CHAPTER 25

Surfacing with Stationary Machines

Objectives

After studying this chapter, you should be able to:

- Read wood grain to prevent chipping workpieces while surfacing.
- Set up and operate a jointer.
- Set up and operate a planer.
- Explain the sequence of steps to square workpieces.
- Maintain jointers and planers.

Technical Terms

chip breaker
fence
grain pattern
honing
infeed roller
infeed table
jointer
jointer/planer
knife marks per inch (KMPI)
newton meter
outfeed roller
outfeed table
planer
pressure bar
snipe
table roller
top dead center

A Patrick A. Molzahn

B Patrick A. Molzahn

Figure 25-1. A—Jointers are used to flatten stock and joint edges square. B—Planers create parallel faces.

Wood faces, edges, and end grain are surfaced to produce flat and smooth cabinet parts. A high-quality surface is obtained through the proper setup, operation, and maintenance of surfacing machinery. Practicing these skills will reduce the time you spend smoothing the product with abrasives or scrapers. The surfacing characteristics of various wood species are found in Chapter 15.

Jointers and planers are the principle machines for surfacing. See **Figure 25-1**. Suppose you begin with rough-sawn stock. One face is surfaced with a jointer. The other face is surfaced with the planer. Moulders are common in industry to quickly convert rough stock to boards of finished dimensions.

The process of jointing, followed by planing, brings stock to a desired thickness. The amount of surfacing needed depends on the material. Wood bought as S2S (surfaced two sides) may not need additional surfacing. Rough and warped stock will require more work.

Surfacing usually corrects warped wood. However, to eliminate warp, extra stock must be removed. Removing a cup or bow reduces the board's thickness. Eliminating crook reduces the board's width. The degree of warp limits the finished dimensions of both thickness and width for any given length of board.

If you are ultimately cutting a board into smaller pieces, doing so prior to surfacing can help reduce loss due to warp. However, this increases the amount of time spent surfacing because of increased handling. You must also keep in mind minimum part lengths required by machinery to feed safely.

25.1 Reading Wood Grain

The results of surfacing can be disastrous unless you can read the grain. The ***grain pattern*** is the figure formed by cutting across the annual rings of a tree. This pattern will be different for flat-sawn versus quarter-sawn lumber, and is largely dependent on how the board is sawn from the log. These sawing processes produce stock with either straight grain or cross-grain.

In wood with straight grain, the lines formed by the annual rings run parallel to each other the full length of the board. In wood with cross-grain, the grain angles, forming V shapes. Problems arise when surfacing cross-grain lumber. Feeding the wrong direction can result in the cutter chipping, tearing, or splitting the wood.

Proper feed directions are shown in **Figure 25-2**. Straight-grained wood can be fed in either direction, for faces and edges, on both the planer and jointer. Cross-grain wood must be fed so the cutter doesn't cause tearout between the layers of wood growth. When surfacing faces, feed so the V-shape grain pattern points away from the cutter. For edges, feed so the V-shape points toward the jointer cutter.

25.2 Jointer

The ***jointer*** is a multipurpose tool for surfacing face, edge, and end grain. When squaring stock, the face and edge are first jointed. Then most woodworkers will plane the second face. The board can then be cut to width and the edge jointed to remove saw marks. While not common, end grain can be machined after cutting workpieces to length.

25.2.1 Jointer Components

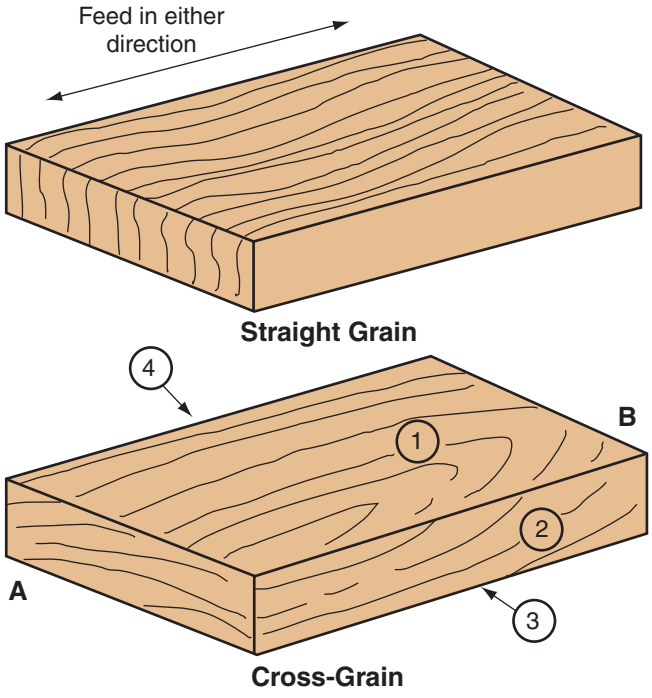
The jointer consists of five major components: the cutterhead, guard, infeed table, fence, and outfeed table. See **Figure 25-3**. Machine size is based on the maximum width of material that can be surfaced.

Safety in Action

Surfacing Safety

Operating jointers, planers, and other power equipment for surfacing requires concentration and planning. Be attentive to your own actions. Plan your material handling steps thoroughly, both before and after processing the material. Always stay a reasonably safe distance from the point of operation. Other safety tips include:

- Wear eye protection.
- Remove jewelry and secure loose clothing.
- Have solid footing.
- Use push blocks and auxiliary devices for safer control of small workpieces.
- The minimum dimension for any workpiece when using a jointer or planer is typically 3″ wide × 12″ long (76 mm × 305 mm).
- Keep point-of-operation guards and other safety devices in place.
- Use fences on jointers to guide your work.
- Know where to reach for the *stop* switch. In an emergency, you must find it immediately without having to look for it.
- Stand to the side of the workpiece when using a jointer or planer.
- Have someone help or use supports when processing long stock.
- Wait for the planer to come to a complete stop before attempting to remove a wedged workpiece.
- Inspect your work regularly for defects indicating inaccurate machine adjustments.
- Maintain equipment properly for efficient surfacing.
- Control wood chips and shavings with an exhaust system.



Surface	Machine	End to Feed First
1	Jointer	A
2	Jointer	B
3	Planer	B
4	Saw/Jointer	B

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Figure 25-2. Plane and joint surfaces so the grain doesn't tear.

Cutterhead

The cutterhead has three or four knives that rotate between 4000 and 5000 revolutions per minute (rpm). The length of the cutterhead varies from 4″ to 12″ (102 mm to 305 mm) or more, limiting the maximum width of stock that can be surfaced.

Guard

A movable cutterhead guard covers the cutterhead. This will likely either be a swing-type guard or a bridge-style guard.

A swing guard, sometimes referred to as a pork chop guard because of its shape, moves out of the way as material is pushed over the cutterhead. A spring causes it to move back into place as the stock exits the cutterhead. Push blocks are generally used to keep hands away from the cutter. See **Figure 25-4A**.

A bridge guard covers the cutter while face jointing. Some models are spring loaded and will retract on their own. Others must be manually adjusted to within 1/4″ (6 mm) of the stock thickness before using the machine. Push blocks are generally not used, though a follower board can be used to help push the material past the cutter for small pieces. The operator's hands slide over the guard while face jointing, **Figure 25-4B**.

Infeed Table

The ***infeed table*** on a jointer or planer supports the workpiece as it is fed into the cutterhead. The

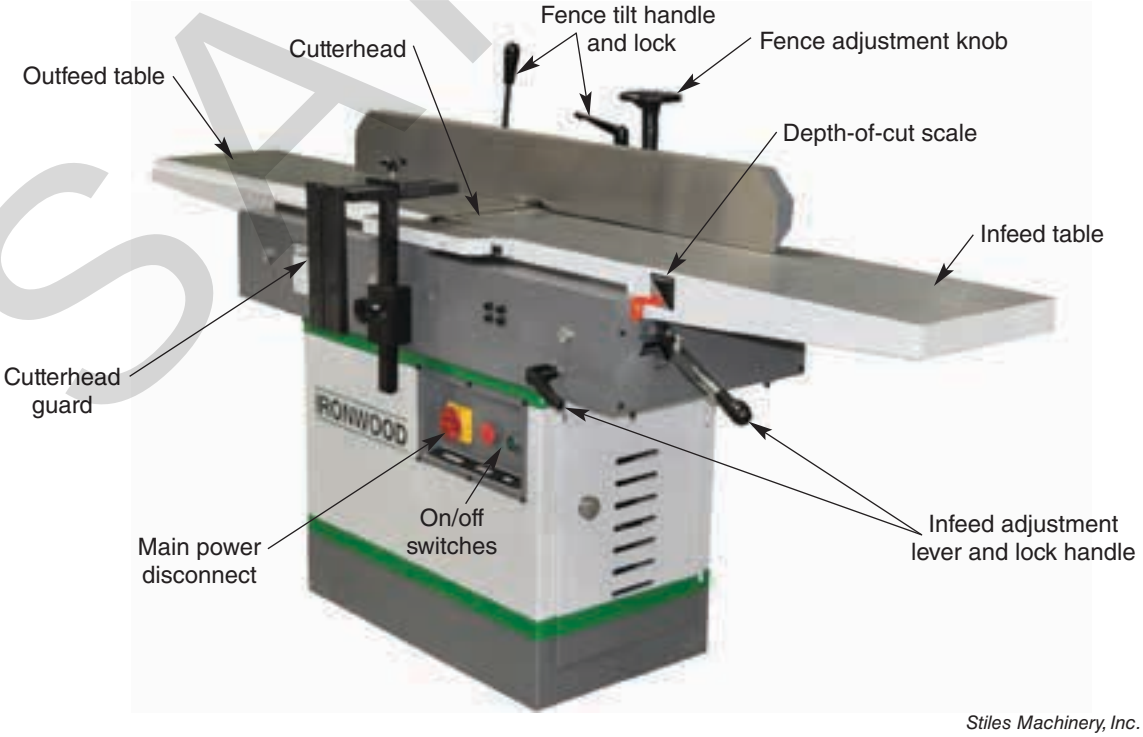

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Figure 25-3. Components of a jointer.

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B Patrick A. Molzahn

Figure 25-4. A—Swing-type guard. B—Bridge-style guard.

depth of cut is set by raising or lowering the infeed table below the top of the cutterhead. This is done by loosening the infeed table lock and turning the infeed table adjusting handwheel or moving the infeed lever. Look at the depth-of-cut scale for the amount of material to be removed. After setting the infeed table, retighten the table lock.

Safety Note

Always check the depth-of-cut setting before operating any jointer. Attempting to remove too much material could result in a dangerous condition. The force required can cause the operator to lose control of the stock as it is being jointed. The stock can kick back, or the operator's hands can slip and be exposed to the cutter.

Fence

The ***fence*** guides the workpiece into the cutterhead. It can be tilted to bevel edges. However, most often it is set square to joint at 90°. To tilt the fence, loosen the fence tilt lock and set the fence angle. You can also slide the fence across the cutterhead. This determines which area of the cutterhead does the surfacing. Reposition the fence periodically when jointing narrow material by sliding and locking the fence over a different section of the cutterhead. This ensures the entire cutterhead width is used, creating more even wear on the knives and resulting is less frequent sharpening. To move the fence, loosen the fence lock knob, slide the fence, and retighten the knob.

Outfeed Table

The ***outfeed table*** supports the workpiece after it passes the cutterhead. The outfeed table should be set at exactly the same height as the cutterhead knives. Adjust the table by loosening the outfeed table lock and raising or lowering the table. While this setting can be set using a straightedge to align the outfeed with the top of the knives, it is better to make a trial cut and adjust the table to the stock.

Procedure

Setting Outfeed Table Height

Follow these procedures:

1. Select a board with a straight edge.
2. Lower the outfeed table approximately 1/16″ (1.5 mm) below the uppermost point of the knives. This is known as ***top dead center***.
3. Turn on jointer and joint the first 2″–3″ (51 mm–76 mm) of material. While holding the board in place, turn off the machine and wait for the cutterhead to come to a stop.
4. Unplug the machine or isolate the power source.
5. Loosen the outfeed table lock and raise the outfeed table to the stock height. See **Figure 25-5**.

This method is preferred to using a straightedge because it accounts for any slight difference between the knife heights and runout in the cutterhead bearings.

25.2.2 Jointer Setup

There are several important steps to take before operating a jointer. First, check the setup. Then decide how to feed the stock.

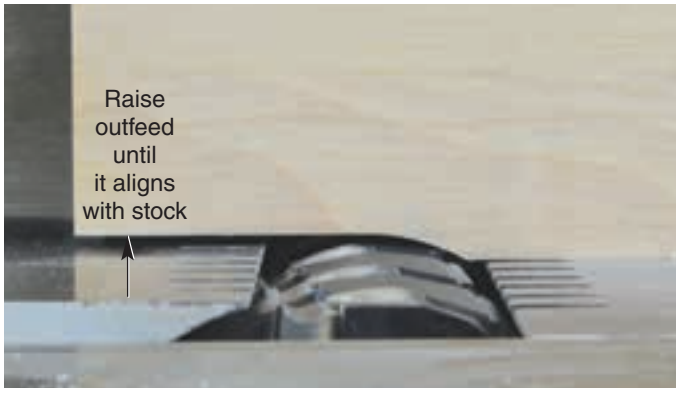

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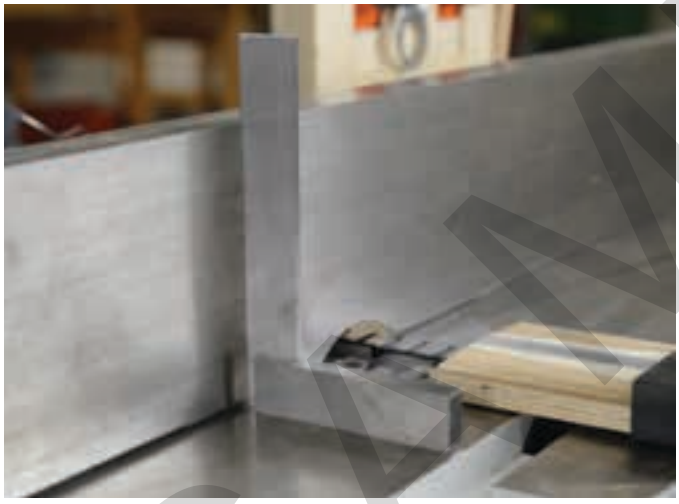
Figure 25-5. The outfeed table must be adjusted so it is in line with the top of cutterhead.

Set the fence position perpendicular to the outfeed table for a 90° (square) corner. Use a try or combination square to set the fence. See **Figure 25-6**. For beveling, use a sliding T-bevel to set the fence angle. Some jointers have a fence tilt scale.



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B Patrick A. Molzahn

Figure 25-6. A—Set the jointer fence at 90° using a square. B—Angles can be set with a T-bevel.

Set the depth of cut. Loosen the table lock and raise or lower the infeed. The depth of cut is typically set at 1/16″ (1.5 mm) or less to remove saw marks. Set the depth according to the depth scale located next to the infeed table. If there is no depth scale, look at the difference between the infeed and outfeed fence heights. (The outfeed table should be even with the cutterhead.) This is the actual depth of cut.

Select appropriate push blocks or sticks. Have several different sizes and shapes available. Knobs or handles on the push blocks provide the safest control. See **Figure 25-7**.

Determine which faces or edges of the stock are to be jointed. Read the grain of the stock. The grain should always slope toward the floor from front to back when feeding. Also inspect for warp. If the workpiece is warped, always place the concave (cupped) side against the infeed table. See **Figure 25-8**.

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Figure 25-7. Use push sticks and push blocks when jointing. Hold the board firmly against the table when face jointing, being careful not to force bowed boards flat.

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Figure 25-8. The concave side of a cupped face should be placed down.

Check the workpiece length. It should be at least 12″ (305 mm) long for jointing. Use a hand plane for shorter workpieces. Minimum width should be at least 3″ (76 mm) to hold it securely with push blocks when face surfacing. For narrower material, use a push stick. The material should also be at least 1/2″ (13 mm) thick. Thinner wood can splinter and has a tendency to chatter.

25.2.3 Jointer Operation

Jointers are used first when squaring stock. Normally, one face of a board is jointed, then one edge. Next, the other face is surfaced to final thickness with the planer. Then the board is ripped to width or slightly oversize. Return to the jointer and remove the saw marks. Once the faces and edges are flat and square to each other, cut one end square. Then cut the workpiece to length.

Procedure

Jointing a Face

To joint a face, proceed as follows:

1. Set the depth of cut at 1/32″–1/16″ (1 mm–1.5 mm).
2. Set the fence to accommodate the workpiece width.
3. Be sure the guard will move freely when you push the material past the cutterhead. If you are using a bridge guard, adjust the height so that it is no more than 1/4″ (6 mm) above the stock.
4. Determine which direction to feed the workpiece. Refer again to **Figure 25-2**.
5. Turn on the jointer.
6. Hold the front of the board down with your left hand or a push block. Guide the workpiece forward with your right hand. Press down lightly with both hands. When the stock reaches the cutter guard, it will push the guard aside. If using a bridge guard, your hand will pass over the guard. Keep downward force on the stock to keep it tight to the table.
7. Feed the workpiece at a moderate rate. Rapid movement will tear or splinter the wood. Excessively slow movement may create burn marks.
8. You may need to support the material beyond the outfeed table. Use a roller accessory set to the outfeed table height, or have another person support the workpiece.

If the workpiece is cupped, place that side down to prevent the material from rocking. Refer again to **Figure 25-8**. If the material is cupped excessively, rip it into narrower, strips, joint the faces and edges, then reglue it. Otherwise, you may reduce the thickness of the stock too much trying to remove the cup.

Twisted stock will rock diagonally when placed on the infeed table. Hold the wood with a push block. Keep the two rocking corners equal distance from the infeed table as you joint the workpiece. It may be helpful to hand plane the two high corners a bit before jointing.

Procedure

Jointing an Edge

To joint an edge, proceed as follows:

1. Set the depth of cut at 1/32″–1/16″ (1 mm–1.5 mm).
2. Check to see that the fence is at a 90° angle to the table.
3. Set the fence to accommodate stock width.
4. Check that the guard will move freely when you push the stock past the cutterhead. If using a fixed bridge guard, you will need to adjust the opening prior to edge jointing.
5. Determine direction to feed stock.
6. Turn on the jointer.
7. Hold the stock tight to the fence with your left hand, **Figure 25-9**. Guide it forward with slight downward pressure of right hand. Use push sticks if necessary to keep hands at least 3″ (76 mm) from the cutterhead.
8. Feed the workpiece at a moderate rate.

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Figure 25-9. Keep a firm grip on the board when edge jointing. The face must be flat and held tight to the fence to create square edges.

For a bow or crook, make sure you have just enough stock length needed for the cabinet part. Place the concave side against the infeed table. See **Figure 25-10**. This prevents the material from rocking from end to end.

A *Patrick A. Molzahn*

B *Patrick A. Molzahn*

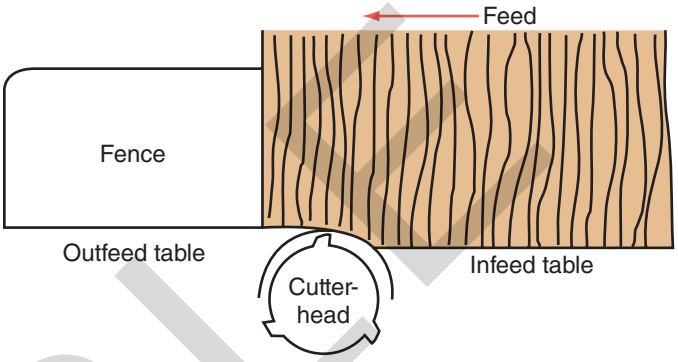
Figure 25-10. A—Flattening bowed boards can result in the loss of a great deal of material. B—Reduce lengths by cutting into smaller pieces if necessary.

Procedure

Jointing End Grain

A properly tuned saw with a good quality carbide blade should produce a crosscut that does not require jointing. However, end grain may be surfaced on the jointer if desired by using a special procedure. The minimum length of cut should be 12″ (305 mm). If you decide to joint end grain, proceed as follows to avoid chipping out the trailing edge:

1. Set the depth of cut to 1/32″ (1 mm).
2. Hold the workpiece face against the fence.
3. Advance the end about 1″ (25 mm) into the cutterhead. See **Figure 25-11A**.
4. Lift and turn the workpiece around.
5. Joint the end. See **Figure 25-11B**. Apply pressure to the outfeed table as you near the 1″ (25 mm) portion you previously jointed.



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B *Chuck Davis Cabinets*

Figure 25-11. Jointing an end. A—Joint about 1″ (25 mm) of an end. B—Turn the workpiece around and finish the operation.

25.2.4 Beveling

To bevel on the jointer, tilt the fence to the required angle. Then follow the edge-jointing procedure. See **Figure 25-12**. For narrow strips, clamp a feather board to the fence or use push sticks.

It is typically more efficient to rip the bevel slightly oversize on the table saw. Then make one or two passes on the jointer to remove any saw marks.

25.2.5 Other Jointer Operations

Additional operations that can be performed on the jointer are cutting rabbet joints and tapering.

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Figure 25-12. Jointing a bevel.

Green Note

Processing wood creates a great deal of residue. Piles of chips and shavings from saws and planers quickly accumulate. Pelletizers and briquetters can convert this waste into material that can be easily handled and sold for use in wood burning furnaces. Instead of paying to have the material hauled away, there may be a ready-market in your own backyard.

Rabbeting

To cut a rabbet on the jointer, your machine must be equipped with a rabbeting ledge and the knives must project beyond the cutterhead. While routers, shapers, or dado blades may be more efficient at cutting most rabbets, the jointer offers the ability to cut a wide rabbet. See **Figure 25-13**.

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Figure 25-13. Jointers that are equipped with a rabbeting ledge can be used for rabbeting. Deep cuts should be made with multiple passes.

Procedure

Cutting a Rabbet

This process will require that you remove the guard. Follow these steps:

1. Ensure the cutterhead is capable of cutting rabbets.
2. Remove the guard over the cutterhead.
3. Move the fence until the exposed part of the knives is equal to the width of the rabbet and lock the fence in this position.
4. Lower the front table until the depth of cut is equal to the depth of the rabbet.
5. Make a trial cut on a piece of scrap wood and adjust as required.

With a jointer, you can cut a rabbet in a single pass or in several passes. If you cut the rabbet in one pass, you may need to reduce the speed of the feed. To cut a rabbet on a small jointer, you may find that you can cut only one-half or one-third of the depth of the rabbet during a single pass.

Procedure

Cutting a Rabbet in Three Passes

To make a rabbet in three passes, do the following:

1. For the first pass, set the depth to one-third of the rabbet depth.
2. For the second pass, lower the infeed table until the depth scale shows about two-thirds of the rabbet depth.
3. For the third pass, lower the infeed table until the exact depth of the rabbet shows on the scale.

A larger jointer with sharp knives can cut rabbets up to 3/8″ deep in one pass, without the danger of kickback.

Working Knowledge

To reduce tearout and produce a cleaner rabbet, precut the inside edge of the rabbet by grooving the board on a table saw before machining. See **Figure 25-14**.

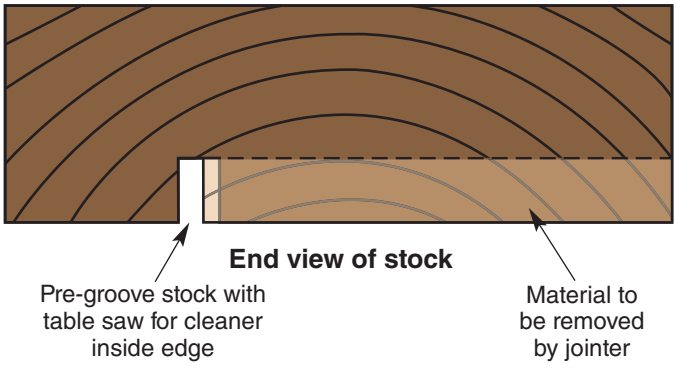

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Figure 25-14. Pre-grooving stock on the table saw will result in cleaner rabbets. Depending on the style of cutterhead, pre-grooving may be required in order to rabbet.

Tapering

Table legs are often tapered from top to bottom. In addition to furniture, tapered workpieces are sometimes needed. One option is to cut them on a saw and use the jointer to clean up the saw marks. However, this will not work for all tapers. See **Figure 25-15**.

To make a taper along the length of a piece of stock, lower the stock onto the spinning cutterhead with the front end of the stock resting on the outfeed table, then joint as usual. With this procedure, you will find that the cut (that is, the amount of wood removed) will begin at nearly zero and finish at the full depth of cut set for the jointer.

Safety Note

Be aware that when you place the front end of the stock so that it just reaches the outfeed table, there is a risk of kickback. Do not let the cutterhead pull the stock clear of the outfeed table. If the stock drops off the outfeed table into the cutterhead, the cutterhead will make a full-depth cut in one bite, and this will cause a kickback.

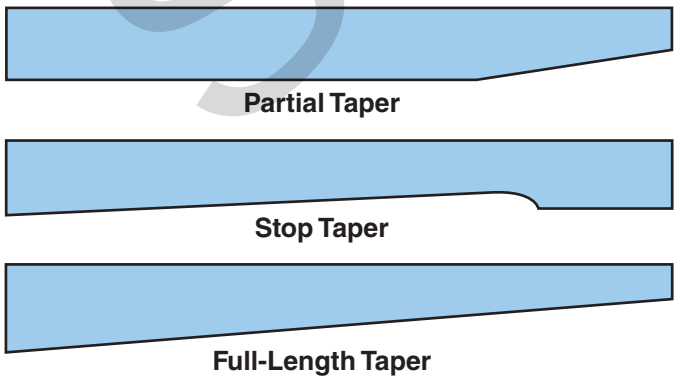

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Figure 25-15. Various types of tapering can be done on a jointer.

If you want to taper from one end of the stock to the other end, it is safer to clamp a stop block to the fence or infeed table. See **Figure 25-16**. Then set the end of the stock tight to the block. Carefully lower the stock into the spinning cutterhead and proceed to make the cut. If the taper is going to slope more

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B Patrick A. Molzahn

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Figure 25-16. Full-length tapers can be done using a jointer. The maximum amount of material to be removed should not exceed 3/8″ (10 mm). A—The board is lowered onto the spinning cutter. It must rest a minimum of 1/8″ (3 mm) on the outfeed. B—A stop block is securely fastened to the fence to avoid kickback. C—Move the board forward, maintaining pressure on the infeed side until enough of the board is on the outfeed bed to avoid tipping the stock.

than 1/4″ (6 mm), make it in two or more passes. Only shallow tapers should be made in one pass. Another option is to band saw the taper and then use the jointer to smooth out the cut.

25.3 Planer

A ***planer*** is used to surface the second face of a board so it is parallel to the first face. See **Figure 25-17**. The planer typically has a wider cutting head than a jointer. Like the jointer, the cutting head determines the maximum workpiece width and the size of the machine. Planer sizes range from 10″ to 48″ (254 mm to 1219 mm).

Do not use a planer to surface both faces of stock without first removing any warp, because the planer infeed and outfeed rollers press the material against the table as it cuts. If there is a cup, bow, or twist in the wood, it will be pressed down while surfacing. The warp will then spring back when material leaves the planer. This is why both a jointer and a planer are necessary for proper squaring operations.

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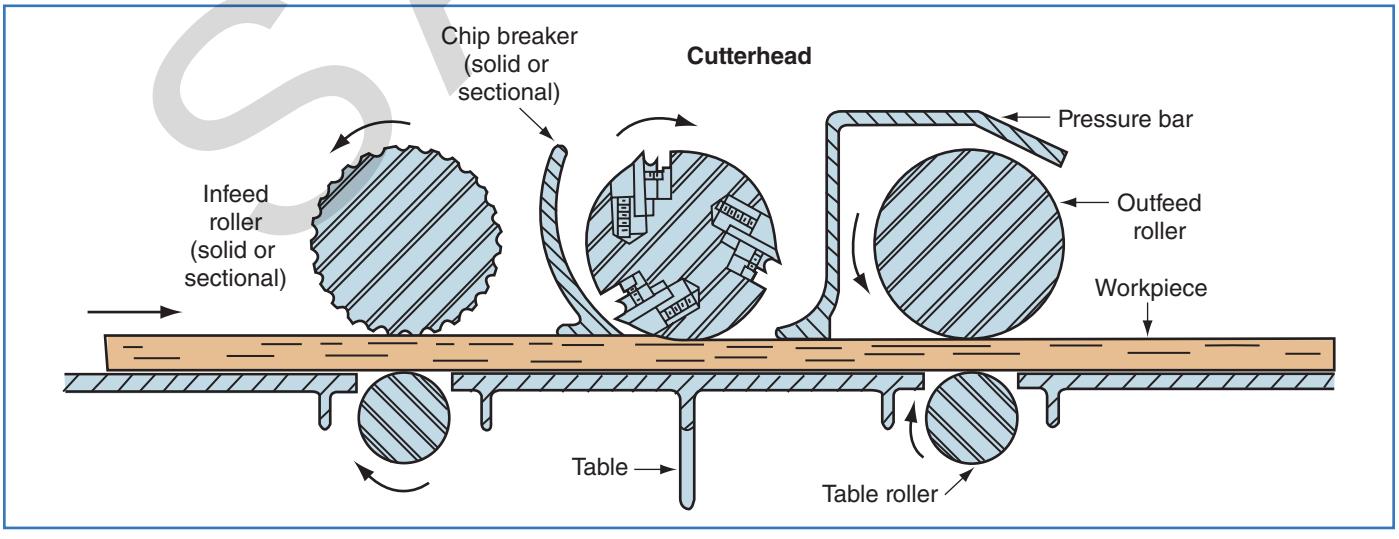
Figure 25-17. After jointing the first face, a planer is used to surface material to thickness.

25.3.1 Planer Components

While portable models exist, the planer is typically one of the larger stationary woodworking machines in most shops. The interior components are shown in **Figure 25-18**. Lumber is fed into the planer between the infeed roller and a table roller. The ***infeed roller*** is often corrugated to grip the wood to help pull it into the cutterhead. The stock then passes under the rotating cutterhead. The cutterhead knives remove wood from the upper surface. The ***chip breaker*** holds the workpiece down and reduces splitting. The ***pressure bar*** holds the stock against the table after the cut is made. The ***outfeed roller*** and a second table roller grab stock to pull it out from under the cutterhead.

Some infeed rollers and chip breakers are in sections. This feature allows workpieces of different thicknesses to be surfaced side by side on the first pass. Without sectional rollers, stock must be fed one piece at a time until all pieces reach a uniform thickness. Then they can be fed side by side.

The exterior components of the planer are shown in **Figure 25-19**. The table adjusting handwheel raises and lowers the table. The planed thickness of stock is shown on the thickness scale. A feed rate handwheel may be present on variable feed-speed machines. An indicator tells the feed rate (feet per minute) of material being planed. There may be one



Powermatic

Figure 25-18. Internal components of a planer.

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Figure 25-19. Exterior components of a planer.

or two switches. With two-switch planers, one controls the cutterhead motor, the other controls the motor for the feed rollers. The table roller adjusting lever raises and lowers the table rollers. Not all planers have this feature.

Table rollers, also called bed rollers, reduce friction between the workpiece and the table, making it easier to feed stock. Table rollers can sometimes inadvertently cause additional material to be removed from the leading or trailing end of the board. This is called ***snipe***, **Figure 25-20**. To reduce the chance of snipe, always set the table rollers to the lowest setting necessary to achieve smooth feeding results.

25.3.2 Planer Setup

There are several steps to complete before operating a planer.

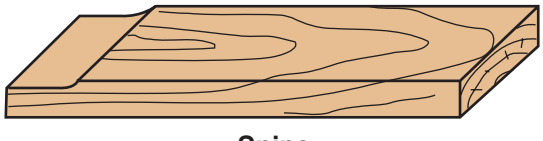

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Figure 25-20. Set table rollers properly to avoid snipe.

Procedure

Planer Setup

Follow these steps to prepare the planer for surfacing:

1. Measure the stock at its thickest point. One face should have already been jointed.
2. Turn the table adjusting handwheel to raise or lower the table. Watch the index mark on the scale. Set the table-to-cutter height 1/16″–1/8″ (1.5 mm to 3 mm) less than the thickness of the stock.
3. Adjust the feed rate. If the feed rate is changed by a shift mechanism, the planer must be off. If it is changed by a variable speed handwheel, the adjustment must be made with the planer running.

The feed rate is chosen according to the width and density of the material, as well as the desired finish. This is referred to as ***knife marks per inch (KMPI)***. Aim for between 16 to 20 KMPI. Slow the feed rate for hardwoods, such as oak. Increase the feed for soft woods, such as pine.

The direction in which the wood is fed will also impact the surface finish. When feeding stock into the planer, the grain should slope upward from the leading end to the trailing end. If the board has cathedral grain, the V will point away from the machine. Refer again to **Figure 25-2**.

25.3.3 Planer Operation

Planer operation is relatively simple. Safe operation of the planer is dependent on following specific steps.

Procedure

Operating a Planer

Follow these steps:

1. Inspect the surface to be planed. Remove loose knots, bark, or debris that could damage the cutter.
2. Read the grain to determine which end of the stock will be fed first.
3. Start the machine and allow it to reach operating speed. Turn on the feed rollers if there is a separate switch.
4. Feed the board straight into the planer. The infeed roller will take hold and control the feed. If it does not, remove the stock and raise the table.
5. Support the stock as it exits the planer.
6. Raise the table and repeat the above steps until the wood reaches the final thickness. Be wary of the planer's thickness gauge if the dimension must be accurate. For the final pass, measure each piece with a rule or caliper for a more exact thickness measurement.

Working Knowledge

Slight amounts of end snipe are not uncommon when planing. This can be caused by bed rollers or a long, heavy board tipping as it enters or exits the cutter. Severe snipe usually indicates the pressure bar, chip breaker, or another part of the machine is not set correctly. It is a good practice to lift the end of the board opposite the cutterhead slightly when feeding and retrieving material. This will usually eliminate the minor snipe that can occur. In any event, avoid measuring the first or last 2″ (51 mm) of a board. Doing so may give an inaccurate reading of the board's thickness.

If the stock binds during the pass, try pushing on the trailing end of the stock. If this fails to feed the stock, move the table roller lever to a higher setting. Otherwise, turn off the planer, wait until the cutter stops, lower the table, and remove the workpiece.

Workpieces must be at least as long as the distance between the infeed and outfeed rollers. These are generally 12″–15″ (305 mm to 381 mm) apart. Shorter workpieces can become wedged under the chip breaker or pressure bar.

Safety in Action

Removing a Wedged Workpiece

If wedging occurs for any reason, you should:

1. Step to the switch side of the infeed opening.
2. Turn off the planer.
3. Lower the table after the cutterhead stops.
4. Push the workpiece out with a stick or other excess material. Never use your hand.

Planing Glued Stock

A wide board composed of several narrow workpieces glued together generally warps less than one solid board. Each piece should have one face and both edges jointed. Glue them together with the jointed faces toward the clamps. Remove excess dry glue with a scraper. Then plane the entire panel to thickness. Use a slower feed rate than normal.

Planing Thin Stock

The minimum thickness for stock is typically 3/8″ (10 mm). However, you can plane material thinner using a backing board. It should be longer and wider than the workpiece, and at least 3/4″ (19 mm) thick. Set the planer cutting depth no more than 1/16″ (1.5 mm) smaller than the combined workpiece and backing board thickness. Feed the workpiece and backing board into the planer together. See **Figure 25-21**.

25.4 Jointer/Planer

The planer and jointer are considered companion machines. They often are placed beside each other. To save space and reduce cost, a single tool, the ***jointer/planer*** is available. See **Figure 25-22**. This multioperational tool uses the same base, cutterhead, and power supply. It converts easily from one process to the other.

Chuck Davis Cabinets

Figure 25-21. Surfacing thin material requires a backing board.

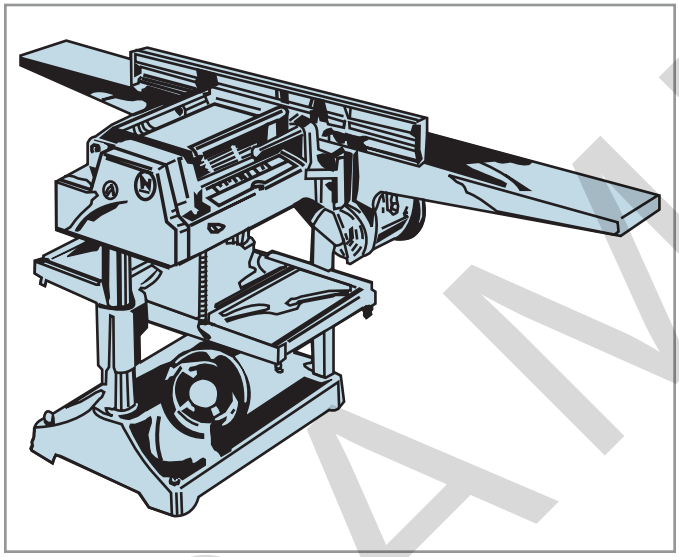

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Figure 25-22. For surfacing operations in a small shop, the jointer/planer is a compact alternative.

25.5 Moulders and Double-Sided Planers

Many shops today use multiple-head moulders to surface their material. A four-head moulder, sometimes called a sticker, will produce S4S material quickly. Rough stock is fed into one end. It passes over a jointing head that flattens the bottom face. The second head joints the right edge of the board square to the bottom face. Then another vertical head squares the opposite edge and machines the stock to width. The fourth and final head planes the top surface, making it parallel to the bottom face and to the desired thickness. See **Figure 25-23**.

Double-sided planers plane the top and bottom faces of stock in one pass. Similar in form to a regular planer, they include a cutterhead on the underside of the table as well as above it. Suppliers often use these machines to skip plane their wood (removing a light amount of material) so buyers can see the grain of the board before purchasing. See **Figure 25-24**.

The major disadvantage with moulders and double-sided planers is that they cannot remove warp from the material. Mechanical feed wheels push the stock tightly to the bed. After machining, bowed wood will spring back to its original shape.

Patrick A. Molzahn

Figure 25-23. Moulders can take rough stock to finished dimensions in one pass.

Newman Machine Co., Inc

Figure 25-24. Double-sided planers are used to surface both sides of a board in one pass.

25.6 Surfacing Machine Maintenance

Surfacing machines must be kept clean, properly adjusted, and lubricated. The cutter should be sharp. Machine maintenance and sharpening are critical to producing flat, unblemished surfaces.

25.6.1 Lubrication

Lubrication is an essential part of preventive maintenance. Moving parts have to be protected from excessive wear. The maintenance manual for your surfacing machine should list the lubrication requirements. It will show a diagram of lubrication points as well as provide a frequency for lubricating. Generally, you should:

- Lubricate rotating shafts and enclosed gear housings (other than sealed bearings). Putting oil on other mechanisms attracts dust, making adjustment difficult.
- Use paste wax, powdered graphite, way oil, or spray silicone for lubricating machine slides, adjusting screw threads, and similar mechanisms.

Partial disassembly may be necessary to locate some lubrication points. Look for grease fittings, oil holes, spring-top oil cups, and screw-type grease cups. Fill these; then make sure the tops are closed. Sealed bearings cannot be lubricated and must be replaced if worn.

25.6.2 Rust Removal

Unpainted and unplated surfaces may rust over time, even when properly stored. Rust can cause excessive friction between the table and the workpiece. Use fine steel wool to remove the rust. Then apply paste wax or spray silicone to the metal. This will reduce friction without staining the wood, although silicone can cause problems with finishing. Establish a schedule for routine maintenance.

25.6.3 Resin Buildup Prevention

Wood resins can build up on machine surfaces and cause many problems. Resin buildup that accumulates on threads, slides, and gears can interfere with adjustments. Buildup on the cutterhead, feed rollers, and table rollers can leave dents and grooves in the planed surface.

Remove resin with a solvent such as turpentine, paint thinner, or kerosene. You may have to disassemble some parts of the planer to gain access to resin buildup areas. Apply a protective coating of paste wax or other lubricant to the cleaned parts.

25.7 Planer and Jointer Knives

There are many tool steels. The basic types are high-speed steel, high-chrome steel, tungsten carbide, and diamond.

High-speed steel (HSS) is the most frequently used knife steel for softwoods and hardwoods. Most tooling manufacturers offer more than one grade. HSS is easily ground with aluminum oxide grinding wheels.

High-chrome steel is recommended for hardwoods because it can take shock. It is effective for woods with high-moisture content. It is also easily ground with aluminum oxide wheels.

Tungsten carbide tooling is available brazed on (carbide-tipped), as inserts, and as two-piece knife systems. A two-piece knife consists of a thin piece of carbide and a thicker piece of corrugated tool steel used as a backer. Brazed carbide has a coarser grain structure and is not capable of as sharp an edge. Carbide is recommended for particleboard, MDF, and extremely dense woods. Carbide tooling may also be profile ground using conventional grinders with diamond wheels.

Diamond tooling is bought already profiled. You lose the versatility that is available with the HSS or tungsten carbide tooling, but gain longer tool life, especially with abrasive materials.

25.8 Keeping Tools Sharp

Keeping tools sharp is a constant concern. Taking the time to sharpen machine knives and cutters increases surfacing quality and may reduce machining time.

Sharpening includes grinding and honing. Grinding is done to remove nicks and excessive wear from knives. Honing removes any burrs caused by the grinding and puts a slight bevel on the ground edge to increase tool life.

Sharpening is an involved process. When surfacing, prevent damage to cutting edges by checking for:

- Nails, staples, or other metal fasteners in the wood.
- Excess glue. Remove as much as possible.
- Any finishing materials. Some pigments are extremely hard and can quickly dull a cutting edge.
- Be aware that woods with a high silica content, such as teak, will dull cutting edges more rapidly.

25.8.1 Inspecting the Machine

Determine the sharpness of knives by looking at them and by listening to the machine. Be careful about touching knives, since even a dull edge can cut.

Partial disassembly may be needed to look at the cutter knives. Inspect the cutting edge under good light. If the tip has a rounded, shiny spot, the knife edge is dull. If the edge is nicked or uneven, it needs grinding. See **Figure 25-25**.

Listen to the machine while it is operating. A low-pitch, low-volume sound usually indicates sharpness because the knives are removing material with ease. A high-pitched, high-volume sound, as well as vibration, can indicate dullness. The knives are forcing their way into the material.

25.8.2 Sharpening and Replacing Knives

Cutterheads come in many varieties. Insert tooling is becoming more popular as an alternative to traditional knives that required frequent sharpening. Carbide knives last much longer than high-speed steel knives. Square inserts feature four cutting edges that can easily be rotated when dull or nicked. Double-edge knives are usually disposed of or recycled when dull rather than resharpened.

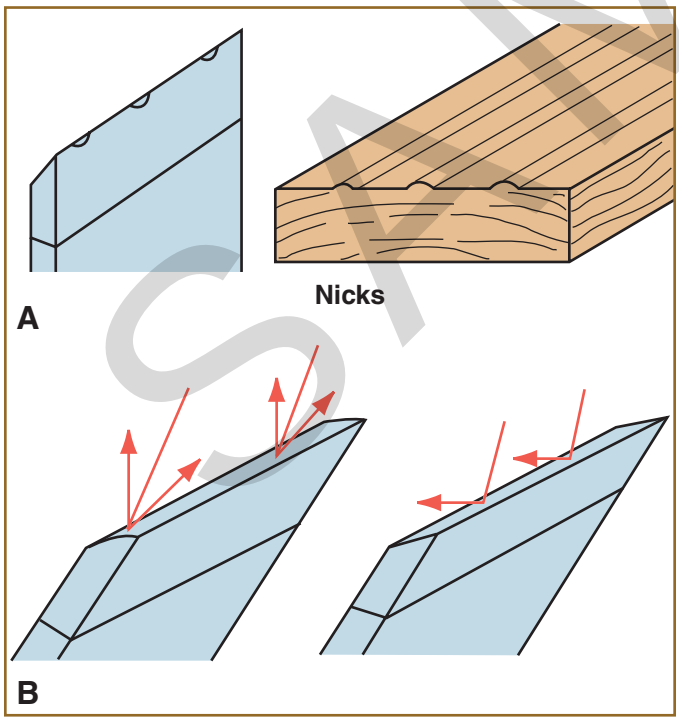

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Figure 25-25. A—Nicks in a planer or jointer blade leave ridges on surfaced material. B—A dull, rounded edge (left) and a sharp edge (right) reflect light differently.

Traditional straight knives made of high-speed steel are still used. If you have a machine with a knife that is showing signs of wear, you will need to make a decision. Should you grind and hone or just hone the edge? Grinding is necessary if there are nicks in the edge or if the knife has been honed a number of times. Honing restores the slight bevel edge on the knife tip.

Grinding

Grinding restores a cutting edge that has been nicked or rounded by wear. The tool may be hand-held or secured in a fixture. In some cases the grinder is attached to the machine. Bench grinders may be adapted with special holding fixtures to secure the knife at the proper angle.

Carbide-tipped jointer and planer knives present a special problem because carbide is very hard. Grinding must be done under special conditions with a diamond grinding wheel and coolant. This requires specialized equipment and is often done by a professional sharpening service.

Excessive pressure during grinding can cause overheating. This can be seen as the knife begins to turn blue. The temper (hardening) is reduced; the knife becomes soft, and as a result, will dull faster. The knife may still be usable, but will need sharpening more frequently.

Be very observant while grinding. Sparks that fly *around* the wheel indicate the edge is dull. The sparks will fly *over* the cutting edge when it is sharp, **Figure 25-26**.

Honing

Honing restores the sharp bevel edge and removes grinding burrs. The edge is hand-rubbed at a slight angle with a fine abrasive stone. Some grinders are equipped with very fine circular

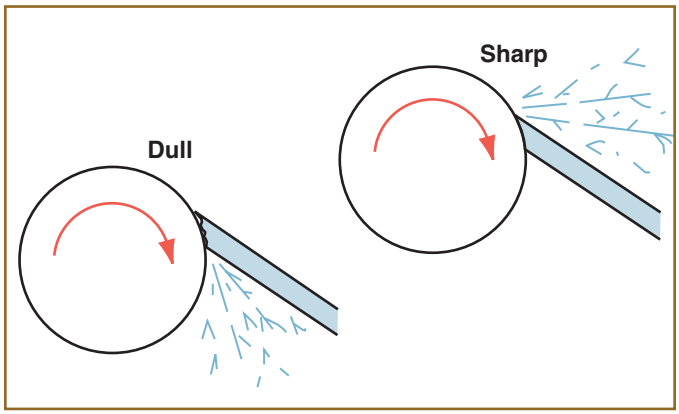

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Figure 25-26. Sparks fly over the tool when it is sharply ground.

honing stones. Honing is done on both cutting edge surfaces. This bends any burrs back and forth until they break off. To check the sharpness, slide a piece of paper across the edge. The paper should slice readily. Any resistance indicates a burr remains on the edge. Do not touch the edge to check the sharpness.

25.9 Sharpening Jointer Knives

Sharpening jointer knives involves two procedures. First, each knife must either be honed, or ground and honed. Then, the outfeed table must be adjusted to the knife height. Always clean off wood chips and resin before inspecting and sharpening the knives.

25.9.1 Knife Honing

Hand honing cutterhead knives is the easiest of all sharpening methods. See **Figure 25-27**.

Procedure

Hand Honing Knives

The process is as follows:

1. Turn the switch off, disconnect the electrical power, and lock out the machine.
2. Move the guard aside or remove it.
3. Remove the fence.
4. Lower the infeed table to its greatest depth of cut.
5. Protect the infeed table with paper and masking tape.
6. Wedge a thin piece of hardboard or plastic laminate between the cutterhead and blade. See **Figure 25-27A**. This holds the cutterhead and further protects the table from damage.
7. Place the stone on the beveled edge of the knife. Rest it on the hardboard or laminate.
8. Slide the stone across each knife the same number of strokes. This should create a very small bevel on the tip of the blade.
9. Move the hardboard behind the knife. See **Figure 25-27B**. Slide the stone across the flat (unground) face of the knives.
10. Raise the table.
11. Replace the guard and fence.
12. Reconnect electrical power to the machine.

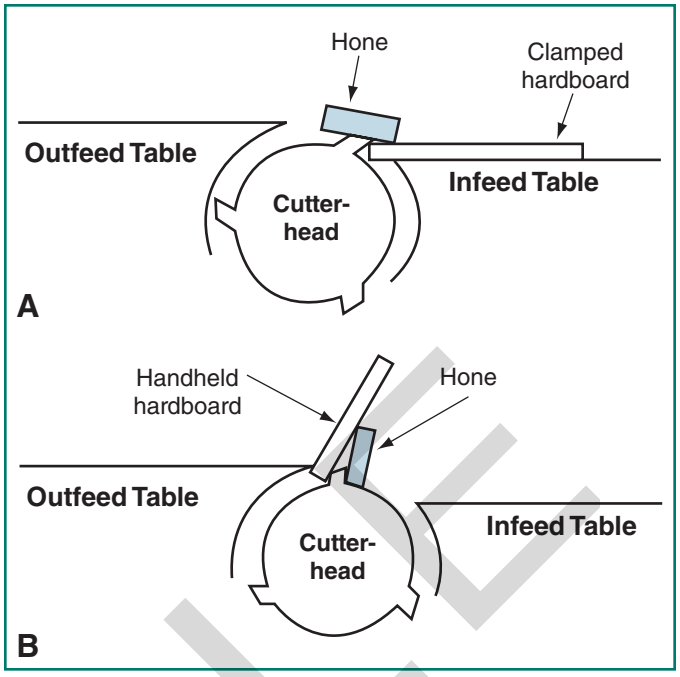

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Figure 25-27. A—Honing the backs of the jointer knives. B—Honing the fronts of the jointer knives.

25.9.2 Jointer Troubleshooting Hints

Typical jointer operation problems are snipe, unwanted taper, washboarding, and knife burns on the surface. Indications of these problems come from workpiece inspection after making a cut. See **Figure 25-28**. Causes of these problems and their solutions are as follows:

- **Snipe.** Outfeed table is lower than the arc of the knives. Raise the table until snipe disappears.
- **Unwanted taper.** Outfeed table is too high. Lower it until the knife is even with table surface.
- **Washboarding.** Workpiece is pushed through the jointer too quickly (or jointer knives are uneven).
- **Knife burns on surface.** Knives are dull or feed rate is too slow.

25.9.3 Removing Jointer Knives

If jointer knives need to be removed, there are special alignment challenges when the knives are replaced. They must each extend an equal distance from the cutterhead. Otherwise, all edges will not contact the workpiece. This can cause a ripple in the jointed surface.

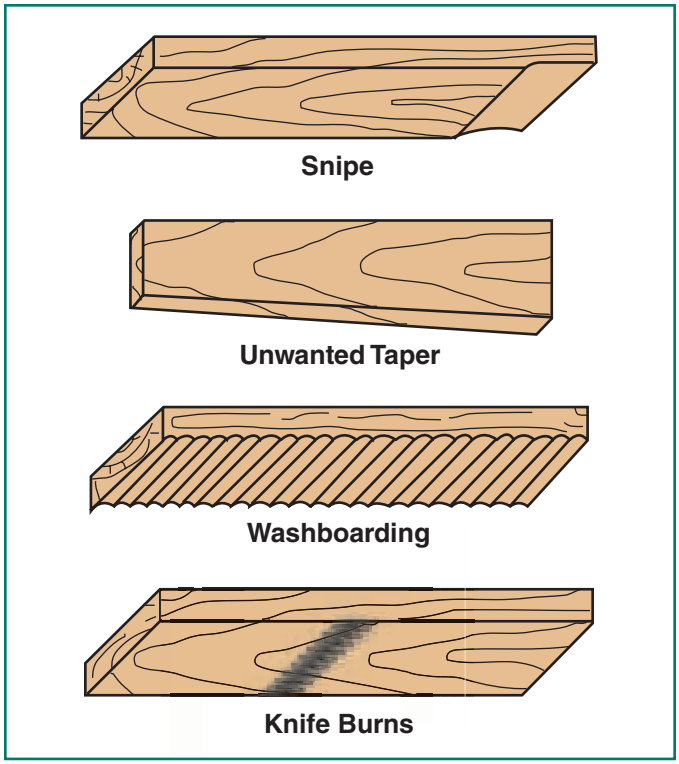

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Figure 25-28. The typical jointer operation problems are snipe, unwanted taper, washboarding, and knife burns on the surface.

Procedure

Removing Jointer Knives

The procedure to remove jointer knives is as follows:

1. With the switch off, disconnect the power and lock out the machine.
2. Remove the guard and fence.
3. Loosen all gib retainer screws 1/8–1/4 turn. Gib retainer screws apply pressure to hold the gib and knife in place. Use a fixture or a wedge to hold the cutterhead and knife steady. Otherwise, place hardboard over the knife. Pull up and away from the cutting edge to loosen the screws. Use the proper wrench; start from one end, and proceed across the knife. Apply a penetrating solvent if the screws will not turn.
4. Loosen the screws until the gib (steel bar that holds the knife in place) can be lifted out.
5. Remove the jointer knife.

After removing knives, clean the gibs, gib screws, and cutterhead with mineral spirits or other solvent.

Knives should be ground on proper equipment by experienced technicians. Do not use a standard bench grinder and fixture. They are not accurate enough for the precision required for the jointer. Professionals will also hone the knives for you after grinding them.

Working Knowledge

Many jointers and planers now come with segmented insert cutterheads. See **Figure 25-29**. When a knife is dull or nicked, simply loosen the gib and rotate or replace the knife. Older jointers can often be retrofitted with new heads.

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Figure 25-29. These self-locating, carbide inserts can be changed easily by loosening the set screw.

25.9.4 Installing Jointer Knives

Traditional knives need to be sharpened and reinstalled. This requires all knives to be accurately set so that they project the same distance from the cutterhead. You may use:

- A gauge especially designed for setting knives.
- A magnet that is perfectly flat. See **Figure 25-30A**.
- A straightedge, **Figure 25-30B**.

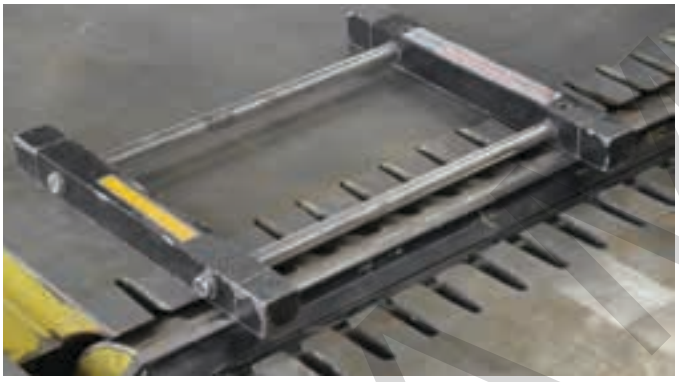
Procedure

Installing Knives

The procedure for installing knives is as follows:

1. Check to see if there are lifter adjusting screws in the knife pocket. If there are lifters, make sure they turn easily. Both the gib and knife often sit on lifters.
2. Place the knife in the slot properly with the gib against it.
3. Align the ends of the knives.

4. Lightly tighten each gib screw for all knives with one to two pounds of torque.
5. Set the alignment device (gauge, magnet, or straightedge) near the ends of each knife.
6. Adjust the height of every knife by turning the lifter screws. Manufacturers provide specifications for the amount the knife protrudes from the cutterhead. Many recommend a maximum 0.125″ (3 mm) from the knife edge to the cutterhead.
7. Recheck the knife height using the gauge, magnet, or straightedge.
8. Torque each retainer screw to between 40 and 50 foot-pounds (ft lb) or 54 to 67 newton meters (N • m). A ***newton meter*** is a measure of torque in the SI system. Verify torque settings with your machine manual or tooling provider.
9. Replace the fence and guard.
10. Reconnect electrical power to the jointer.
11. Stand aside and turn the machine on and off quickly. Listen for any unusual sounds.



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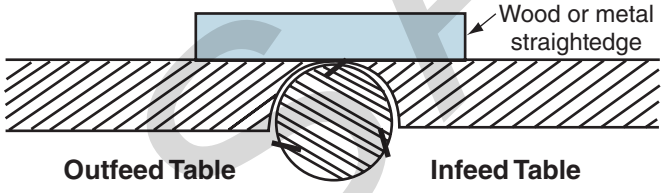

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Figure 25-30. Setting the height of jointer knives. A—Using a magnetic setting jig to hold the knife. B—Using a straightedge.

Working Knowledge

Some jointers have a rabbeting arm for making rabbet joints. If your jointer is so equipped, you should align the ends of the knives as closely as possible. They should each extend about 0.005″ (0.13 mm) beyond the outfeed table's edge.

After the jointer is reassembled, check the outfeed table adjustment. It should be perfectly even with the top dead center of the knives. If not, the stock will not feed properly. Adjust the outfeed as described earlier.

25.9.5 Checking for Nonparallel Infeed and Outfeed Tables

Over time, infeed and outfeed tables can become misaligned. They should be checked periodically or when defects are noticed to ensure that they are parallel.

Procedure

Correcting Table Misalignment

Suppose you have made several passes with the jointer. When you check the workpiece, you find the jointer is cutting a taper. More material is being removed at one end than the other. To correct this problem, you should:

1. Set the infeed table to zero cut.
2. Place a long straightedge across both tables.
3. Look between the straightedge and the tables. See **Figure 25-31**. There should be no light passing between them.
4. If the tables are not parallel, adjust the outfeed table as instructed in the manufacturer's maintenance manual. For example, there may be an adjustable cam for this purpose. If you have an older model jointer with no adjustments provided, place metal shims where the outfeed table and machine base castings join.

Working Knowledge

Do not shim the infeed table. The shims will eventually work loose and fall out as a result of frequent adjustment cycles. The outfeed is rarely adjusted and is, therefore, the better table to shim to correct any misalignment.

25.10 Planer Maintenance

Planer maintenance includes sharpening the planer knives and adjusting the tables, rollers, and other components of the machine. If a planer is not properly adjusted, serious defects in surfaced stock will result, **Figure 25-32**.

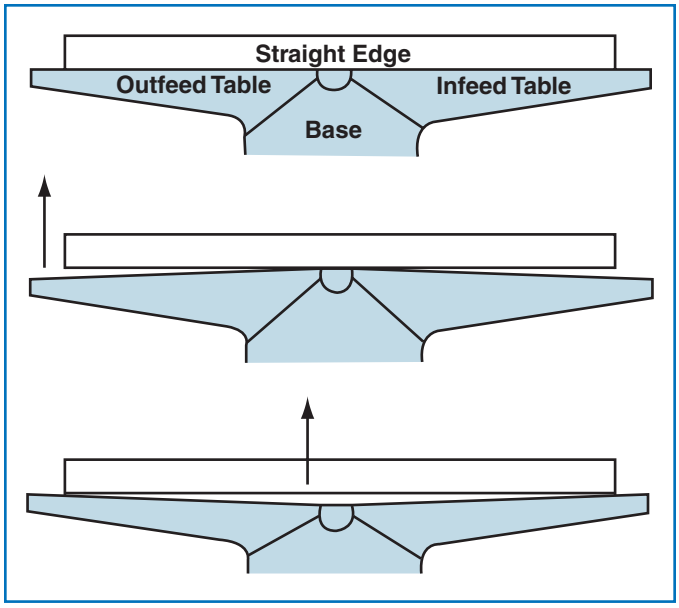

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Figure 25-31. Inspect whether infeed and outfeed tables are parallel. Adjust the outfeed table as necessary.

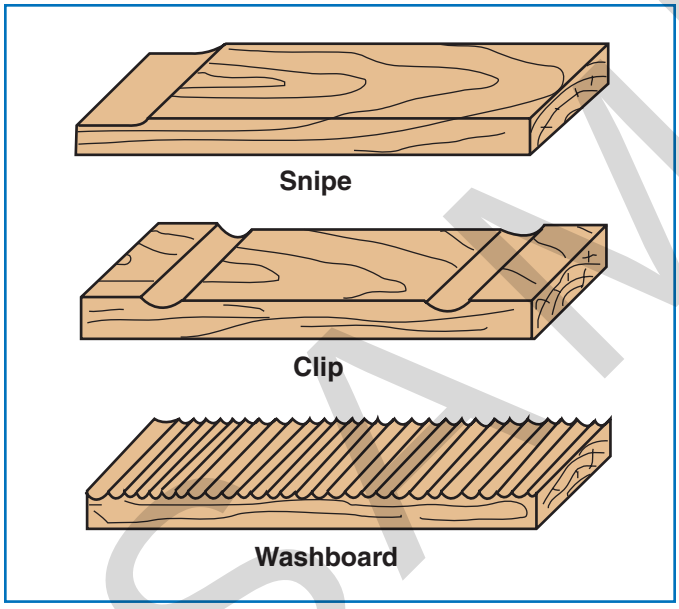

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Figure 25-32. Snipe, clip, and washboard result from inaccurate planer settings.

25.10.1 Sharpening and Replacing Planer Knives

If your planer is equipped with insert tooling, simply turn or replace the inserts. Older style planer knives can often be jointed or ground in place. These processes can be done with the knives in the machine using special attachments.

Jointing Planer Knives

Jointing restores the cutting edge to planer knives. The jointing procedure may vary slightly among planers. Each machine manufacturer may have different sharpening attachment setup procedures. However, the procedure is basically the same.

Procedure

Jointing Planer Knives

The jointing procedure is as follows:

1. With the switch off, disconnect the power and lock out the machine.
2. Remove the top cover.
3. Position the jointing attachment on the machine, Figure 25-33. On some machines, this attachment is permanently mounted in the machine.
4. Secure the jointing bracket in the attachment. The bracket holds the jointing stone.
5. Lower the stone. It should touch a high spot on the knife very lightly. This is likely to be at one end of the knife. This is where the cutting edges have been used the least.
6. Move the jointing assembly to the left or right on each knife. Raise the stone if it drags on any of the knives.
7. Position the jointing bracket to the side of the machine next to the handwheel.
8. Reconnect electrical power.
9. Stand to the side of the machine on the side of the jointing attachment handwheel. Make sure you are not in line with the table. Turn on the machine.
10. Turn the handwheel so the jointing stone traverses the full length of the knives. Light sparks will fly as the stone makes its pass. Sparks will not be visible where the knives are worn.
11. Lower the stone slightly. Stop when you see the first sparks.
12. Turn the handwheel and move the stone back across the knives. Watch the sparks. If you see light sparks throughout the travel, then stop the machine.
13. Inspect the knives. You should see a secondary surface on the knife edge. This is called the land and it should be 0.020″ (0.5 mm) or less in width.
14. Remove the jointing attachment and replace the top cover.

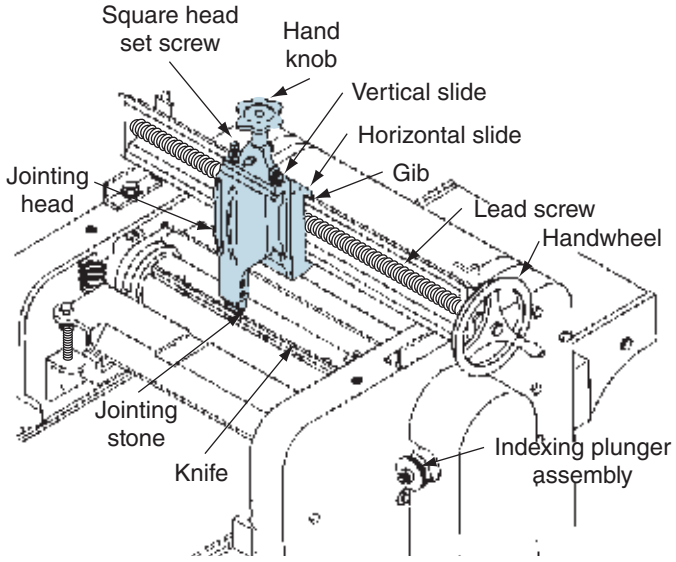

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Figure 25-33. Jointing ensures that all knives project equally, enabling faster feed rates. The jointing attachment is bolted to the machine.

Working Knowledge

Most surfacers in a small to medium shop produce a one-knife finish. That is, while all knives are cutting, only one knife leaves the visible scalloped finish on the material. This is a result of multiple factors, including knives projecting at slightly different distances and run out, or movement, in the bearings of the cutterhead. Industrial planing operations often joint their cutterheads while the machine is running. This results in all knives producing the finishing cut, and allows them to increase the rate of feed significantly.

Grinding Planer Knives

You may joint the knives several times before the bevel, or land, on the edge of the knife exceeds 0.020″ (0.5 mm). Then grinding is necessary. Grinding may be done while knives are installed or after they are removed.

Procedure

Grinding Planer Knives

The method for grinding knives while they are installed in the machine is:

1. Turn the switch off, disconnect electrical power, and lock out the machine.
2. Remove the top cover.
3. Install the grinding assembly, Figure 25-34.
4. Lock the cutterhead in position with the indexing plunger assembly. The knife must be directly under the grinding wheel.

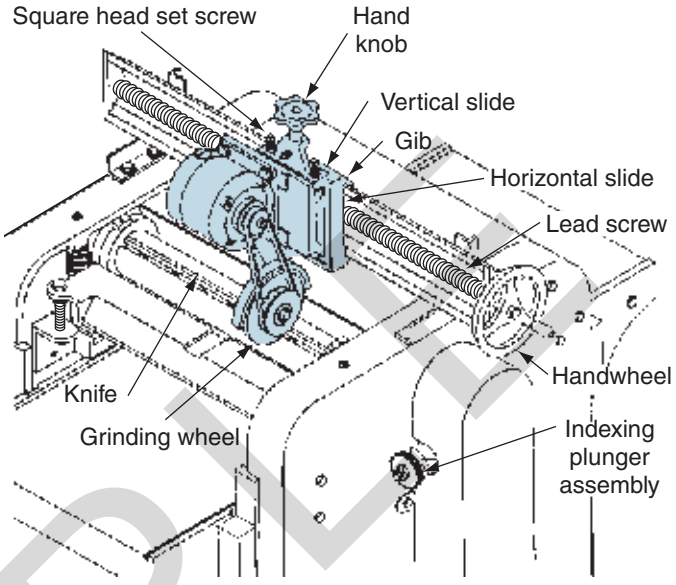

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Figure 25-34. Grinding attachments.

5. Lower the grinding wheel until it touches the knife. Do this at the highest point on the knife's length. Never let the grinding wheel touch the cutterhead.
6. Turn the grinding wheel by hand. It should produce a few very light scratches on the knife. These will show if the wheel is touching the knife properly.
7. Move the grinding wheel off the end of the knife by turning the handwheel.
8. Connect the grinder to electrical power.
9. Turn the handwheel while the grinder is operating. Traverse the entire length of the cutterhead. Do not let the grinding wheel sit at one spot on a knife.
10. Lower the grinding wheel slightly. Again, move the wheel the entire length of the knife. Do this until the knife edge is about 0.003″ (0.08 mm) wide. This is approximately the thickness of a piece of paper. There is no need to remove the entire surface. This results in a thin, wiry edge that can easily break off.
11. Note the setting on the grinding wheel. Then raise it just more than the total distance you lowered it. (This is done so the wheel clears the next knife.)
12. Unlock the indexing plunger and rotate the cutterhead so another knife is facing up. Relock it.
13. Continue to grind knives and rotate the cutterhead. Grind until you reach the depth noted on the first knife.
14. Remove the grinding attachment.
15. Secure the top cover.
16. Reconnect electrical power.

If you do not have a grinding attachment, remove the knives and have them sharpened by a professional.

Procedure

Removing Planer Knives

To remove the knives, you must:

1. Turn the switch off and disconnect electrical power and remove the planer's top cover.
2. Loosen the gib retaining screws. See **Figure 25-35**. They hold the gibs against the knives. Pull up and away from the cutting edge to avoid cutting yourself. If accumulated resins make the screws difficult to loosen, use mineral spirits or other solvent to dissolve the resin.
3. Lift the knives out by the ends.
4. Remove the gibs.

Once removed, have the knives sharpened by a professional. Then the knives must be reinstalled and precisely adjusted.

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Figure 25-35. Loosen gib retaining screws to remove planer knives.

Procedure

Reinstalling Planer Knives

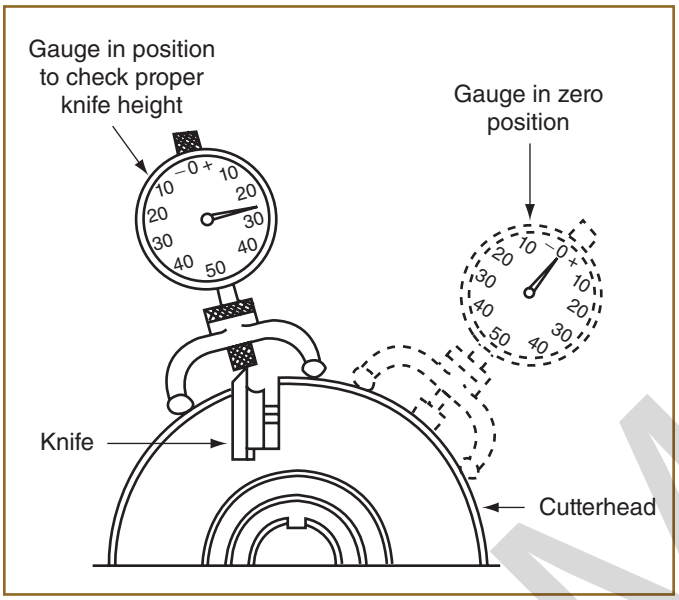
This process is:

1. Turn the lifter screws so the knife lifter sits at the bottom of the knife slot.
2. Place the knives and gibs in the cutterhead slots.
3. Tighten the end screws on each gib with about 1 to 2 ft lb (1.35 to 2.70 N • m) of torque. This is snug enough to keep them in place. Always tighten screws by pulling the wrench. Do not push it toward the cutting edge.
4. Adjust each knife with a template or dial indicator, **Figure 25-36**. Place the template or indicator over the sharp edge. Turn the adjusting screws as necessary. Raise the knife by turning the adjusting screws clockwise. When lowering the knife, turn adjusting screws counterclockwise. Then tap on the knife with a piece of wood to lower it.

5. Use a torque wrench to tighten each gib screw with 30–50 ft lb (40–67 N • m) of torque.
6. Inspect each knife setting when the gibs are secure. Use the template or dial indicator.

Some machines have very long knives that tend to warp. The center of the installed knife may be low or high. Check both ends and the center when the gib screws are lightly torqued. If the center is high, set the center lifter first. Moderately torque one or two of the center gib screws. Then turn the lifter adjusting screws on each end. This will raise the knife ends to the same setting as the center.

If the center is low, set both end adjusters first. Next torque several end gib screws. Then turn the center knife lifter screws to raise the center. Finally, fully torque all of the gibs.



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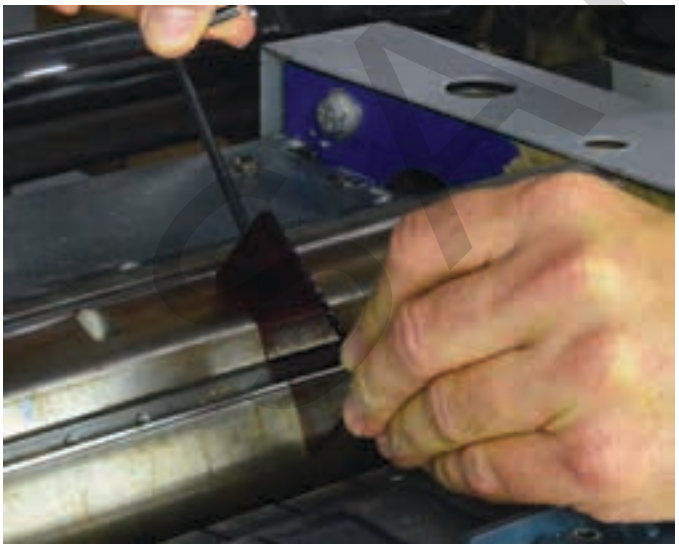

B

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Figure 25-36. Setting planer knife height. A—A dial indicator is very accurate. The indicator should read zero over the cutterhead. B—A template can also be used to set knife height. Many newer planers offer insert knives which can simply be changed when dull, without needing to readjust the knife height.

25.10.2 Adjusting the Planer

For a planer to function properly, the major parts must be set correctly. Adjustments should be checked after the knives are sharpened. You will need a dial indicator on a flat base. See **Figure 25-37**. Settings to be checked include:

- Planer table.
- Infeed roller.
- Chip breaker.
- Outfeed roller.
- Pressure bar.
- Table rollers.

Safety Note

When performing any adjustments on a planer that require inspection of the cutterhead, make sure the machine is locked out to prevent accidental start-up.

Table Setting

The planer table is generally set first. The table-to-knife distance must be the same on the left and right sides. Rarely do you need to adjust the table.

Patrick A. Molzahn

Figure 25-37. Planer adjustments are made using a dial indicator on a flat base.

Procedure

Adjusting the Table

However, periodically check it as follows:

1. Place the dial indicator directly under the cutterhead. Set it to the left or right side of the table. The knife edge must be at its lowest point.
2. Raise the table until you get a reading.
3. Move the indicator to the other side. Compare the dial readings. They should be within 0.001″ (0.025 mm) of each other.
4. If adjustments are necessary, consult your machine manual. Machines can differ in how they are adjusted. Look for an adjusting nut and set screw where the table raising screw and table meet. Loosen the set screw. Turn the adjusting nut to correct the difference. Retighten the set screw.

Infeed Roller Adjustment

The infeed roller may be solid or in sections. It is mounted on a spring that allows the roller to rise when stock is fed into the machine. The roller must be set lower than the table-to-knife setting. On a solid roller, it should be 1/32″ (0.8 mm) lower. On a sectional roller, it should be 1/16″ (1.5 mm) lower.

Compare dial readings under the knife and under the roller. They should differ by 0.031″ (0.8 mm) for solid rollers or 0.062″ (1.6 mm) for sectional rollers.

Chip Breaker Adjustment

The chip breaker is spring loaded like the infeed roller. You will find a set screw and locknut at each end. Using a dial indicator, adjust these so the chip breaker is 0.031″ (0.8 mm) below the knife edge. A chip breaker set too low will prevent the workpiece from feeding. A high setting may allow wood to tear and split. It can also cause snipe on the leading edge of the board. The same setting is used for solid and sectional breakers. If you adjust the infeed roller, you must adjust the chip breaker.

Pressure Bar Adjustment

Many planer-caused defects are the result of an improperly set pressure bar. Its function is to hold material down after passing under the cutterhead. The bar should be in line with the arc of the cutterhead knives. If it is too high, a shallow clip will occur at each end of the board. Refer again to **Figure 25-32**. If it is set too low, stock will not feed through.

To set the pressure bar, place a dial indicator on the table bed under the cutterhead. Adjust the table so the bottom arc of the cutter just touches the indicator. Then move the block under the pressure bar. Adjust the bar so it is no more than 0.001″ (0.025 mm) above the arc of the cutterhead. Fine adjustments may still have to be made after a test cut.

Outfeed Roller Adjustment

Behind the pressure bar is the outfeed roller. It is also spring loaded. Its setting is identical to the chip-breaker adjustment. Set screws and locknuts at the ends control the setting.

Table Roller Adjustment

Table rollers raise the workpiece off the planer table as it passes through the machine. This reduces friction so the infeed and outfeed rollers can move the stock more easily. On most planers, table rollers are set 0.008″ (0.2 mm) above the table with the table roller adjustment lever set at zero. (Not all planers have table rollers.) Some dial indicators can be set upside down to check the roller adjustment. Preset the dial at zero against the table. Then move the indicator over the roller. Set screws and locknuts hold the rollers at the proper setting.

25.10.3 Testing the Planer

After all adjustments have been made, plane a length of scrap wood. There may be some visible planer defects. The most common are clip, snipe, and washboard. Troubleshoot and eliminate these and other problems. See **Figure 25-38**. This may require resetting some of the planer adjustments.

Troubleshooting Hints		
Problem	**Cause**	**Solution**
Board will not feed through.	1. Pressure bar too low. (most common cause) 2. Table rollers too low. 3. Insufficient pressure on infeed roller or outfeed roller. 4. Cut too deep.	1. Readjust pressure bar. 2. Raise roller with quick-set handle. 3. Increase pressure equally on both sides. 4. Reduce cut to capacity of machine.
Snipe appears at beginning of board only.	1. Front table roller set too high.	1. Readjust front table roller.
Snipe appears at end of board only.	1. Rear table roller set too high.	1. Readjust rear table roller.
Chip appears 3–6″ (7.6-15.2 cm) from both ends of the board.	1. Pressure bar set too high. 2. Table roller set too high.	1. Readjust pressure bar. 2. Check position of quick-set handle and if at zero, readjust table rollers.
Board appears to splinter out.	1. Excessive feed. 2. Cutting against grain. 3. Chipbreaker too high. 4. Green lumber.	1. Reduce feed. 2. Reverse starting end of workpiece. 3. Lower chipbreaker. 4. Accept surface as is or change stock.
Knives raise grain.	1. Dull knives. 2. Green lumber.	1. Sharpen knives. 2. Accept surface as is or change stock.
Chip marks appear on stock.	1. Exhaust system not working properly. 2. Loose connection in exhaust system. 3. Chips stuck on outfeed roller.	1. Repair or replace. Check for proper duct sizing. 2. Repair. 3. Clean roller.
Taper across width.	1. Table not parallel with cutterhead.	1. True table to cutterhead.
Glossy or glazed surface appearance on stock.	1. Dull knives. 2. Too slow a feed.	1. Resharpen knives. 2. Increase feed.
Washboard surface finish.	1. Knives not set at the same height. 2. Too fast a feed rate. 3. Table gibs loose.	1. Reset knives. 2. Reduce feed rate. 3. Readjust gibs.
Chatter marks across width of board. (Small washboard.)	1. Table rollers too high (particularly) noticeable on thin material.	1. Use backing board.
Line on workpiece parallel to feed direction.	1. Nick in knives. 2. Scratch in pressure bar.	1. (a) Resharpen knives, to remove nick. (b) Offset nick mark if possible. (c) Replace knives if nick too wide or deep. 2. Hone pressure bar smooth.
Excessive noise.	1. Dull knives. 2. Joint on knives too wide. 3. Table roller too high for workpiece thickness.	1. Resharpen knives. 2. Regrind knives. 3. Lower table rollers.
Excessive vibration.	1. Knives not sharpened evenly such that they are different heights.	1. (a) Measure knives, set for even overall height and resharpen. (b) Replace knives.
Workpiece twists while feeding.	1. Pressure bar not parallel. 2. Table rollers not parallel with table. 3. Uneven pressure on infeed or outfeed roller. 4. Chipbreaker not parallel. 5. Resin buildup on table.	1. Readjust pressure bar. 2. Reset table rollers. 3. Readjust for even pressure. 4. Readjust chipbreaker. 5. Clean table.
Main drive motor kicks out.	1. Excessive cut. 2. Bad motor. 3. Dull knives.	1. (a) Reduce depth of cut. (b) Reduce feed rate. 2. Replace motor. 3. Resharpen knives.
Feed motor stalls.	1. Bad motor. 2. Lack of lubrication on idlers.	1. Replace motor. 2. Lubricate idlers.

Powermatic

Figure 25-38. Learn to troubleshoot and correct planer problems.

Summary

- Surfacing is a fundamental process in cabinetmaking. Creating flat and square cabinet parts is essential for producing high-quality products.
- The jointer and planer are part of the surfacing process. One surface and both edges are jointed. The second surface is planed.
- Read the grain in order to properly surface your workpiece. The grain pattern is the figure formed by cutting across the annual rings of a tree.
- Problems arise when surfacing cross-grain lumber. Feeding the wrong direction can result in the cutter chipping, tearing, or splitting the wood.
- When surfacing cross-grain faces, feed so the V-shape grain pattern points away from the cutter. For edges, feed so the V-shape points toward the jointer cutter.
- The jointer is a multipurpose tool for surfacing face, edge, and end grain.
- Jointer components include the cutterhead, guard, infeed table, fence, and outfeed table.
- Before operating a jointer, check the setup. Then decide how to feed the stock.
- Jointers are used first when squaring stock. The typical sequence is to joint one face of a board, then one edge. Next, surface the other face to final thickness with the planer and then rip the board to width.
- Other jointer processes include beveling, rabbeting, and tapering
- A planer is used to surface the second face of a board so it is parallel to the first face.
- Interior planer components include an infeed roller, chip breaker, pressure bar, and outfeed roller. Exterior components include the table height adjustment, on/off switches, main power disconnect, depth of cut scale, bed roller adjustment, bed rollers, and variable speed adjustment.
- Planer feed rate is determined based on the width and density of the material, and the desired finish.
- Before operating a planer, check the setup, inspect the surface to be planed, and read the grain to determine which end will be fed first.
- Keep surfacing machines clean, properly adjusted, and lubricated. Remove rust and resin buildup when necessary.
- Basic types of planer and jointer knives include high-speed steel, high-chrome steel, tungsten carbide, and diamond.
- Maintain tool sharpness by inspecting the machines and sharpening and replacing knives when necessary.
- Sharpening jointer knives involves two procedures. First, each knife must either be honed, or ground and honed. Then, the outfeed table must be adjusted to the knife height.
- Typical jointer operation problems are snipe, unwanted taper, washboarding, and knife burns on the surface.
- Over time, infeed and outfeed tables can become misaligned. They should be checked periodically or when defects are noticed to ensure that they are parallel.
- Planer maintenance includes sharpening the planer knives and adjusting the tables, rollers, and other components of the machine.
- Check planer adjustments after knives are sharpened.
- After all adjustments have been made, plane a length of scrap wood. Troubleshoot and eliminate any problems.

Test Your Knowledge

Answer the following questions using the information provided in this chapter.

4. The process of jointing, followed by planing, brings stock to a desired _____.
5. What is meant by *reading the grain* of a piece of wood?
6. List the five major components of a jointer.
7. The depth of cut on a jointer is set by raising or lowering the infeed table below the top of the _____.
5. *True or False?* The outfeed table should be set at exactly the same height as the cutterhead knives.
6. List two steps to take before operating a jointer.
7. List the steps taken when squaring a board.
8. The depth of cut for most jointing should be _____.
   A. 1/32″–1/16″
   B. 1/16″–1/8″
   C. 1/8″–1/4″
   D. None of the above.
9. *True or False?* Place the cupped side down when face jointing to prevent the material from rocking.
10. Why is the planer infeed roller corrugated, while the outfeed roller is not?

11. What is the benefit of having an infeed roller or chip breaker that is in sections?
12. During planer setup, raise or lower the planer table so it is _____ less than the stock thickness.
    A. 1/32″–1/16″
    B. 1/16″–1/8″
    C. 1/8″–1/4″
    D. None of the above.
13. The _____ is chosen according to the width and density of the material, as well as the desired finish.
    A. pressure bar weight
    B. cutterhead speed
    C. feedrate
    D. bed roller setting
14. *True or False?* Stock less than 3/8″ (10 mm) should be fed on top of backer board.
15. Which of the following lubricants can be used to lubricate slides and screw threads?
    A. Paste wax
    B. Spray silicone
    C. Graphite
    D. All of the above.
16. List four types of tool steel used for planer and jointer knives.
17. _____ is done to remove nicks and excessive wear from knives.
    A. Honing
    B. Polishing
    C. Grinding
    D. Sniping
18. Determine the _____ of knives by both looking at the knives and listening to the machine.
    A. hook
    B. rake
    C. bevel
    D. sharpness

Match the recommended setting with the correct planer part.

A. 0.062″ below knife edge
B. 0.031″ below knife edge
C. 0.000″–0.001″ side-to-side
D. 0.008″ above the table
E. 0.000″–0.001″ above the cutterhead arc

19. Planer table
20. Section infeed roller
21. Chip breaker
22. Pressure bar
23. Table rollers
24. *True or False?* Truing restores the sharp bevel edge and removes grinding burrs.
25. *True or False?* When removing both jointer and planer knives, you must loosen the gib retaining screws that hold the knives in the slots.
26. List the tools used to set knife height for both jointers.

Critical Thinking

1. Your customer is complaining about the surface quality of the boards you planed for them and is refusing to pay for your work. How would you attempt to resolve the situation?
2. What are some of the potential benefits of being able to sharpen your own tooling?

Suggested Activities

1. Most planers have a speed control to adjust feed rate. When a board is fed faster, the number of knife marks per inch (KMPI) decreases. Use the following formula to calculate the KMPI for various speed settings on your planer:

$$\frac{\text{RPM of cutterhead} \times \text{number of knives*}}{\text{Feed rate in feet per minute} \times 12}$$

*Note: Unless you are using a jointed cutterhead, not typical of most planers, use "1" for this value, as only one knife is leaving the final finish on the stock.

Share your answers with your instructor.

2. Obtain one board for each speed setting on your planer. If your planer is variable speed, select a maximum of four boards. Plane the surface of each board using a different speed setting. Carefully measure the KMPI. Use chalk or a lumber crayon to help highlight the marks if they are difficult to see. Compare your results with the calculations from the previous task. Do they match? Share your results with your instructor.
3. Using the operator's manual for your planer, locate the recommended maintenance tasks. Make a list of these tasks, including how frequently they should be done. Share this list with your instructor.