

# scraping, sanding, and preparation for finishing

It is impossible to obtain a good finish on work unless it has been properly prepared. There are many types of finish that may be used, but none of them is made to cover poor workmanship. In fact, the finish will magnify the defects. Scratches or other marks that may not be detected or may be only slightly visible on the bare wood will show up as noticeable blemishes on the finished work.

Successful finishing begins with having the work properly sanded and free from dents, scratches, chips, and other imperfections. Some dents can be removed by placing several thicknesses of wet cloth over them and then pressing a hot iron on the cloth, keeping the iron moving so as not to scorch the work. The steam created swells the wood fibres and brings them back to their original position. This process may have to be repeated several times to raise the dent completely. The spot can be sanded

when dry. All nails should be set below the surface but should not be filled until one coat of finishing material has been applied. If they are filled first, the oil from the filler soaks into the wood and the filler falls out. However, if a protective coat is first spread on the work to seal the wood fibres, the filler will remain in place.

You should take enough time to do a good job of cleaning and sanding. Having spent hours to make a project, you would be wise to spend a little more time in scraping and sanding so that a worthwhile finish can be obtained.

### Scrapers

Scrapers are wood-smoothing tools that make a finer cut than the plane. They are used just prior to sanding to remove plane marks and other defects too small to plane off but too deep to sand out.

There are several types of scrapers, each made for a different purpose. Figures 23:1 to 23:4 illustrate some of these.

The scraper removes a fine shaving by means of a burred cutting edge, while the plane uses a sharp bevelled edge. These different cutting actions are illustrated in Figure 23:5.

Figure 23:6 illustrates the shape of

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the burr formed on a hand scraper. The procedure for sharpening scrapers is dealt with later in the book.

When using a hand scraper on a large flat surface, push with your two thumbs in the centre and near the cutting edge (as shown in Figure 23:7). This curves the scraper slightly and makes it cut at the centre section. On smaller surfaces the scraper may be pushed or pulled, depending on which is the more convenient way to get at the various parts of the work. Since a very fine cut is being

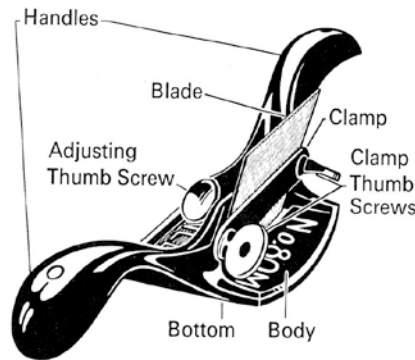


Fig. 23:1 Cabinet Scraper

Stanley Tools



Fig. 23:2 Hand Scraper



Fig. 23:3 Scraper Plane

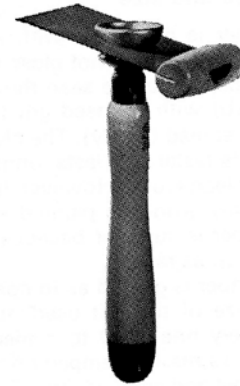
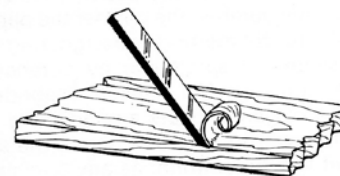
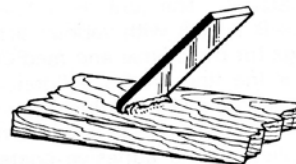


Fig. 23:4 Hoe Scraper

Millers Falls Co.



Cutting Action of a Plane.



Cutting or Scraping Action of a Scraper.

Fig. 23:5 Cutting Action of Planes and Scrapers

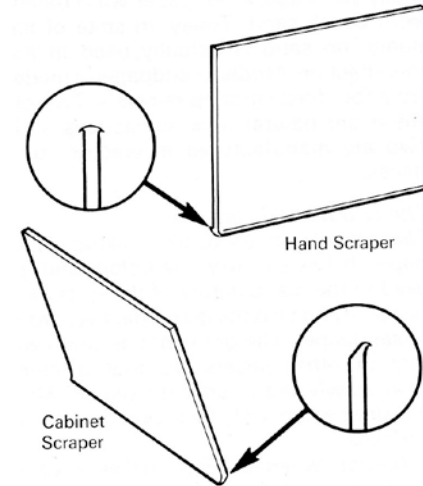


Fig. 23:6 Burrs Formed on Scrapers



Fig. 23:7 Method of Holding a Hand Scraper

Press Here and Spring to a Slight Curve

## hand and machine woodwork

made, the scraper can be used to cut with or against the grain. The cabinet scraper and the scraper plane should be used on flat surfaces only.

### Sandpaper

It is important that you use the correct method of sanding and select the proper grade of paper for the work you are doing.

The name *sandpaper* is a general term given to all abrasive papers used for smoothing wood. The name originated many years ago when paper was coated with beach sand. Today, in spite of its name, no sand is actually used in its manufacture. Modern sandpaper is made from four finely ground minerals. Two of these are natural rock substances and two are manufactured in electric furnaces.

#### The two natural minerals

*Flint quartz* is used for making flint paper. It has an off-white colour and is used in the manufacture of the least expensive, and also the least effective, type of sandpaper. The grit is not as sharp as that in other papers, so that it cuts more slowly and wears out more quickly. It is used extensively for sanding painted surfaces.

*Garnet*, when ground, makes a very hard, sharp, dark red grit. When made up into sandpaper, it is sold in sheets or roll stock. Garnet paper is used extensively in industry both for hand sanding and on power sanders. It is more expensive than flint paper but is of a much better quality.

#### The artificial minerals

*Aluminum oxide* is made in an electric furnace from bauxite, the raw material from which aluminum is made. It is reddish-brown, very hard, and sharp. Aluminum oxide paper may be used on either wood or metal.

*Silicon carbide* is also made in an

electric furnace at very high temperatures from silicon (sand) and coke. This is the way nature makes diamonds from the heat and pressure of the earth. Man, by using the same method, has been able to make grit that is almost as hard as diamond. Silicon carbide paper is gray or black in colour and may be used either dry or with water or mineral spirits. It is often referred to as *wet dry paper*.

### Grit type and size

Sandpaper is made (a) with an open grit (the particles are not close together and the paper may be seen through the grit) or (b) with a closed grit (the particles are spread thickly). The closed grit paper cuts faster and lasts longer when used on clean wood. However, for sanding gummy wood or painted surfaces, open paper is superior because it does not clog up as rapidly.

Sandpaper is graded as to coarseness by the size of the grit used. It ranges from a very fine 10/0 to a medium of 2/0. These sizes are stamped on the back of the sheet and are read "two 0", "three 0", "four 0", and so on. The coarse sizes are  $\frac{1}{2}$ , 1,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , and 3. The more 0's, the finer the paper; the larger the whole number, the coarser the paper. A more recent method of designating the coarseness of sandpaper by number is shown on page 171. The corresponding 0 sizes of garnet paper are indicated.

Whatever the grade of paper, the size of grit will be uniform, as any oversized grit in a fine sheet of paper would cause scratches. The grit is filtered through a silk screen with various sizes of openings for the coarse and medium grades. For the fine grades a flotation system is used whereby the fine grit will drop to the bottom of a liquid. The grit is applied to the adhesive-coated paper by an electrostatic process that stands all the grit particles on end, thus making the paper cut much faster.

	The Corresponding	
	Sandpaper	0 Sizes of
	Number	Garnet Paper
Very Fine	280	8/0
	240	7/0
	220	6/0
Fine	180	5/0
	150	4/0
	120	3/0
Medium	100	2/0
	80	1/0
	60	1/2
Coarse	50	1
	40	$1\frac{1}{2}$
Very Coarse	36	2
	30	$2\frac{1}{2}$
	24	3

### Tungsten carbide

Another development in abrasive material is tungsten carbide, an extremely hard, manufactured carbon material used for tips on steel-cutting tools. The carbide is broken up into fine particles and bonded onto thin steel plates. The metal sheets are made in convenient sizes and used on sanding blocks in the same manner as sandpaper (see Figure 23:8). If the surface does not become clogged with glue or paint or otherwise damaged, the extremely hard cutting surface will last indefinitely. This type of material can be used only on flat surfaces. Only fine and medium grades are available. Wood-cutting files are also made with a tungsten carbide cutting surface.

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Fig. 23:8 Sanding with Tungsten Carbide

### How to sand

To make the sanding operation more effective and less tedious, there are a few techniques that should be followed. To sand a flat surface true, some type of sanding block should be used. Several types of blocks are sold commercially for this purpose, or one can be made. It should have a felt or rubber pad to cushion the paper. An unpadded block should never be used for finish sanding. If a chip or piece of grit gets between the paper and the block, it will make scratches that are very difficult to remove.

Begin the sanding with coarse paper. Sand at an angle to the grain. This will level the work but leave fine scratches over the entire surface. To remove these, follow with a medium grit paper, sanding with the grain. If the wood has a coarse open grain, such as oak, sand at an angle to avoid enlarging the pores and removing the soft part of the grain. Finish the sanding with a fine paper, working with the grain. Pencil any small irregularities that remain, and sand until they disappear. Before the final sanding the work is sometimes given a wash coat of thin shellac. This will stiffen up any loose wood fibres, which can then be easily sanded off.

To produce a true flat surface by hand sanding, you must use a uniform stroke of equal pressure for the full length of the



General Brock S. S., Burlington James C. Fish Photography  
Fig. 23:9 Hand Sanding Operation

work. Sand with short strokes and move along the work, overlapping each stroke. If square edges are required, hold the paper flat, and do not bend it round the corners or edges. Use a sanding block that will allow the sandpaper to reach all parts of the edge.

The individual parts of a project should be sanded before being assembled in order to take care of many of those hard-to-get-at corners and because single parts and sub-assemblies are much more easily sanded when they can be placed flat on a bench. The work should be organized so there will be a minimum of sanding on the completely assembled project. Curved edges can be sanded as shown in Figure 23:9.

## ASSIGNMENT

### Scrapers

1. What is the main purpose of a scraper?

2. Name four types of scrapers.
3. How does the cutting action of the scraper differ from that of the plane?
4. How should the hand scraper be held for most effective results on large flat surfaces?
5. Why may the scraper be used to cut with or against the grain of the wood?

### Sandpapers and sanding

6. Why is it absolutely essential that all scratches and defects be removed from a project before any finishing material is applied?
7. How may a dent be removed from a project without removing any wood?
8. Why should you wait until a coat of finishing material is applied before filling nail holes?
9. Why would we say that sandpaper is now improperly named?
10. Name and describe three types of sandpaper. What abrasive material is used for the manufacture of each?
11. (a) Which is the finer sandpaper: 2/0 or 4/0?  
(b) Give the corresponding number sizes of 2/0 and 4/0 sandpaper.
12. How are the particles of grit divided and attached to the paper backing?
13. How does tungsten carbide abrasive differ from sandpaper?
14. Why should an unpadded sanding block not be used for finish sanding?
15. What three grades of sandpaper should be used in preparing a piece of work for stain or shellac?
16. Why should individual parts be sanded before they are assembled?

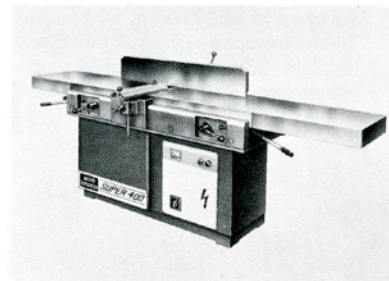
### Jointer

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



Wadkin Bursgreen

Fig. 20:1 400 mm Jointer with Long Bed

## planing machines

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.

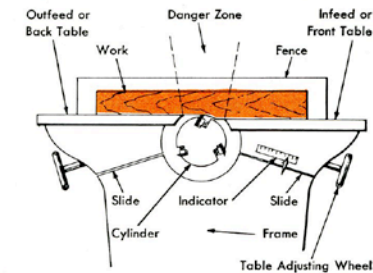


Fig. 20:2 Cutting Action of a Jointer

planing machines

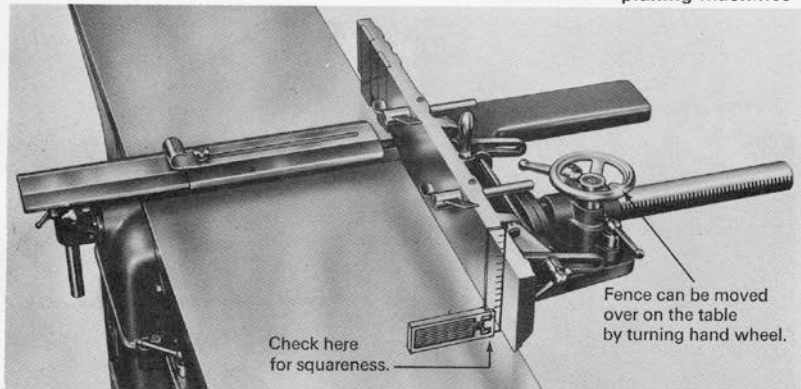


Fig. 20:3

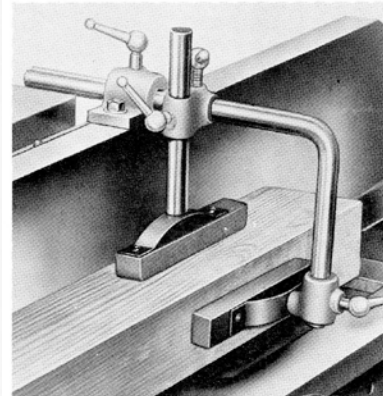
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Fig. 20:4 Jointer with Spring Guard

James C. Fish Photography

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

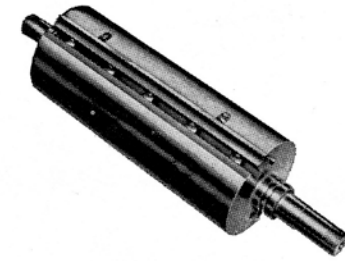
(c) *The smoothness of the finish.* If you wish only to reduce the thickness of a piece of stock, larger cuts can be taken than when making a cut to produce a fine finish.

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.

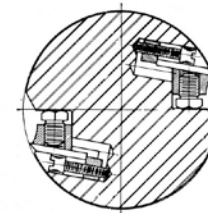
A graduated scale with an indicating arrow is provided on most machines. The height of the outfeed table should be adjusted *only* when the knives have been changed or sharpened.

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

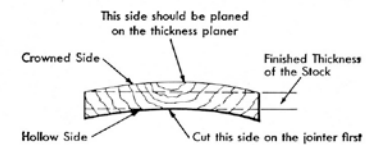


Fig. 20:7 Planing a Warped Board

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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.

**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

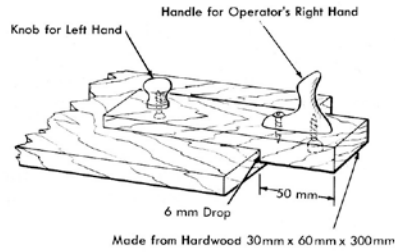


Fig. 20:8 Push Stick

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

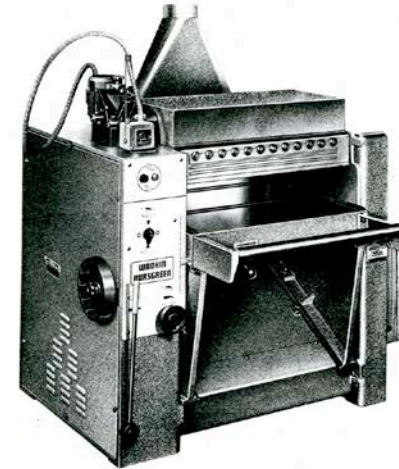


Fig. 20:9 500 mm Panel Planer with Shaving Collector Hood and Sharpening Attachment.

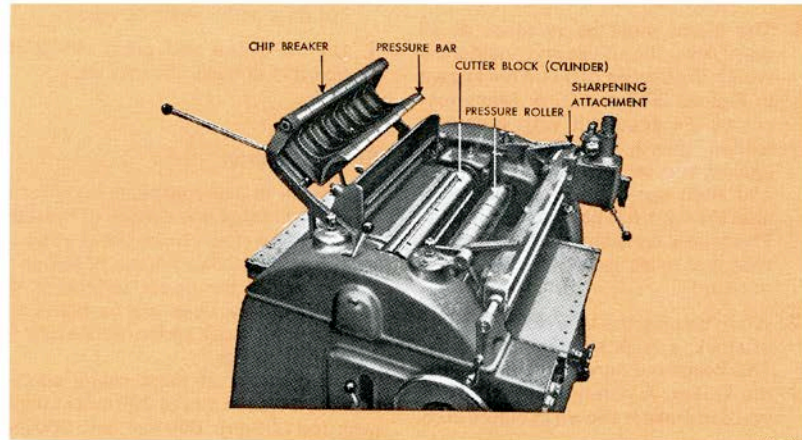


Fig. 20:10 Chip Breaker Swung Up To Expose Cutter Block and Pressure Roller

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.

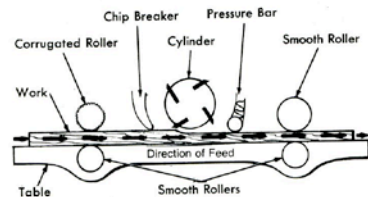


Fig. 20:11 Operation of the Planer

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

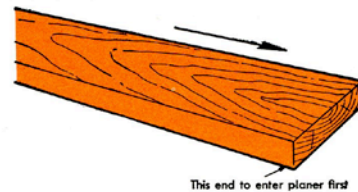


Fig. 20:12

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.

**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?