CHAPTER NINETEEN

variety saws and radial arm saws

saws

:ular saw is the most useful in any woodworking shop be- the time and labour it saves. Due ırge number of operations that erformed on most circular saws, also called *variety saws.*

:e of a variety saw is determined diameter of the blade. The 250 mm, and 300 mm sizes are most often used in woodwork- s.

are two general types of variety) the tilting table and (b) the ɔor or blade. In the first type the lted for cutting angles, the blade g in one position. In the second type the table is stationary and the blade is tilted. The arbor is the power-driven shaft on which the blades are mounted. The tilting arbor or blade is generally considered to be the better saw. Some saws have a double arbor with two saw blades, one a rip saw, the other a cross-cut. Either saw can be turned up so it is above the table, while the other is below. A tilting arbor saw is shown in Figure 19:1.

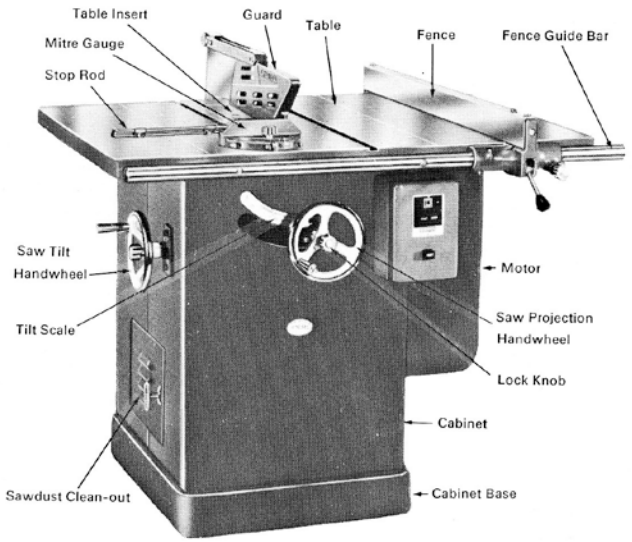
Some of the many operations that can be performed on the variety saw are cross-cutting, ripping, bevelling, grooving dadoing, and chamfering.

Types of blades commonly used are shown in Figure 19:2. Special carbide-tipped blades are made that are more expensive but make a smoother cut and stay sharp longer than the all-steel conventional blades.

To cut easily and operate efficiently, saw blades must rotate at the correct speed. The larger the diameter of the blade, the greater the rim speed for a given r/min. Large production saws have large-diameter blades and a faster rim speed than the smaller bench saws. This allows the work to be fed faster and still produce a smooth cut. A 200 mm blade should rotate at 3400 r/min, giving it a rim speed of approximately 2164 m/min. A 250 mm blade should rotate at 3100 r/min, giving it a rim speed of approximately 2468 m/min, while a 300 mm blade (the size used in most school shops) generally rotates at 3400 r/min, giving it a rim speed of approximately 3200 m/min.

For most cutting operations the blade should be covered with a guard. When required, these guards can be easily removed or raised and swung to one side. However, this should only be done for operations that cannot be performed with the guard in place. All guards should have kick-back fingers to prevent the work from being thrown back at the operator. A basket-type guard with a splitter block is shown in Figure 19:3.

The rip saw guide, or *fence*, as it is usually called, is attached to the saw by means of bars at the front and back of the table. The front bar is calibrated in centimetres and millimetres (older models may still have calibrations in inches and fractions of inches), so that



Combination Blade.

Rip-saw Blade.

Cut-off or Cross-cut Blade.

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Fig. 19:2 Types of Blades

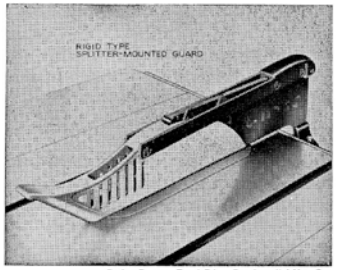

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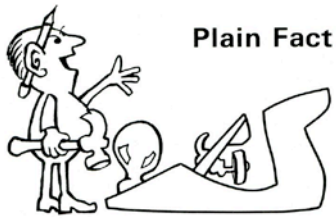
Fig. 19:3 Saw Guard



Plain Fact

A CIRCULAR SAW CAN BE THE GREATEST OF ALL LABOUR-SAVING MACHINES BUT ALSO THE MOST DANGEROUS IF THE PROPER SAFETY PRECAUTIONS ARE NOT OBSERVED.

the fence can be set for cutting to any desired width. There is a locking device to hold it permanently at any spot. The fence should be adjusted so that it is parallel with the saw blade, or the work will bind when being cut.

The cross-cut fence fits into the groove at the right or left side of the blade, making it possible to use the fence at either side of the blade. This fence on most saws can be tilted to cut at an angle, as shown in Figure 19:4. It is marked off in degrees so that it can be set at any angle. For this reason it is called a *mitre gauge.*

Adjustments

On a tilting arbor saw the blade is tilted to cut bevels by turning a hand wheel situated below the table. The degrees are marked on the tilt scale so that you can set and lock the blade at any desired angle. The height of the blade is adjusted by another hand wheel. The height of the blade will determine the depth of the cut for making dado or rabbet cuts.

Rip sawing

Ripping refers to cutting a board lengthwise. The face that rests on the saw table should be relatively flat and the edge to be placed against the rip saw fence should be straight to prevent binding or kick-backs.

A push stick must be used to guide

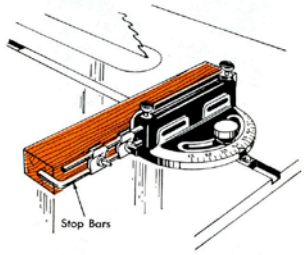


Fig. 19:4 Mitre Gauge*

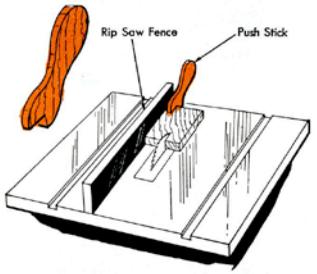


Fig. 19:5 Use of Rip Saw Fence and Push Stick*

the work through the saw. One such stick is shown in Figure 19:5. The part of the board that you need should be between

* *Note*: A guard must be in place for all these cutting operations. The guards have been left off in these drawings to show the details clearly.

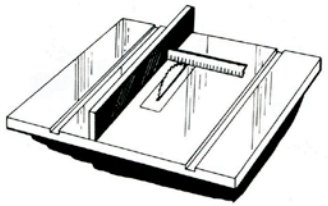


Fig. 19:6 Setting the Rip Saw Fence for Cutting to an Accurate Width*

the fence and the saw. For instance, if you required a 50 mm strip of wood to be cut from a piece 150 mm wide, the fence should be set at the 50 mm graduation on the front of the saw so that the piece you want will be between the fence and the saw. If a very accurate width is desired, it is well to measure between the edge of the saw blade and the face of the fence, as is shown in Figure 19:6. If long stock is being ripped, the end must be supported, or a helper should assist you by guiding and supporting the piece as it comes through the saw. As a safety measure, do not stand directly behind the saw blade when rip sawing.

Cross-cut sawing

All cross-cutting must be done with the use of the cross-cut fence, more often called a mitre gauge. Never attempt to cut freehand without a guide.

When squaring the end of a piece of stock, move the rip saw fence well over out of the way. Now place the work against the cross-cut fence and hold it firmly while sliding both the fence and the work forward until the cut is made. Now draw the fence and stock back to the starting location. Leave the waste stock on the saw table. When cutting several pieces to the same length, you may use the rip saw fence as a length

* *Note*: A guard must be in place for all these cutting operations. The guards have been left off in these drawings to show the details clearly.

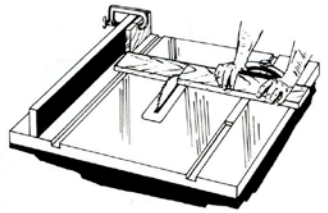


Fig. 19:7 Block Used as Length Guide*

guide if a block is clamped to it at a point just ahead of the blade (see Figure 19:7). Never use the rip saw fence itself as the length guide. The piece that is cut off may bind between the fence and the blade and be thrown back at the operator.

Other cutting operations

Rip sawing and cross-cutting are referred to as straight-line cutting operations. There are a great number of other more intricate cutting operations that can be performed on the variety saw. These you will become familiar with as you gain experience in using the saw.

Two of the attachments used for some of these operations are the dado head

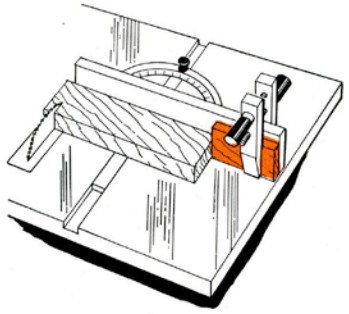


Fig. 19:8 Length Stop Attached to the Cross-cut Fence*

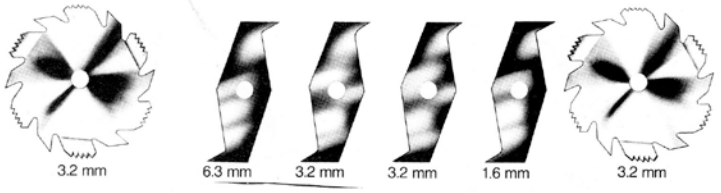


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Fig. 19:9 Dado Head Blades and Cutters

and the moulding head. The dado head consists of two saw blades and several cutters ranging in thickness from 3 mm to 6 mm. This arrangement of blades and cutters can be assembled to cut grooves from 6 mm to 20 mm in width. The regular saw blade is removed and the dado head blades and cutters are put on the arbor in its place. Allow the dado head to project above the table the desired depth of the groove to be cut. This arrangement is very handy for cutting dadoes or recesses in the upright parts of cupboards to support the shelving, as well as for many other jobs. The dado head blades and cutters are shown in Figure 19:9.

The moulding head is used for cutting shaped mouldings of many types, such as those used on window sash and table tops. This attachment consists of the head and three interchangeable knives, which are locked in place by Allen screws. A large number of knives may be obtained in different shapes. They are made in sets of three, ground exactly alike. See Figure 19:10 for some of these shapes.

The moulding head is put on the arbor in place of the blade with the knives projecting sufficiently above the table to make the moulded cut on the edge of the work.

Safety precautions for the variety saw

Power saws are responsible for a larger number of serious accidents than any other woodworking machines. It is therefore essential that you know as much as possible about saws. Be on the alert and exercise all possible safety precautions. Points you should remember:

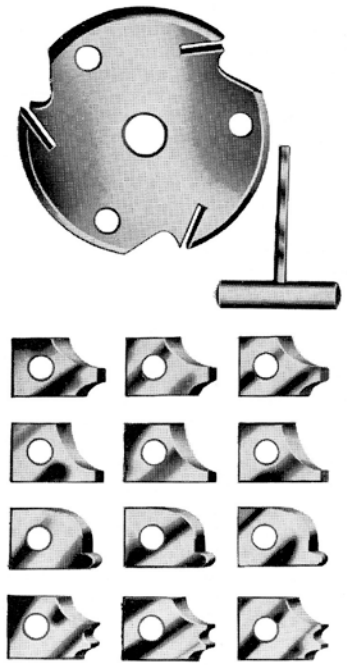

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Fig. 19:10 Moulding Head and Knives

1. Use the guard for all operations except those which cannot be performed with it in place. In such cases extra care must be taken.
2. Do not stand directly behind the saw blade.
3. Do not reach over the saw blade with your hand. Keep your hands well away from the revolving blade at all times.
4. Always use a push stick when rip sawing.
5. When rip sawing make sure the edge of the piece placed against the rip saw fence is straight.
6. When cross-cutting do not place the end of the piece against the rip saw fence.
7. Always use either the rip or the cross-cut fence; never attempt to cut freehand.
8. Do not clean, adjust, or oil the saw while the blade is in motion.
9. Never attempt to cut pieces less than 200 mm long.
10. If you are in doubt about the set-up or operation of the saw, ask your instructor for help.

The observance of these rules is a matter of common sense and respect for a useful and powerful machine that can be dangerous if not properly used.

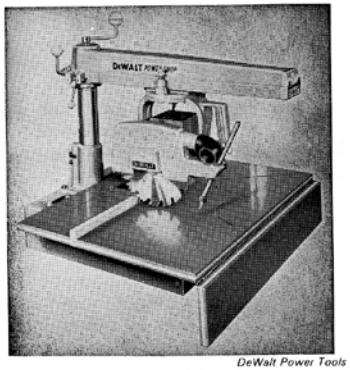

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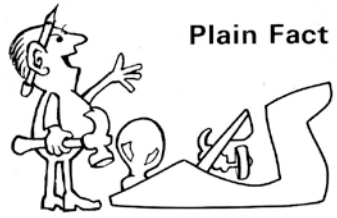
Fig. 19:11 Radial Arm Saw

Radial arm saws

The radial arm saw shown in Figure 19:11 is a relatively new type of power saw. It was developed from the older-type swing saw used by lumber yards and mills. The radial saw differs from the variety saw in that for most operations the work remains stationary while the saw blade is moved. The saw blade is attached directly to the motor shaft. A higher-speed universal motor is used that travels at 6500 r/min, faster than most



Plain Fact

THINK SAFETY FIRST AND THE OPERATION OF THE SAW SECOND.

variety saws. This enables it to operate more efficiently with the router head and other attachments.

The principle of the radial arm saw is that the motor and saw blade are mounted on a movable overhead arm. A Y-shaped yoke attaches the motor unit to the arm.

The three hinge points at the arm, yoke, and motor unit can be likened to the human arm, elbow, and wrist, which allow the hand to be placed in any position within the circle of the arm. The shoulder action is shown in Figure 19:12. The arm of the saw will swing on the column through the full circle. The elbow movement is illustrated in Figure 19:13. The yoke will swing a full 90° in either direction and lock in position for ripping. Figure 19:14 shows the wrist action of the motor, which can be tilted to any angle for bevel cuts. The motor can also be set vertically, placing the blade in a horizontal position. The arm can be raised or lowered for different depths of cut, as shown in Figure 19:15.

These three points of adjustment allow the blade to be placed in any position, angle, or height over the saw table. This fact makes the radial arm saw a very efficient and versatile machine.

Some of the basic operations performed on this saw are cross-cutting, rip sawing, bevelling, and mitring, as well as the making of combination cuts (sometimes called *compound cuts*). Moulding, dadoing, sanding, drilling, and shaping can be done on this machine by using special attachments.

One of the advantages of any overhead power saw is that the cutting action is in full view of the operator at all times.

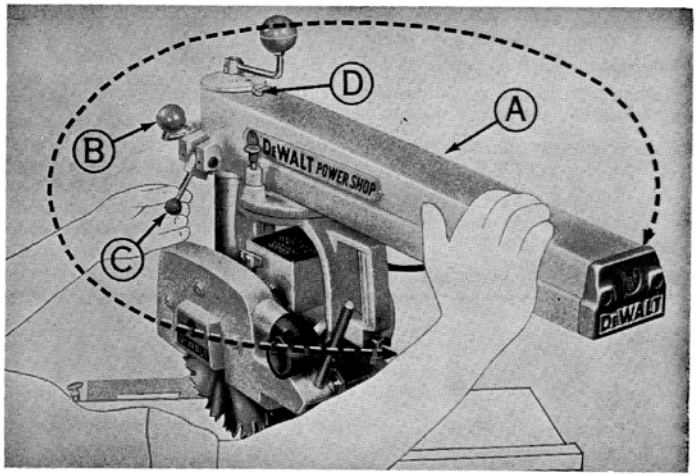


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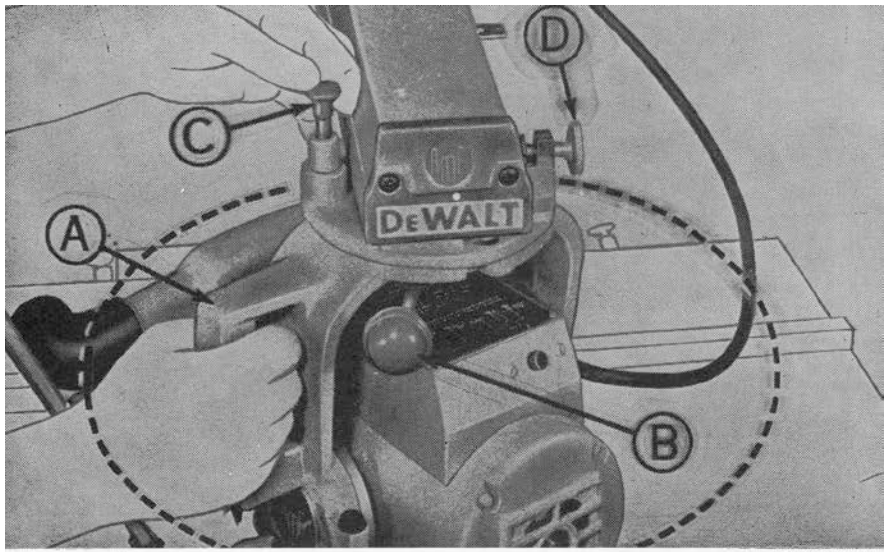
Fig. 19:12 To rotate arm—Release arm clamp handle (B) and lift mitre latch (C). Then swing the arm (A) into the desired angle to either the right or the left. The mitre scale marked off in degrees is shown at (D).



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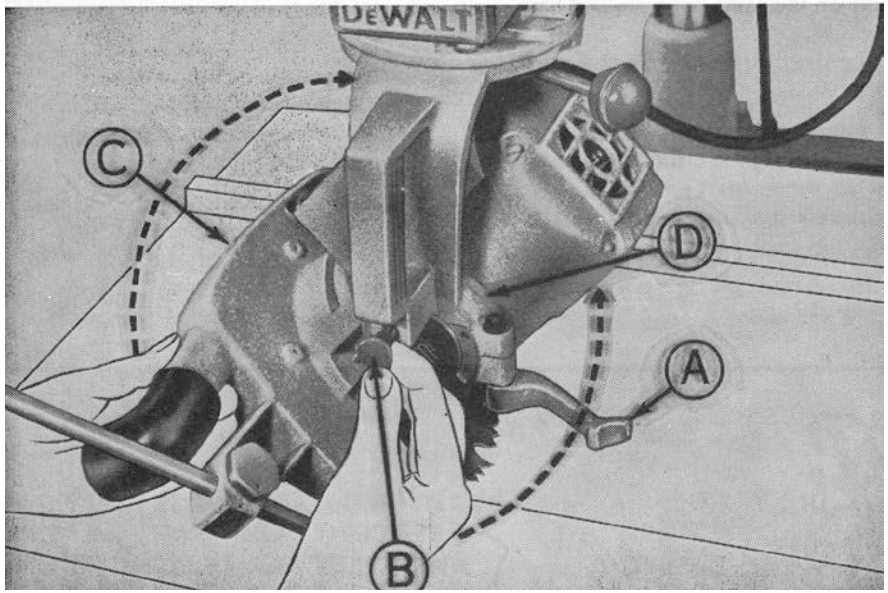
. 19:13 To swivel the saw on the arm—Release swivel clamp (B) and lift locating). Now swing the yoke (A) to the desired angle to the right or the left, and lock it in p tightening the clamp (D).



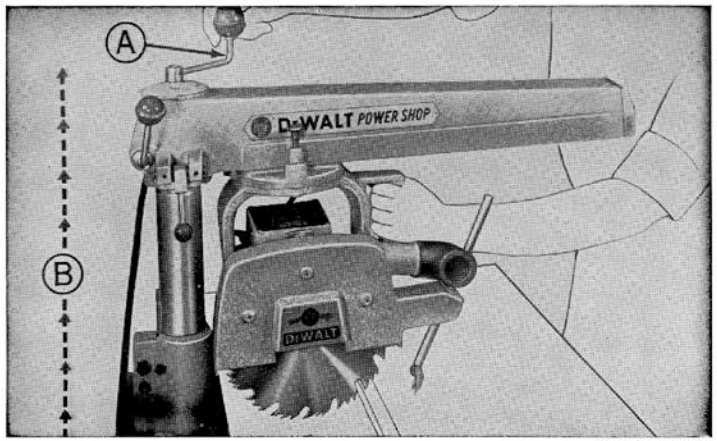


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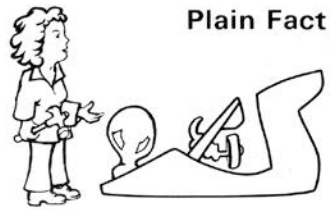
Fig. 19:15 To raise or lower the saw—Turn the elevation handle (A). One revolution of the handle moves the saw 3 mm. Cut on the pull stroke when cross-cutting. (Note: The illustrations shown in Figures 19:12 to 19:15 are all of one make of saw. However, most other makes operate on the same principle and have similar adjustments.)

Safety precautions for the radial arm saw

The safety precautions to be observed while operating the radial arm saw are the same as those for the variety saw with the following additional points:

1. There is a lock for each adjustment. These must all be tight before starting the saw.
2. For cross-cutting or angle cutting, have the motor fully back against the column when positioning the work or starting the cut.
3. The saw blade rotates clockwise or toward the column. You should therefore cut on the pull stroke. The rotation of the saw helps to keep the work tight against the guide.
4. Keep in mind the direction of rotation when mounting saw blades or attachments.
5. When rip sawing, make sure you enter the wood from the right side of the saw. Most saws have an arrow indicating the correct direction.
6. Have the anti-kick-back fingers resting on the wood when rip sawing.
7. Mount all attachments and accessories according to the saw manufacturer's instructions.



Plain Fact

A CIRCULAR SAW IS ONLY AS EFFICIENT AND SAFE AS THE PERSON USING IT.

ASSIGNMENT

Variety saw

1. Why are many circular saws called variety saws?
2. How is the size of a variety saw determined?
3. State the difference between a tilting table and a tilting arbor variety saw.
4. List five operations that can be performed on the variety saw.
5. What are the four types of blades used on a variety saw?
6. What would be the rim speed of a 300 mm saw blade if the r/min is 3000?
7. What is the purpose of the kick-back fingers on the saw guards?
8. On a saw, what is the rip or cross-cut guide called?
9. Why is the cross-cut saw fence called a mitre gauge?
10. Why should the part of the wood you require lie between the fence and the saw blade when ripping?
11. If you wish to cut 150 mm off the end of a 900 mm board, how would you set up and operate the saw (in relation to the mitre gauge and rip saw fences)?
12. If each of the saw blades used on a dado head is 3.2 mm thick, what thickness of cutters would be required between them to cut a dado 19 mm wide?
13. List: (a) One important safety rule that must be followed when cross-cutting. (b) One safety rule for rip sawing. (c) Three general safety rules required when any type of blade is used.
14. Explain the use of a splitter block (see Glossary of Terms).

Radial arm saw

15. Explain the chief difference between a radial arm saw and a variety saw.
16. What is the principle of the cutting action of the radial arm saw?
17. What are the three major adjustments on a radial saw?
18. What is a compound cut?
19. List some of the operations that can be performed on the radial saw through the use of attachments.
20. List three important safety precautions that apply specifically to the radial arm saw.
21. If the blade of a radial arm saw revolves at 6500 r/min, what would be the rim speed of a 300 mm blade?
22. Explain how you would set up a radial arm saw to cut a compound angle.

glues and clamps

Wood glues and adhesives are not a development of modern times; in fact they were used by the Egyptians 3000 years ago. Some of the ancient Greek furniture that was assembled with glue is still intact in our museums. Since then there have been many advances in the manufacture of glue and many new types have been developed for specific purposes.

Wood glues may be classified according to their origin, their curing temperature, and their resistance to moisture.

(*a*) *Origin*. Glues may be made with a base of natural materials, such as animal or vegetable matter, or they may have a synthetic base, involving petroleum or chemicals.

(*b*) *Curing Temperatures*. Low-temperature-curing glues cure or harden at room temperature. Intermediate-temperature-curing glues will harden at temperatures of from 26°C to 100°C. High-temperature-curing glues will harden only at temperatures in excess of 100°C. The heat must be artifically applied to the glue point for curing.

(*c*) *Resistance to Moisture*. Glues are divided into three groups: waterproof glues, moisture-resistant glues, dry bond or non-moisture-resistant glues.

Types of glue

Some of the types most frequently used are:

Prepared liquid animal glues
These are made from hides and bones of animals. They are brown in colour and slow-setting. Being ready-prepared they are convenient to use, but they are not waterproof.

Hot glue
Animal glue is also made in a flake form. This must be soaked in water for twenty-four hours and then heated in a double-boiler arrangement or an electric glue pot, and used as hot glue. It sets rapidly, making it necessary to lose no time in clamping the work after applying the glue. It is not waterproof.

Casein glue
This type, which comes in a powdered form, is made from skim milk and chemicals and needs only to be mixed with water. It must be used within a few hours after it is mixed and after mixing must *not* be placed in metal containers. It is white in colour, moisture-resistant, and slow-setting.

Resin glue
Resin glue is probably the most commonly used of all glues for general purposes. A great deal of chemical research and experiment has gone into the development of the urea formaldehyde plastic resin glues now in use. *Liquid resin glue* has become very popular for industrial and household purposes because it is convenient to use in its ready-prepared form. It holds well, is water-resistant, and what is probably most important of all, sets so rapidly that it is completely hard in one hour. This saves a great deal of clamping time. This glue is white but dries to an almost transparent film. *Resorcinol resin glue* is made in a powdered form that must be mixed with water before using. It is light brown but does not stain the wood. This glue is often used for boat building and for other work where waterproof glue is essential. The joints must be well fitted and clamped. Follow the manufacturer's instructions closely when mixing resin glues.

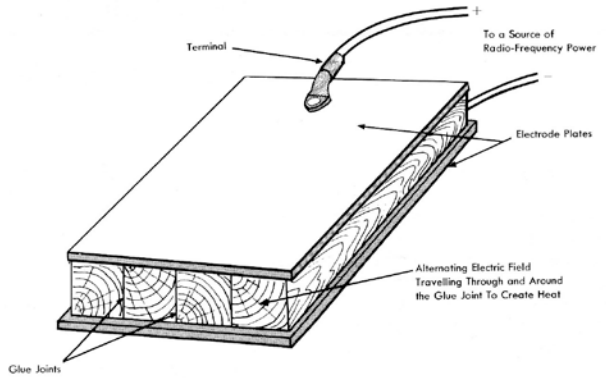


Fig. 13:1 Dielectric Heating

Fast-drying *thermosetting glues*, which require heat to harden, are now in general use in many woodworking industries. The glue is spread on the wood, which is then placed between two metal plates referred to as electrodes, and a source of high-frequency electric current is connected to terminals on the electrodes. The result of the current flow through the wood is to agitate the molecules that make up the wood. This molecular friction generates the heat within the wood necessary to cure or harden the glue rapidly. This process is extensively used for the manufacture of moulded plywood furniture and other wood products. Figures 13:1, 13:2, and 13:3 illustrate three methods of gluing wood using high-frequency electric current. This process is often referred to as *dielectric heating*.

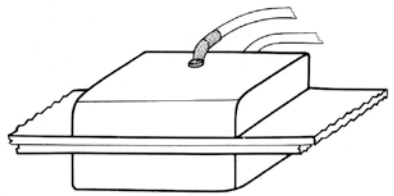


Fig. 13:2 Gluing Stock While It Is in Motion. Long thin members are passed between the electrode plates with the glue joint being made as the wood is in motion. The speed of the wood will depend on its thickness.

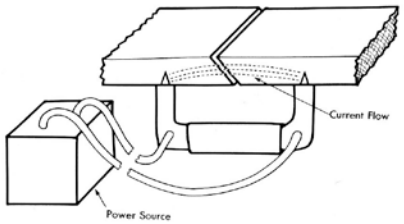


Fig. 13:3 Spot Gluing with Portable Dielectric Unit

Contact cement
This is a glue used to bond a plastic material, such as Arborite, to wood. Contact cement is a liquid, ready-prepared type of glue. As the name implies, the two surfaces to be joined together stick immediately on contact if they have both been coated with glue. A coat of the glue is spread on the two surfaces and allowed to dry for from 15 to 20 min or until it becomes tacky. They are then pressed together; no clamps are required.

Care must be taken when placing the two surfaces together to see that they are properly aligned, since it is almost impossible to move either of the parts once contact has been made.

Gluing stock together

When gluing stock together these points must be kept in mind:

1. Test the pieces for fit by clamping them together before gluing. This allows you to make adjustments in the fit, as well as to have the clamps adjusted and ready for use.
2. Have the glue and the room at the correct temperature.
3. When using bar clamps, place blocks between the clamps and the edge of the work.
4. Have all the necessary material, such as glue, clamps, nails, hammer, and screws available before starting to glue.
5. The surfaces to be glued must be free from dirt, grease, or other foreign matter.
6. Spread the glue with a brush or thin stick. If the glue is in a plastic squeeze bottle, it may be spread directly from the container. In industry a mechanical belt spreader is often used.
7. It is advisable in most cases to spread glue on both sides of the joint.
8. Use a sufficient number of clamps. If the joint is a long one, alternate them, using a moderate pressure. (See Figure 13:10.)
9. When gluing a joint, check to see that it is tight, flat, and square.
10. With a scrap of wood or a damp cloth, remove the surplus glue before it has set hard but after it has set slightly, so that it will not smear.

Clamps

There are three types of clamps used in general woodwork. These are:

(a) The *cabinet* or *bar clamp*, which is made in varying lengths from 600 mm to 1800 mm. The length of each one can

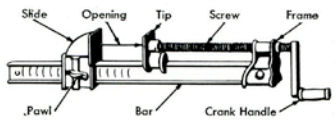
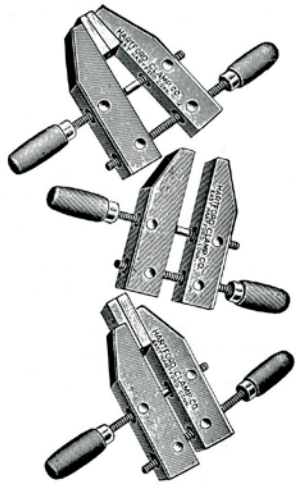


Fig. 13:4 Bar Clamp

be adjusted by sliding the end section along the bar (see Figure 13:4).

(b) The *hand screw*, which consists of two hardwood jaws with two threaded screws with a handle on each. These clamps can be used with the jaws parallel or they can be tapered to fit an irregularly shaped piece of stock, as shown in Figure 13:5. Hand screws are made in various sizes; use the size that suits the work to be glued.



Hartford Clamp Co.

Fig. 13:5 Hand Screws, Sometimes Called Hand Clamps

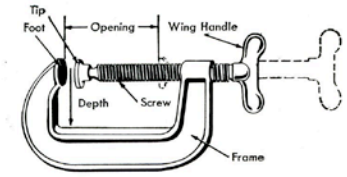


Fig. 13:6 "C" Clamp

(c) The *"C" clamp*. This is so named because of its shape and is an all-metal clamp. It is made in a large range of sizes from 50 mm to 400 mm, the size being the distance the clamp will open when the screw is fully extended (see Figure 13:6).

The application of these clamps is shown in Figures 13:7 to 13:12.

When assembling a project that requires gluing and clamping, care must be taken to square up the project after

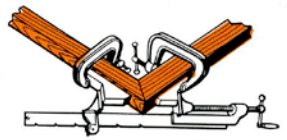


Fig. 13:7 Clamping a Flat Mitre Joint Using Clamp Blocks

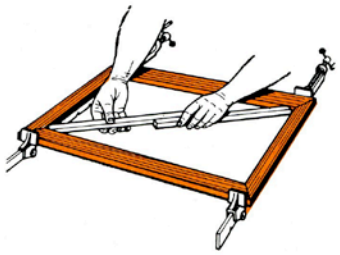


Fig. 13:8 Testing Squareness with Diagonals

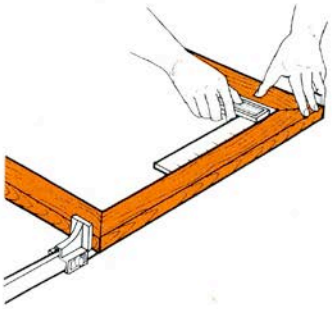


Fig. 13:9 Testing Squareness at Each Corner

the glue and the clamps have been applied and before the glue has set. If the work being assembled is square or rectangular, this can be done by measuring from opposite corners and adjusting the clamps to make the diagonal distances the same, as shown in Figure 13:8. In some cases it may be checked with a try square (see Figure 13:9). Figure 13:11 illustrates an assembled project in clamps.

Holding tools

Clamps and hand screws are often used as holding tools, or as temporary vises, or to hold stop blocks to benches or machines. It is frequently necessary to clamp parts of a project together while they are being permanently fastened with nails or screws. Clamps are also used extensively in the bending of wood to shape, by clamping it to a form of the required shape. Three uses of hand screws as holding tools are shown in Figure 13:12.

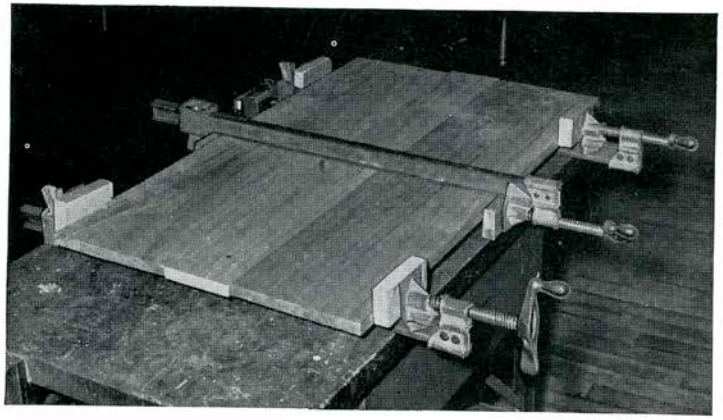


Fig. 13:10

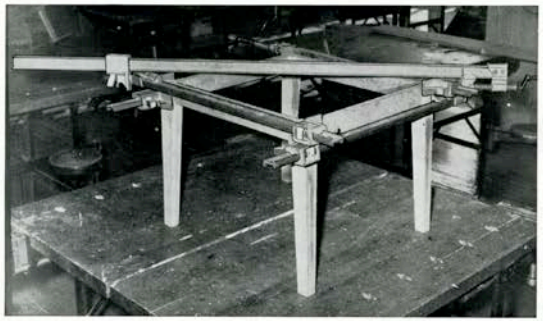
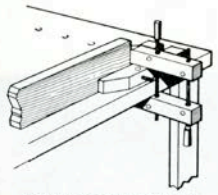
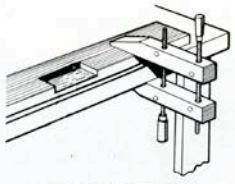


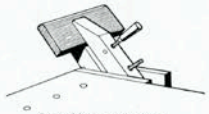
Fig. 13:11



Stock Being Held for Edge Planing.



Holding Work Flat on the Bench.



For Holding Small Pieces.

Fig. 13:12

ASSIGNMENT

1. What evidence have we that glue has been in use for many centuries?
2. In what two forms are animal glues made?
3. (a) From what material is casein glue made? (b) What precautions must be taken when using casein glue?
4. State the advantages of prepared liquid resin glue.
5. Describe one method of creating the necessary heat when thermosetting glue is used for laminating wood.
6. List two types of glues that are water-resistant and two that are not.
7. Which type of glue is used to laminate plastic materials to wood? How does it differ from other types of glue?
8. Explain the steps you would take, as well as the precautions you would observe, when making a large glue joint.
9. List three types of clamps, and give the special use of each.
10. How is an assembled project checked for squareness when it is being glued?
11. List two uses for a clamp as a holding tool other than the three shown in Figure 13:12.

CHAPTER TWENTY

planing machines

Jointer

The two machines used to plane smooth and true surfaces and edges on lumber are the jointer and the planer. Of these two machines the more versatile is the jointer because it can be used for planing both the broad surfaces and the edges of stock, as well as for bevelling, tapering, and rabbeting.

The sequence of operations for planing stock with a machine is the same as that used for planing stock by hand. The first step should be to plane the best surface flat and smooth. This can be done most efficiently on the jointer. The jointer may also be used to reduce stock to any desired thickness, although under ordinary conditions a planer is used for this purpose.

The size of the jointer is determined by the length of the cylinder. Jointers range in size from 100 mm to 900 mm. A 400 mm jointer is shown in Figure 20:1.

The wood is planed off the lower side of the board by passing it over a rapidly revolving cylinder on which are mounted two or more knives. The cylinder and its cutter knives make up the *cutter head.* The thickness of the cut is governed by the height of the *infeed table.* This is the front table or the part over which the wood is started. The *outfeed table* is the opposite end of the machine on which the planed part of the wood rests. The outfeed table should be exactly the same height as the highest point of the arc described by the revolving knives on the cylinder.

The infeed table should be set below the outfeed table at a distance equal to the required cut. The lower the infeed table is set, the heavier will be the cut. The amount of wood to be removed at one cut will depend on the following factors:

(*a*) *The width of the piece.* The wider the board, the smaller the cut should be.

(*b*) *The type of wood.* A lighter cut must be made on hardwood than on softwood.

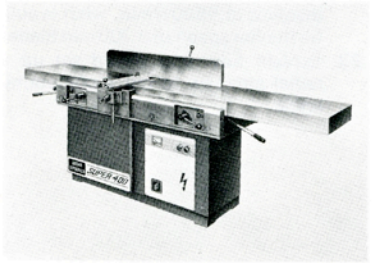


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Fig. 20:1 400 mm Jointer with Long Bed

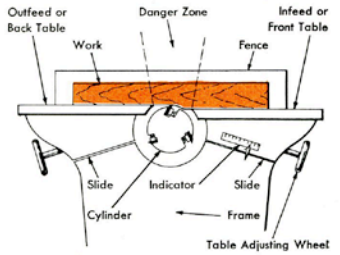

Fig. 20:2 Cutting Action of a Jointer

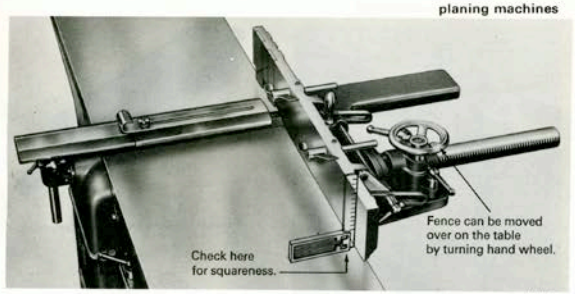

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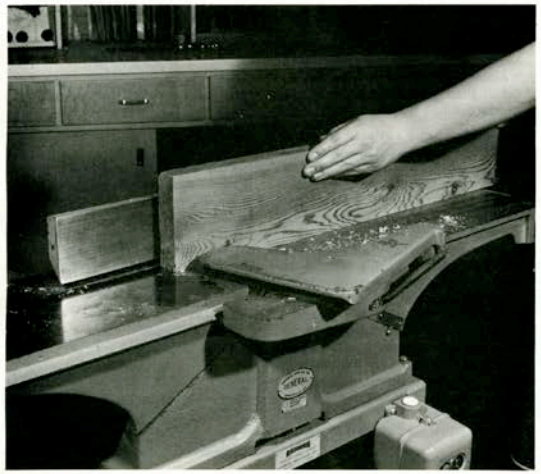
Fig. 20:3



James C. Fish Photography

Fig. 20:4 Jointer with Spring Guard

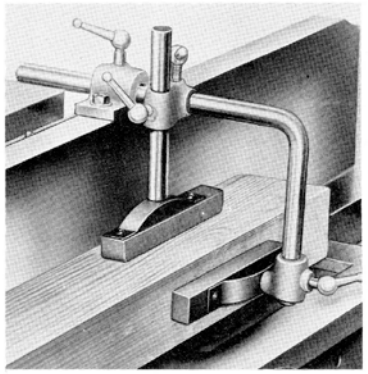


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Fig. 20:5 Hold-Down Safety Device Used When Cutting a Rabbet on the Jointer

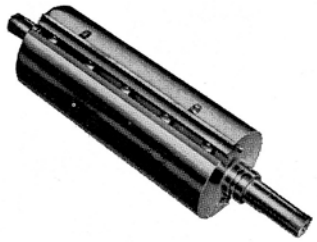
(c) *The smoothness of the finish.* If you wish only to reduce the thickness of a piece of stock, larger cuts can be taken than when making a cut to produce a fine finish.

In general, a 3 mm cut may be made on the edge of a 25 mm piece and a 1 mm cut from the face side of a piece of 25 mm × 150 mm stock. This adjustment is made by turning the hand wheel on the front of the jointer.

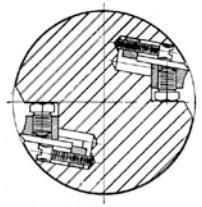
A graduated scale with an indicating arrow is provided on most machines. The height of the outfeed table should be adjusted *only* when the knives have been changed or sharpened.

When planing the edge of a piece of stock, you should hold the side firmly against the fence. If an angle is to be cut, the fence can be tilted. If the piece is being jointed for an edge-to-edge joint, make sure the fence is set exactly at a 90° angle to the table. It is well to check it with a try square, as shown in Figure 20:3.

When planing the face of a warped board, place the cupped side down, as shown in Figure 20:7. After this side has



Standard Two-knife Wedge Type Cutterblock.



Section Through Standard Two-knife Wedge Type Cutterblock.

Wadkin

Fig. 20:6

been planed on the jointer, it can be brought to thickness on the planer. If it is to be reduced to thickness on the jointer, the thickness must be scribed on it with a marking gauge. It is possible to plane it down to thickness on the jointer if you pay close attention to the scribed line. Feed the work into the jointer so that the knives will cut with the grain of the wood.

One of the main uses of the jointer is

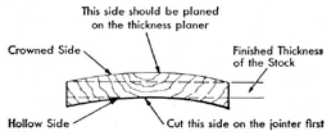


Fig. 20:7 Planing a Warped Board

to remove the twist from a piece of stock (that is, a piece that is slightly propeller-shaped). One face can be trued up on the jointer. Then the piece can be brought to thickness on the planer from the true face.

To cut tapers, first square a line across the work at the point where the taper starts. Lower the work onto the table with the line over the centre of the cylinder and set the height of the infeed table to the amount of taper required.

To cut stop chamfers, clamp blocks to the fence at the required locations so that the chamfer starts and stops at the right spot.

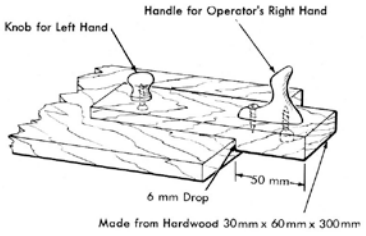


Fig. 20:8 Push Stick

Safety precautions for the jointer

Although the jointer is not a difficult machine to operate, it has been responsible for many serious accidents, most of them due to carelessness or lack of knowledge on the part of the operator.

The following are some of the safety precautions that must be observed while operating the jointer:

1. The guard must be in place at all times (over the knives and against the work). Two types of guard are shown in Figures 20:3 and 20:4. Many machines are equipped with a spring-loaded guard that presses tightly against the work as it is being cut, and then snaps back to the fence after the work has passed the cylinder. This type is considered superior to the type that must be set for each width of board.
2. When planing the face side of a piece of stock, a push stick must be used. This keeps the hands well away from the knives. A handy push stick that you can make is shown in Figure 20:8.
3. It is not always possible to use a push stick. In these cases keep your fingers well away from the ends of the piece. Do not allow your hands to rest on the part of the stock that is directly over the cutter head. This is referred to as the *danger zone* (see Figure 20:3).
4. Do not plane stock shorter than 225 mm or thinner than 15 mm.
5. Do not adjust the fence or clean the shavings from the table while the cutter head is in motion.
6. Observe the amount of wood the jointer is set to cut before turning on the machine. It is well to make a trial cut on a scrap piece of wood.
7. Do not plane end grain unless the board is at least 250 mm wide.

Surface planer

The planer in many respects is similar to the jointer in that one surface of the work is planed by the knives on a rotating cylinder. The planer differs, however, in that it planes the upper surface of the wood. Its only uses are to plane the surface of the stock and to reduce it to the correct thickness.

The capacity of most *single surface planers* is from 6 mm to 225 mm in thickness and 500 mm, 600 mm, and 900 mm in width, although larger planers are made for special purposes.

A single surface planer, sometimes called a *thickness planer,* is shown in Figure 20:9. This is the type to be found in most schools and small shops. It has a wedge bed arrangement for raising or lowering the table.

Double surface planers are made that have two cutter heads and plane both the top and bottom surface of the wood in one operation.

The planer operates basically in this way. The wood is drawn into the machine by a corrugated power-driven roller at the infeed end. The stock passes under a spring-loaded pressure bar and chip breaker. The former holds the work down firmly while the revolving cylinder knives remove the surface of the wood, after which it passes under a smooth roller on the outfeed end of the machine. There are also two smooth rollers on the bottom table that help to draw the wood through the planer.

The pressure or infeed roller and the pressure bar are both made in individual spring-loaded sections to take care of any roughness or raised section in the surface of the rough lumber that might otherwise cause it to stick. The springs allow a small section of the roller or bar

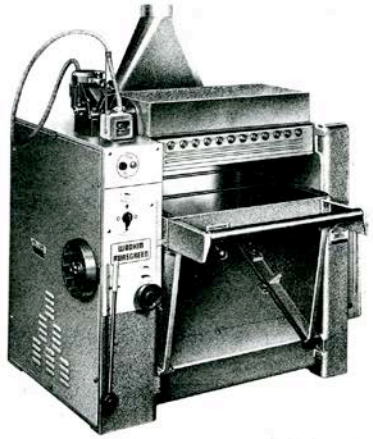


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Fig. 20:9 500 mm Panel Planer with Shaving Collector Hood and Sharpening Attachment.

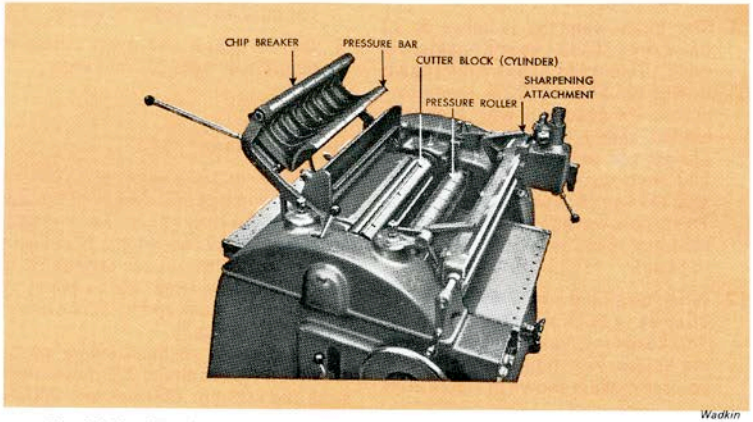

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Fig. 20:10 Chip Breaker Swung Up To Expose Cutter Block and Pressure Roller

to spring up and the wood to pass through the planer.

Most planers have two motors. One operates the cutting head while the other operates the feed rollers. This allows the feed rollers to work independently of the cylinder and makes it possible to have three or four different roller speeds. The speed of the cylinder, however, does not change. An efficient cutting-head speed is 5000 r/min. There are generally four knives inserted in the cylinder. Most planers are equipped with a sharpening device whereby the knives are sharpened while they are mounted in the planer.

The table is raised or lowered by a hand wheel on the side of the planer. A scale and pointer indicates the thickness to which the piece will be cut.

The amount of wood to be cut off at one time will depend on the width of the piece and the hardness of the wood, but, in general, a 3 mm cut may be made on softwood and a 2 mm cut on hardwoods. Generally one revolution of the hand wheel raises the table 3 mm.

How to set and operate a planer

1. Set the planer to cut 2 mm less than the thickness of the piece. If several pieces are to be planed at once, set it for the thickest piece.
2. Before feeding the wood, note the direction of the grain. With a planer, as with a hand plane, the wood must be cut with the grain. The point of the grain should be toward the operator.

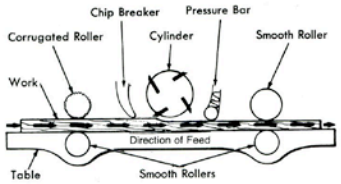

Fig. 20:11 Operation of the Planer

The cylinder rotates in the opposite direction to the feed rollers. Figure 20:12 illustrates which end of the board should enter the planer first.

3. If the pieces are more than 100 mm wide, put only one piece through at a time.
4. When several pieces are being planed at a time, put all the pieces through before resetting the thickness for the next cut.
5. If the piece is badly warped or twisted, a true surface should be cut on the jointer. This face can then be placed down on the table so that the rough side may be planed parallel to it. If, however, the boards are reasonably straight and true, both sides may be planed on the planer, in which case an equal amount should be cut off each side. If a warped board is planed on the planer, the rollers will hold it down while it is being planed, but when it leaves the machine it will have the same warped or twisted shape.

Safety precautions for the planer

Although the planer is probably the safest of the woodworking machines because there are no exposed knives or blades, there are still, however, several limitations and safety precautions that must be observed.

1. Do not plane boards that are less than 350 mm long. If a piece passes completely under the infeed roller before it reaches the outfeed roller, it will stay in the machine until it is cut smaller by the revolving knives. Then it may be thrown back at the operator, causing injury.
2. Do not attempt to plane stock less than 6 mm thick.
3. Make sure the pieces are free from nails or other foreign matter that might seriously damage the blades. If the lumber has pitch on the surface, be especially careful not to lay rules or other small tools on it, as they may be drawn into the machine.
4. Do not place your hands near the infeed rollers. Under no circumstances should you reach into the machine when it is in operation.
5. Let the machine reach full speed before inserting the stock.

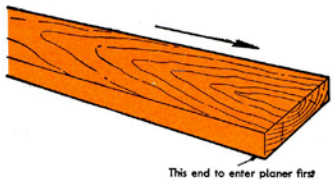

Fig. 20:12

ASSIGNMENT

Jointer

1. List five operations that can be performed on the jointer.
2. Does the cutter head revolve toward the infeed or the outfeed table?
3. What governs the depth of the cut on a jointer?
4. What should be the height of the outfeed table in relation to the cutting knives?
5. What factors will determine the amount of wood to be removed for each cut?
6. Should a larger cut be taken off the face or off the edge of a board?
7. In general, how much wood should be taken off the piece in one cut?
8. Describe the operation of bringing a piece of work to a given thickness on the jointer.
9. Explain how to cut a taper on the jointer.
10. How and why is a push stick used?
11. List the four safety precautions that you consider the most important in the operation of a jointer.

Planer

12. What is the difference between a single surface planer and a double surface planer?
13. What causes the board to be drawn through the planer?
14. Which surface of the wood is planed as it passes through the planer?
15. What is a suitable amount of material to be removed from hardwood in one cut?
16. Why is the infeed roller made in spring-loaded sections?
17. When planing a group of boards to thickness, should you set the planer to cut the thinnest or the thickest piece?
18. Why should one face of a twisted board be planed on the jointer before it is cut to thickness on the planer?
19. Why should short stock never be cut on the planer?
20. How can you develop confidence when operating woodworking machines?