face side, gauge both edges and ends to thickness. Lay the stock on the bench against the stop and, watching the gauge lines on both edges, plane away the waste stopping at the gauge lines.

Block plane

The block plane is primarily intended for planing **end grain** but can also be used for trimming other small items (Fig. 5.82).

Fig. 5.82 Block plane

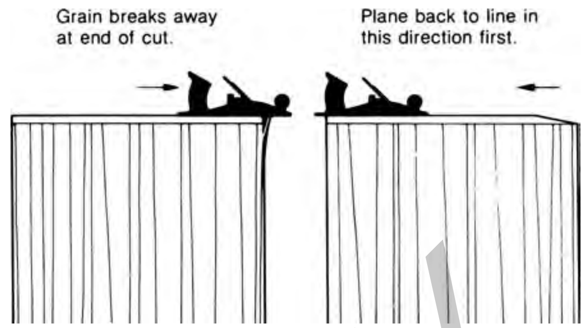


This plane is approximately 180 mm in length, with a blade 41 mm in width, set at a low angle of 20°. There is no back iron and the blade is sharpened at the same angle as the bench planes—a grinding angle of 25° and a sharpening angle of 30°. It is mounted in the plane with the bevel side up. Different makes will vary in the way the blade is fitted and adjusted; however, the better quality planes have full screw adjustment for depth of cut and lateral movement. To use the block plane for planing end grain, the blade must be razor sharp and should be set for a very fine shaving (Fig. 5.83). To prevent the timber splitting away at the end of the cut, plane from both directions.

Lubricating the sole of the plane

Planing will be made much easier if the sole of the plane is lightly lubricated. However, this must be done sparingly, and care must be taken to ensure that the surface of the timber is not contaminated with oil or wax. Candle grease or other dry lubricants are suitable. Alternatively, an oil pad can be made up. Roll a strip of felt into a small tin can and apply neatfoot oil. Allow the oil to soak into the felt until it seems almost dry.

Fig. 5.83 Planing end grain

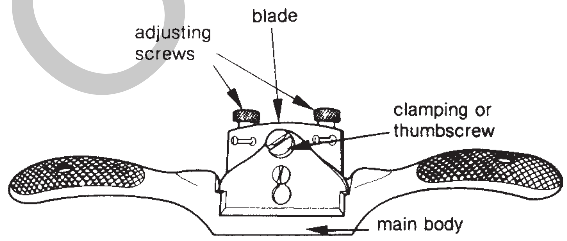


To use the oil pad, wipe just the toe of the plane across the pad so that any residue will be removed from the surface of the timber by the shaving following.

Spokeshave

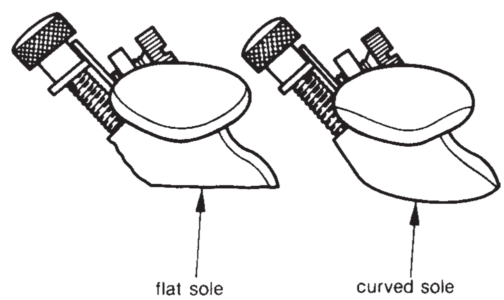
The spokeshave has a cutting action similar to the planes and its purpose is to clean up curved edges of timber (Fig. 5.84).

Fig. 5.84 Spokeshave



The sole is narrow to enable it to follow curves. The general practice is to use a spokeshave with a flat sole to follow convex curves and one with a curved sole on concave surfaces (Fig. 5.85).

Fig. 5.85 Flat and curved spokeshaves



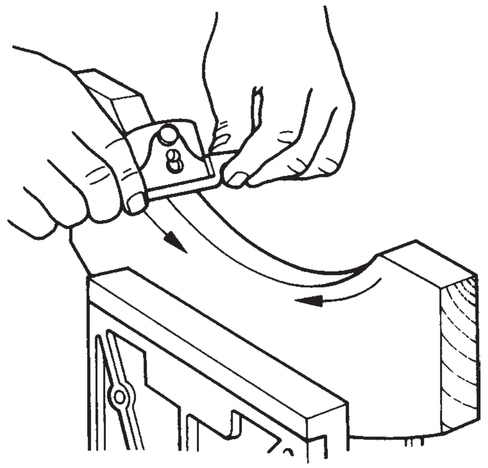
The blade is 43 mm to 53 mm wide. There is no cap iron; the single cutter is clamped in place by a lever cap.

To set the depth of cut, loosen the thumb screw, use the two adjusting screws to make the adjustment and then tighten the thumb screw.

In use, the spokeshave is set to take a fine shaving and must always follow the direction of the grain. Ideally, the spokeshave should be held square across the timber; however, it is often found that it cuts more cleanly if held at a slight angle to make more of a slicing cut.

To clean up a concave curve, grip the spokeshave by the handles, with the thumbs resting on the back edge in the small depressions provided for the purpose.

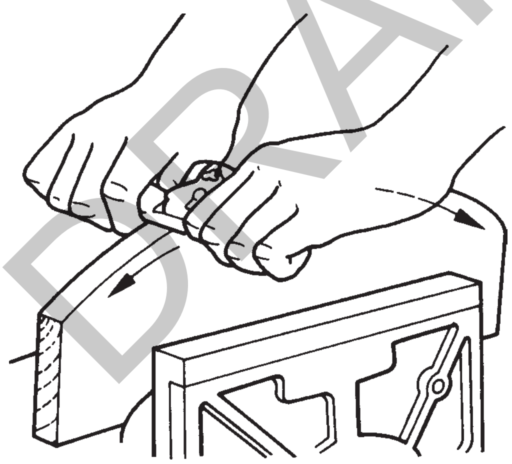
Fig. 5.86 Dressing a concave curve



Hold the job securely in the vice and commence at the top of the curve; push the spokeshave away from you, following the direction of the grain to the bottom of the curve. Reverse the timber and work the other half of the curve.

A convex curve can be worked in a similar manner: commence at the centre of the curve and dress each way in the direction of the grain (Fig. 5.87).

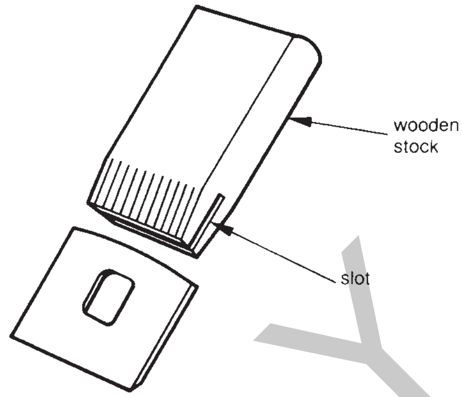
Fig. 5.87 Dressing a convex curve



The blade of the metal spokeshave is sharpened in a similar manner to the blade of a plane (Fig. 5.88). If it is difficult to hold the small blade, secure it in a stock fashioned from a piece of timber.

The stock consists of a block, approximately 100 mm × 45 mm × 19 mm, with a slot in which the blade is held. The block is rounded off to comfortably fit the hand.

Fig. 5.88 Sharpening a spokeshave blade



The planes detailed previously are the ones that are now commonly available or used in Australia. Many more hand planes exist and most are still able to be purchased. They are all designed for specific purposes. Do some research and see how many planes you can find.

Workbench

The workbench is an essential item of workshop equipment. The basic requirements of a bench suitable for trade use are illustrated in Fig. 5.89.

The bench must be solid and rigid and mortised or bolted together. A double-sided bench where the joiner can work around all sides is preferable, and it must be large enough to lay out items of joinery, doors or large panels of sheet material. The overall dimensions indicated can be taken as a guide—the height can be adjusted to suit the individual.

The top must be made from a fine-grained timber (e.g. klinki pine) that will not bruise other material worked on the bench. Bolts for fixing the top to the frame should be counterbored, and a wooden plug should be set in to cover the head of the bolt.

Attachments to the bench will include a woodworker's vice, a bench stop and a bench holdfast.

Woodworker's vice

The size of the vice is indicated by the width of the jaws and varies from 150 mm to 250 mm. The movable jaw is operated by a handle that revolves a screw, which in turn engages in a nut at the back of the vice. A useful feature on some vices is a *speed screw*. This consists of a quick-release lever which, when pressed, releases the nut holding the screw, allowing the movable jaws to slide freely so they can be quickly adjusted to any thickness of material.

When fixing the vice to the bench, the top of the metal jaws must be kept down at least 10 mm from the top of the bench; wooden liners are fixed inside the jaws and are level with the benchtop (Fig. 5.90).

Bench stop

The bench stop is usually located at the left-hand end of the bench. It can be the metal type, set flush into the benchtop

Fig. 5.89 Workbench

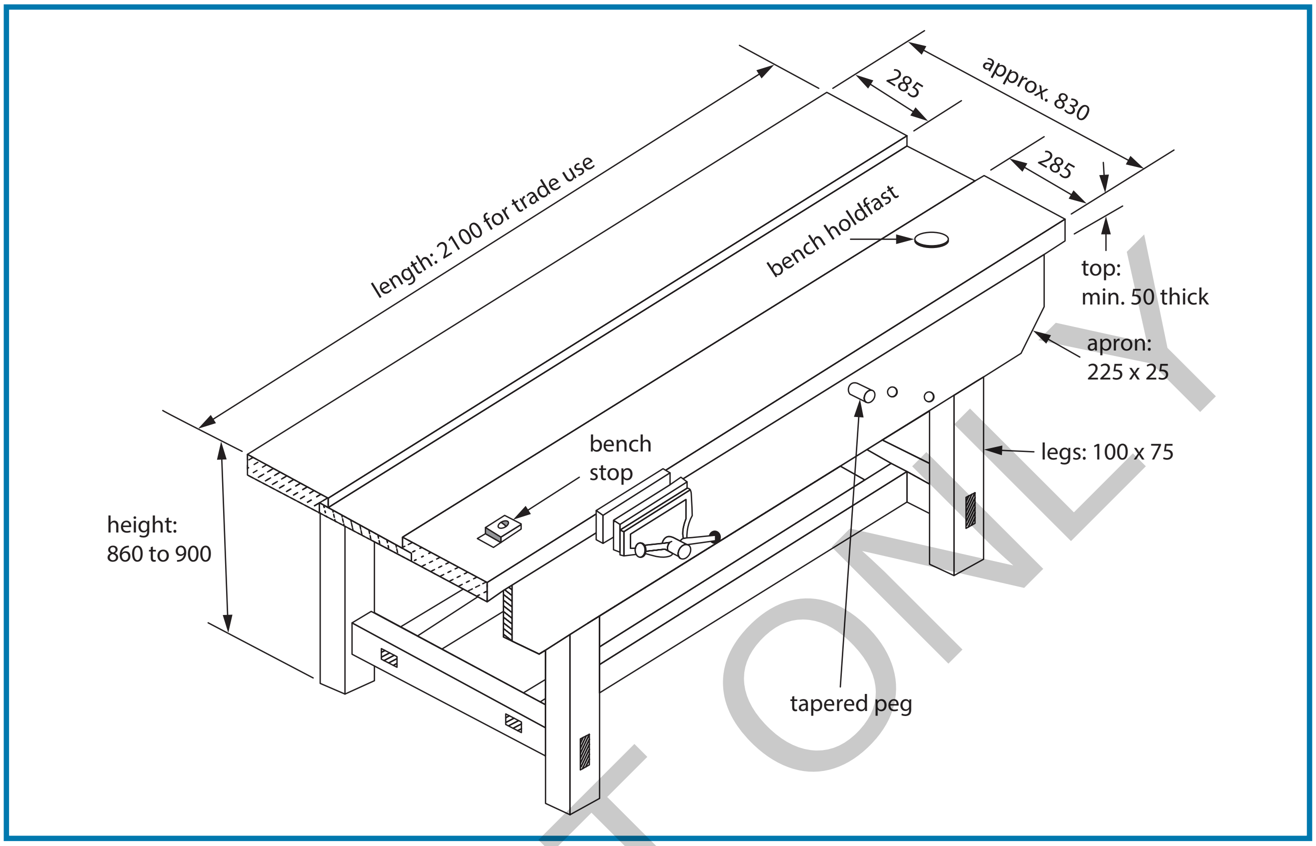
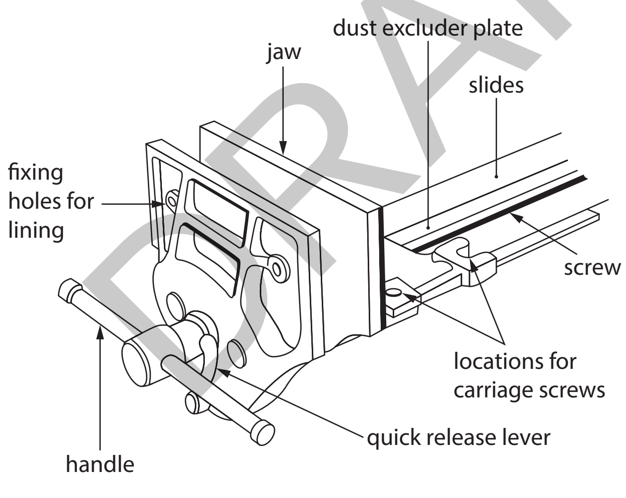


Fig. 5.90 Bench vice



and adjustable in height, or a wooden peg projecting from underneath, also adjustable in height (Fig. 5.91a).

Another useful type of stop is a *'V' block* (Fig. 5.91b). It serves as a stop and also holds timber upright.

Bench holdfast

One or more collars are set into the benchtop, which engage the shaft of the holdfast (Fig. 5.92). As the screw bears down on the top of the shaft, the arm pivots, holding the work piece firmly down on the benchtop.

Other useful features of the workbench

Holes approximately 22 mm in diameter, drilled in the apron of the bench, are used to fit a tapered wooden peg which can support the ends of long pieces of timber when held in the vice.

Individual tradespeople will make their own additions to a workbench—for example, a shelf or drawer underneath, or racks across the end, to store tools and small items when not in use.

Workbench accessories

Bench hook

The bench hook is used to hold timber firmly and to protect the bench during sawing operations (refer to tenon saws) (Fig. 5.93). The **cleats** can be glued and pegged to the base with a 10 mm dowel. If the cleats are screwed, the screws should be well countersunk to prevent tools being damaged.

Fig. 5.91 (a) bench stop; (b) 'v' block bench stop

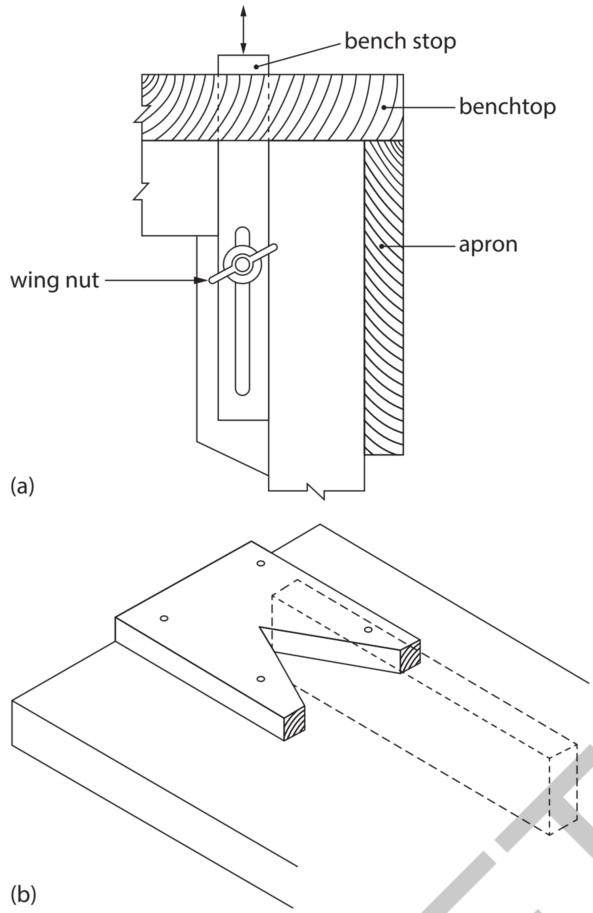


Fig. 5.92 Bench holdfast

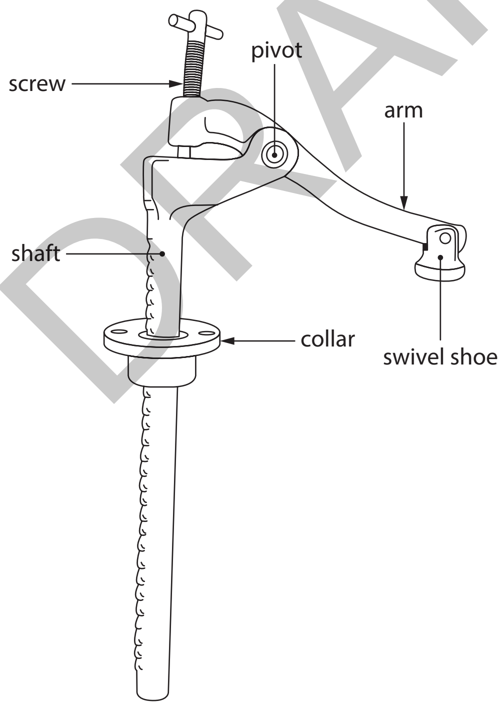
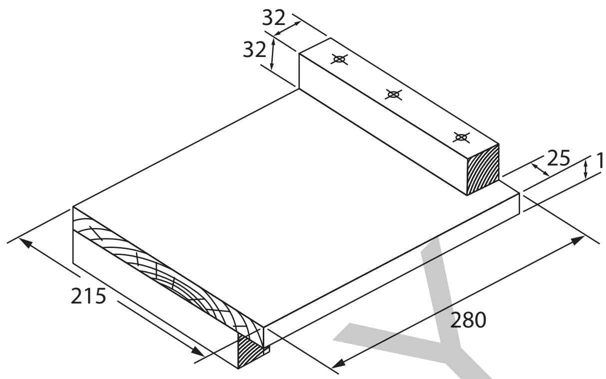


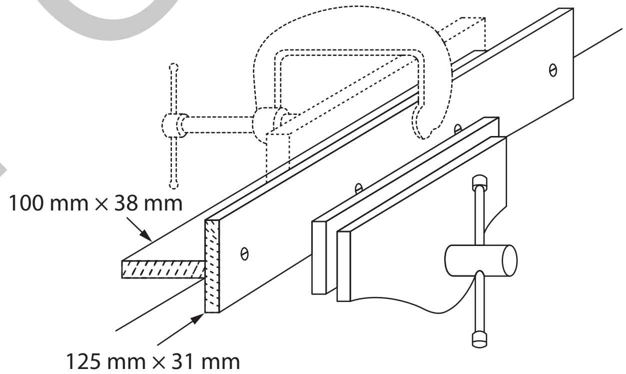
Fig. 5.93 Bench hook



Mortise board

Timber being mortised, drilled or chopped can be held securely against the face of the block of the mortise board (Fig. 5.94) with a G-cramp. The mortise board also protects the benchtop.

Fig. 5.94 Mortise board

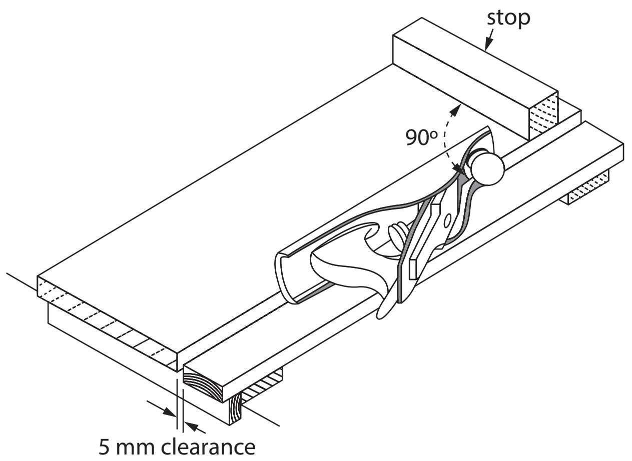


Shooting board

A shooting board is another item made up by the joiner (Fig. 5.95). It assists when planing the edges of thin boards straight and square, or when trimming the square ends of timber. Its length is approximately 600 mm. The shooting board consists of two boards forming a rebate in which the plane will slide. A clearance of say 5 mm is allowed for in the corner of the rebate so that the waste can clear and not accumulate which would affect the accurate running of the plane. The stop must be rigid, and set at right angles to the direction of the plane.

When planing end grain, work from both directions (refer to block plane) to prevent the corners splitting away. Turn the work piece over, hold at an oblique angle, and trim the corner back to the line. Reverse the timber, and holding it firmly against the stop, trim the end square.

Fig. 5.95 Shooting board



Saw stools

Saw stools are essential equipment; they vary in dimensions and construction. Fig. 5.96 shows the details of a saw stool suitable for average conditions. The height can vary from approximately 560 mm to 600 mm, and can be adjusted to enable the carpenter to assume a comfortable posture. Note that the legs must be set out in pairs by reversing the direction of the bevels.

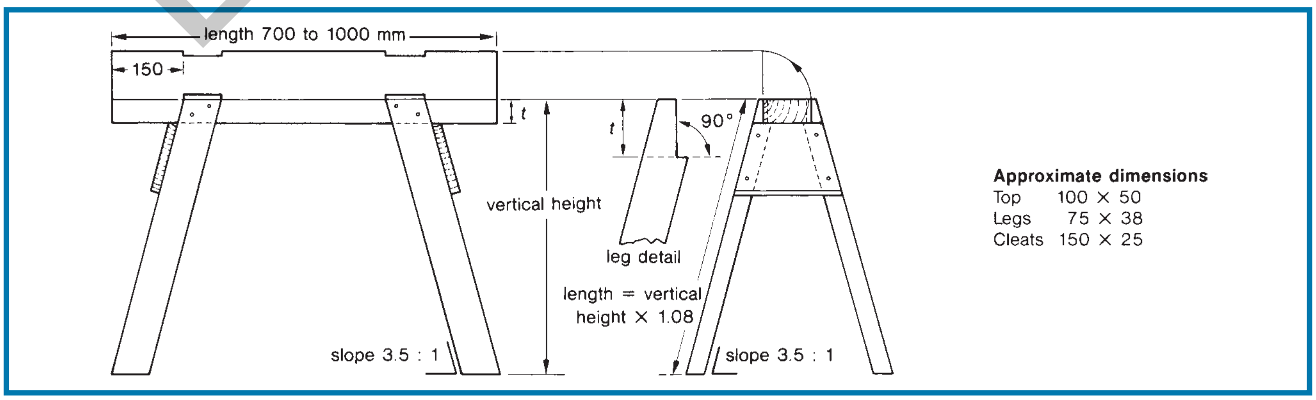
Approximate dimensions:
Top 100 × 50
Legs 75 × 38
Cleats 150 × 25

Try building a saw stool. They are an essential item for onsite work. A well-constructed saw stool will last for years.

Cramps

Cramps come in various forms and, as will be shown later, an important consideration when making up any item of joinery is how it can be cramped or pulled together tightly.

Fig. 5.96 Saw stool



G-cramp

The G-cramp is the most versatile and popular cramp (Fig. 5.97). It is used for holding material securely on the bench and cramping glued joints together; a heavy G-cramp is a valuable aid for holding members together during fixing in construction work.

G-cramps are commonly made in a wide range of sizes from 50 mm to 300 mm, the size being the maximum distance between the jaws of the cramp. For trade use, cramps should be made from forged steel with a steel screw; some smaller sizes may be aluminium or pressed metal.

Always place a block of scrap timber under the shoe of the cramp when using on finished work to prevent the surface being marked, and only hand-tighten the cramps.

Edge cramps

Edge cramps are a comparatively recent development of the G-cramp, and are very useful for cramping edge strips to prefinished boards (Fig. 5.98).

Quick-release or fast-action cramp

In a quick-release or fast-action cramp, a sliding jaw moves on a steel bar (Fig. 5.99a). It can be quickly adjusted to any opening

Fig. 5.97 G-cramp

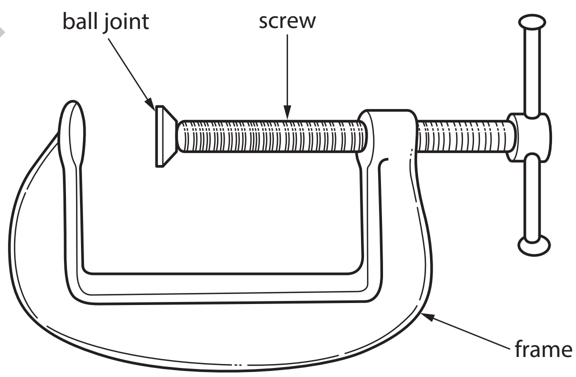


Fig. 5.98 Edge cramp

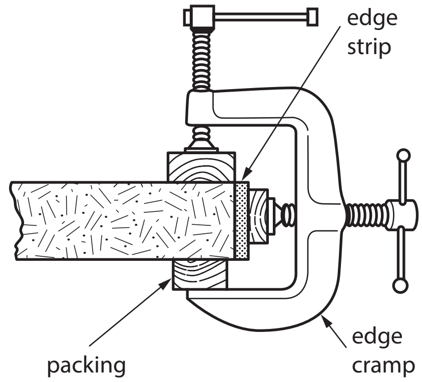
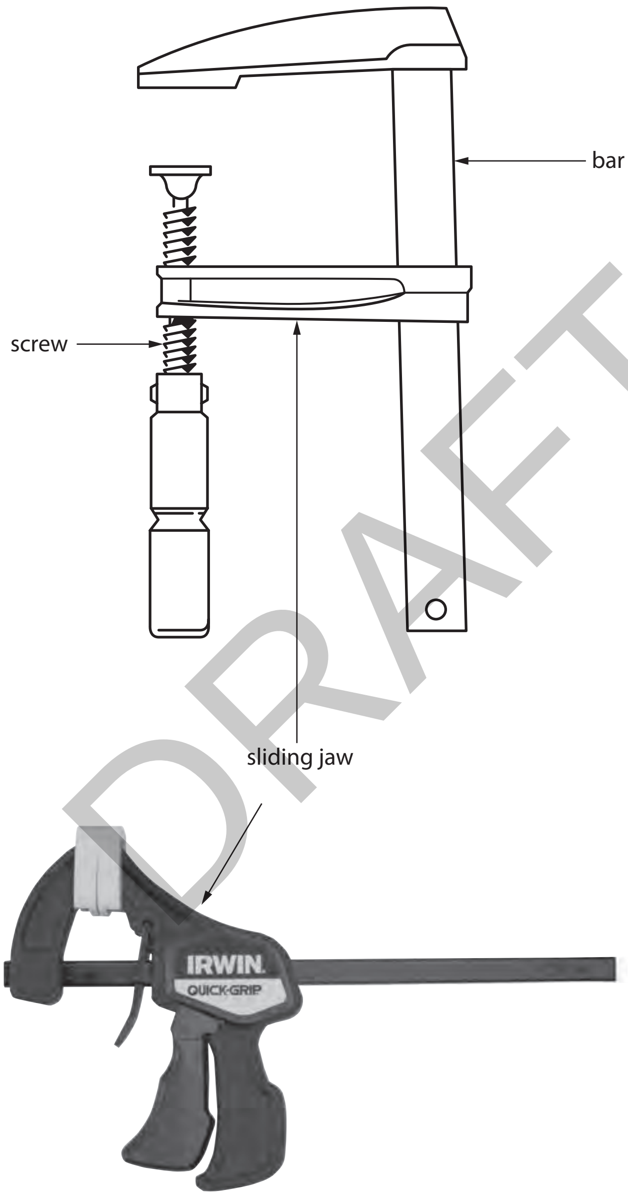


Fig. 5.99 Quick-release or fast-action cramps

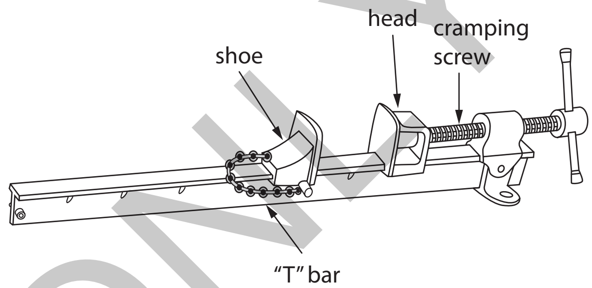


and tightened by the steel screw. Size can vary from 100 mm to 1000 mm. They are used in similar circumstances as the G-cramp, and the carpenter should adopt the same precautions.

Sash cramps

Sash cramps may vary from a light, flat bar cramp to one with a heavier T-bar section, but now all are generally referred to as sash cramps (Fig. 5.100). The size of the cramp is the length of the steel bar, and may range from 600 mm to 1800 mm.

Fig. 5.100 Sash cramp



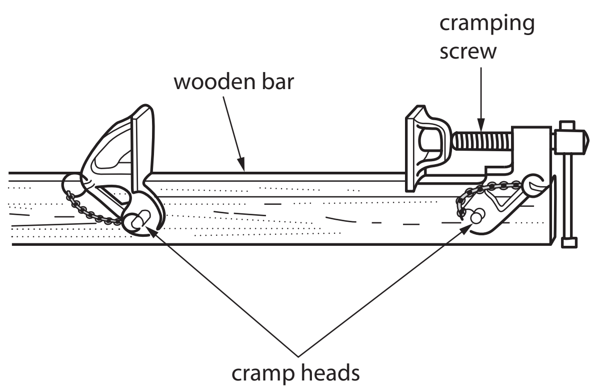
Sash cramps are used for tightly cramping together joinery items, window sashes, doors, wide boards or cabinet framing during gluing-up operations.

The opening of the jaws is adjustable by moving the sliding shoe along the bar and fixing by a pin through the nearest hole. Final adjustment and tightening is then made by the screw and adjustable head. Blocks of scrap timber should be used under the shoe and head to prevent damage to finished work.

Cramp heads

Cramp heads are a convenient way to make up a long sash cramp of any length (Fig. 5.101). The cramp heads are fixed by a pin to a bar of timber 25 mm thick. Another type of cramp head can be fixed to a length of galvanised water pipe and will serve the same purpose.

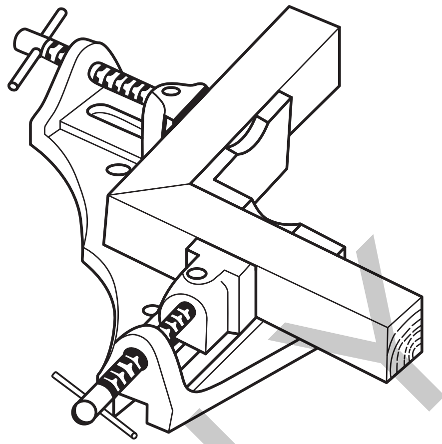
Fig. 5.101 Cramp heads



Corner cramp or mitre cramp

The corner cramp is used to cramp mitre joints together and hold them securely in place while gluing, nailing or otherwise fixing (Fig. 5.102). It has two sets of screw-adjusted 'feet' which will hold the two halves of the joint at right angles to each other against a fence.

Fig. 5.102 Corner or mitre cramp



Student research task

Search online for the PPE requirements of your state or territory workplace safety authority (e.g. WorkSafe Victoria, NT WorkSafe). Read the information about PPE and where and when it should be used.

The many re's of sustainability

In of the language of sustainable thinking, many words starting with 're' are used to communicate the idea of consuming less. Below are some of the words you may come across:

- *Reduce* means to reduce the amount of virtually every material needed in construction, particularly high embodied energy materials (i.e. those that require more energy to produce and distribute) or the waste produced during the building process.
- *Reuse* means to reuse a product for a different purpose than its originally intended use.
- *Recycle* means to either reuse a material or product or to send them to a recycling centre.
- *Recovered*, or *reclaimed*, materials means if you were to find usable materials or building components, you should recycle or reuse them.
- *Rebuy* means to rebuy certain materials or building components so that you limit the consumption of new materials. This will allow the process to start all over again.
- *Refurbish* means to consider reinvigorating something old (if feasible) instead of throwing it out.
- *Repair* means to bring an old and lightly tarnished or defective item back into use by repairing it.
- *Rethink* means to think about how materials, energy, water and waste products can be minimised and how older materials can be reused.
- *Resource management* means to undertake 'stewardship' or responsibility when selecting and using materials.