

BOWLING GREEN STATE UNIVERSITY
SCHOOL OF ART
WOODSHOP MANUAL

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1. General Reference

1.1 Introduction

The woodshop offers a variety of different tools for performing different types of cuts and functions. The following is a general guide outlining the most common types of cuts and which tools typically perform them. It should be noted that this listing is not exhaustive and that special circumstances can require the utilization of a tool in a manner not outlined below.

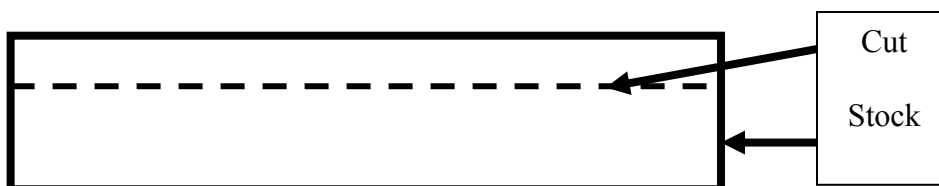
In deciding which tool is the best tool for the job, the type of wood being manipulated, its dimensions, the required level of accuracy, as well as the skill level of the worker all influence the choice. If in doubt about which tool to select, or if you find yourself uncomfortable in performing a cut, contact one of the art technicians for advice and assistance. Your fingers are far more important than expedience.

1.2 Machine vs. Hand

Although power tools offer an expedient means to moving wood quickly and easily, they are sometimes not the best choice in achieving the goal. Good old-fashioned hand working can be as accurate, easier, and a more efficient means to a goal. The choice between power and hand tools is dependent upon many factors. Those factors include the complexity of the cut, the number of cuts to be made, and the time available for doing the work.

1.3 Rip-cuts

Rip-cuts are traditionally understood as cuts made along the grain of the wood. In this manual we will also refer to cuts along the longest axis of the stock as rip-cuts.



Primary tools for making rip-cuts

- a) Table Saw
- b) Band Saw
- c) Hand Saw
- d) Coping Saw

1.4 Cross cuts

Crosscuts are traditionally understood as cuts made across the grain of the stock. Here we will also refer to cuts along short axis of the wood as cross-cuts.

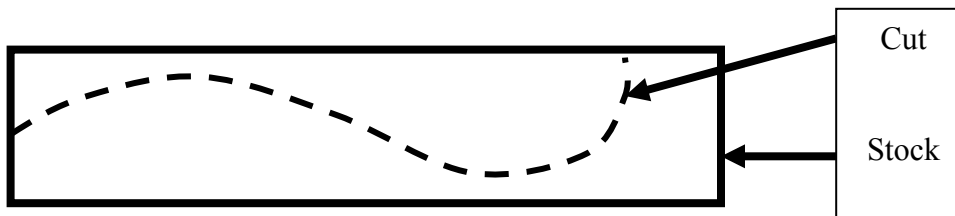


Primary tools for making cross-cuts

- a) Compound Miter Chop Saw
- b) Radial Arm Saw
- c) Panel Saw
- d) Band Saw
- e) Hand Saw
- f) Coping Saw

1.5 Curved cuts

Depending upon the size of the stock being cut, its thickness, as well as how small a radius curve is desired, different tools are available.

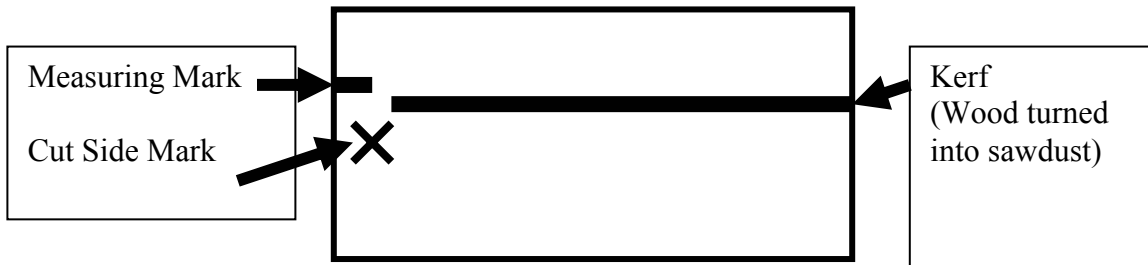


Primary tools for making curved cuts

- a) Band Saw
- b) Jig Saw
- c) Scroll Saw
- d) Coping Saw

1.6 The Kerf

Most power saws remove about 1/8" of wood when a cut is made. The line that the saw makes when it cuts through the wood marks that part of the board that has been turned into sawdust. The actual amount of wood lost is dependent upon the type of tool and blade being used. When preparing to make a cut, first measure and mark the wood where the cut needs to be made. Then draw an "X" on the scrap side of the mark to indicate where to line up the blade. Do not line up the blade directly on your mark. Line it up on the "X" scrap side of your mark.



1.7 Shop Introduction

Although the woodshop can be a hazardous place to work, it is no more dangerous than driving a car or using an elevator. However, you should be cautious when any equipment is being used, either by you or by anyone else.

Below is a list of the fundamental rules of the woodshop:

- Everyone working in the shop must read and adhere to the posted safety rules.
- Wear safety glasses at all times.
- Ear protection should be used if working within the woodshop for extended periods of time, as well as with some of the more noisy equipment.
- No loose clothing, hair, or jewelry. No gloves, no open toe shoes or sandals.
- No cutting “green wood” (fresh, not dry), or treated wood (which is stained green and contains arsenic).
- Wood needs to be free of all metal objects (i.e. staples, nails, screws, etc.).
- The appropriate dust collector should be turned on when cutting.
- If producing a lot of wood dust (as in sanding) a proper respiratory protection device should be utilized (dust mask).
- Due to limited space there will be no storage of supplies or projects.
- Tools are to be used correctly and not to be abused.
- Students are only allowed to work in the woodshop while being supervised.
- Do not use a tool unless you have been trained in its proper use.
- Do not operate any tools while under the influence of alcohol or drugs, or extremely tired or sick.
- You must be a BGSU School of Art Student, faculty, or staff member to use the woodshop.
- Clean up and put tools away before you leave. The shop should be kept in an orderly and clean manner at all times.
- All guards and safety equipment must be in place and used.
- Tools must be unplugged whenever the cutting part of the tool is being handled (as when changing drill bits and saw blades).
- Never leave a power tool running and unattended. Turn off before walking away from tool.

- Tools are not checked out.
- **This is in no way to be considered a totally comprehensive list of the shop's rules and requirements. Working with power tools always requires a level of common sense which must be exercised at all times**

2. Dust Collectors

Most of the power tools in the woodshop are connected to the two dust collectors. When using these tools the appropriate dust collector must be turned on and the appropriate air gate must be opened.



An open air gate.

2.1 Delta Dust Collector

The tools connected to this system are: the sanding station, drum sander, table saw, 20" band saw, radial arm saw, and the compound miter saw.

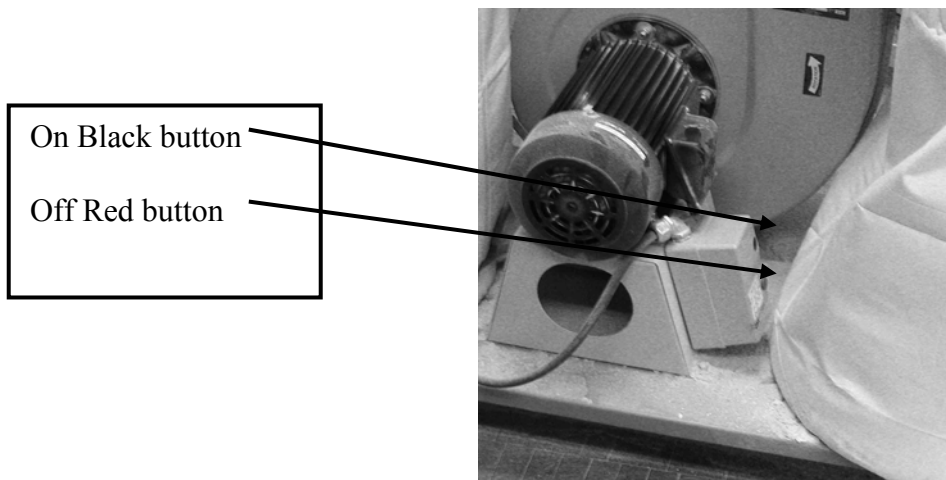


Deflated dust collector



Inflated

1. To turn on push the black button located under the motor.



2. The air gate connected to the tool you are using must be pulled out to open it.
3. To turn off push the red button.
4. Push in the air gate connected to the tool you used when done.

2.2 Arrestal Dust Collector

The tools connected to this system are: The sanding table, lathe, shaper/router table, and the oscillating spindle sander.

1. To turn on push the green button.



2. The air gate connected to the tool you are using must be pulled out to open it.

3.To turn off push the red button.

4. Push in the blast gate connected to the tool you used when done.

3. Table-saw

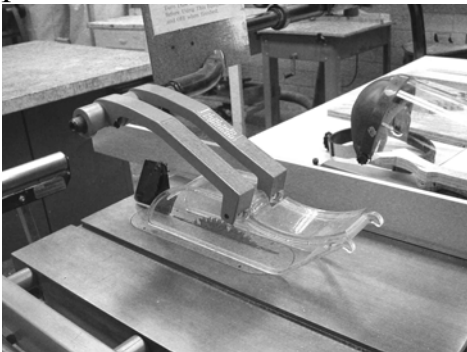
3.1 Introduction

The table-saw is the central tool of the woodshop. Its primary function is to perform the basic rough cutting of stock—but its unique design enables it to be quite versatile, allowing it to perform a wide variety of jobs. The tool is also one of the most dangerous of the shop and needs to be operated with care

NOTE: Before making any adjustments to this tool, be sure that it is off and the blade is not moving. Any manipulation within the blade area requires the tool to be unplugged.

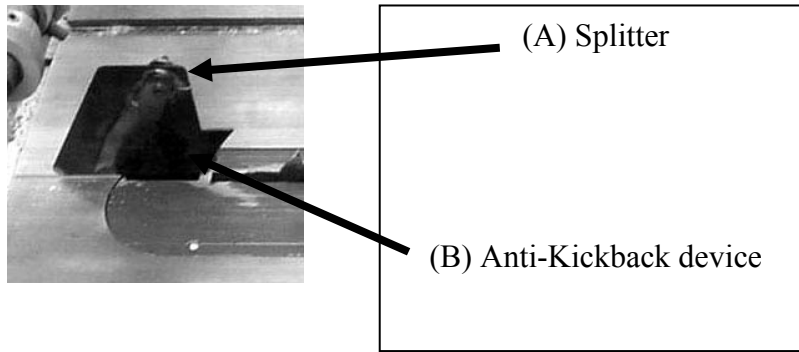
3.2 Guard Introduction & Use

The table-saw utilizes several safety guards—the splitter/anti-kickback device and a blade guard. These devices must be used. Failure to do so can result in serious injury. Occasionally, it is safer to not use either one or both of the guards, depending upon the type of cut being performed. However, only the art technicians can use the table saw without the safety guards in place.



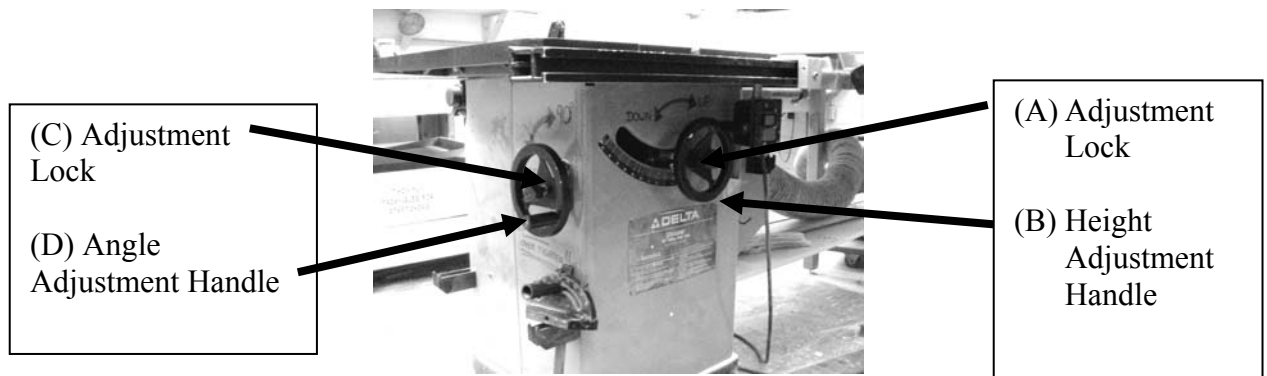
3.3 Splitter/Anti-kickback Device

The splitter/anti-kickback device must remain in place at all times and can only be removed by an art technician. The splitter (A) keeps the freshly cut wood from possibly squeezing and gripping the moving blade. It also allows the wood to only be moved parallel to the blade. The anti-kickback device (B) only allows the wood to move in one direction past the moving blade and prevents it from being pushed back towards the operator.



3.4 Blade Height & Angle

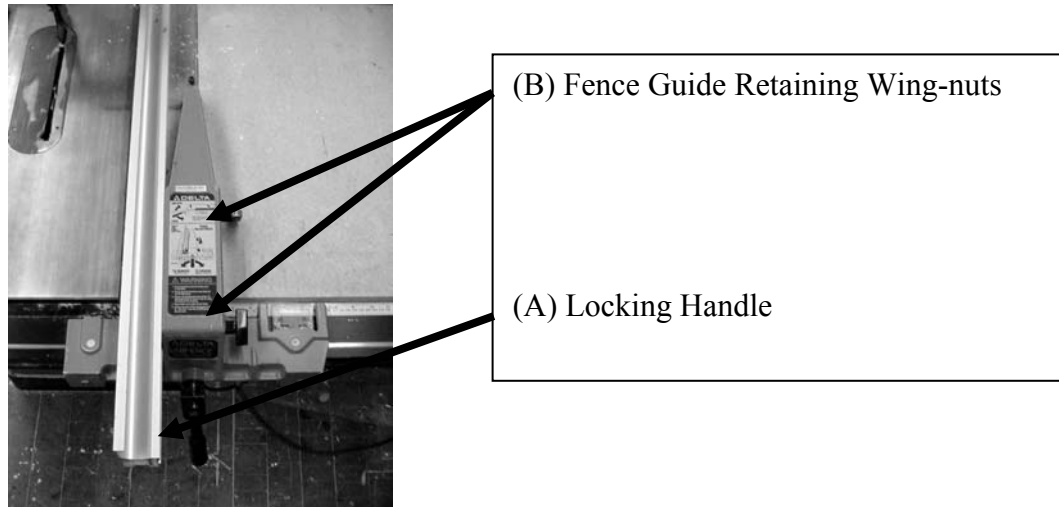
The blade should be adjusted to protrude above the wood being cut by a minimum of 1/4". Loosen the height adjustment handle lock (A) located in the middle of the height adjustment handle (B), which raises and lowers the blade. To adjust the angle of the blade, loosen the angle adjustment handle lock (C) located in the middle of the angle adjustment handle (D), which alters the angle of the blade.



NOTE: When changing the angle of the blade, care must be taken to ensure that the blade clears the kerf plate, blade guard, and fence.

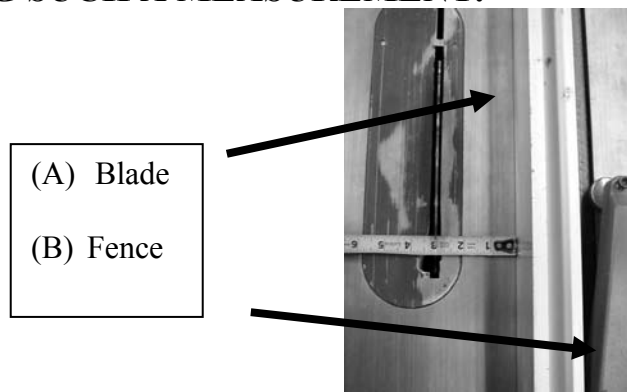
3.5 Fence Adjustments

The distance between the fence and the sawblade determines the finish cut size. To set this distance first raise the locking handle (A) to release the fence lock. You can slide the fence to the left or right while holding the handle or the end of the fence rail. Once fence has been relocated, firmly push down upon the locking handle to lock the fence in place—check to ensure that the fence is indeed locked before using the machine.



The fence rail itself can be moved forward or backward by loosening the fence guide retaining wing nuts (B). The fence can be reversed for use on the left side of the blade by removing the fence guide retaining wing-nuts (B), repositioning the fence and retaining bolts through the housing and reattaching the wing-nuts onto the other side.

Measurements are accurately achieved by measuring from the inside of the blade (A) to the fence (B). **NOTE: BE SURE THE SAW IS TURNED OFF AND THE BLADE IS NOT MOVING WHEN MAKING SUCH A MEASUREMENT.**

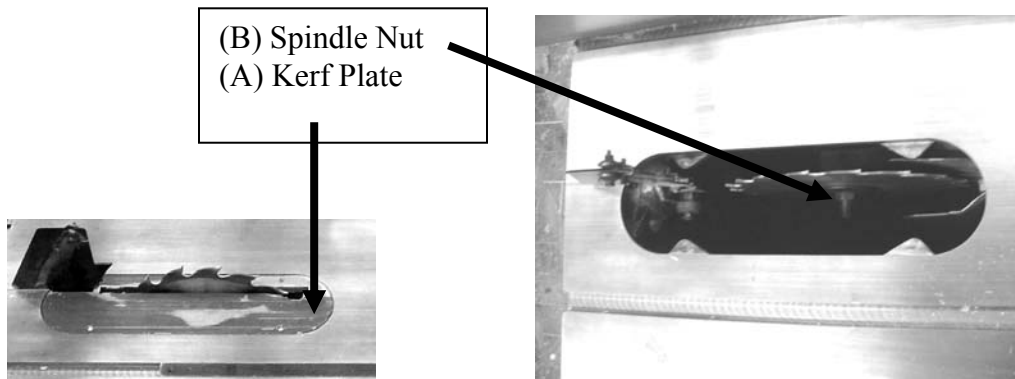


3.6 Tool Use

Once the blade height and angle is set, and the fence is set and locked turn the saw on by pushing the green button. Let the saw come up to speed. Then, keeping the wood flat on the table and rubbing against the fence, push the wood slowly **past** the blade. Your right hand should be pushing the wood with your left hand guiding the wood. It is very important that the wood is kept flat and against the fence at all times. If cutting wood narrower than 6" use a push sticks.

3.7 Changing the Blade

UNPLUG THE MACHINE. Remove the kerf plate to access the blade (A). Hold the blade in place with a piece of scrap wood and use the proper wrench to free the spindle nut (B). **NOTE: THE SPINDLE NUT THREADS ARE THE REVERSE OF STANDARD THREADS.** Turn the wrench clockwise to loosen the nut. Be careful to not drop the nut down into the saw! Remove the blade and place the new one on, ensuring that the teeth are pointed the correct direction, towards the front of the saw. Replace the spindle washer and nut (turning them counter-clockwise); replace the kerf plate.



4. Band-saw

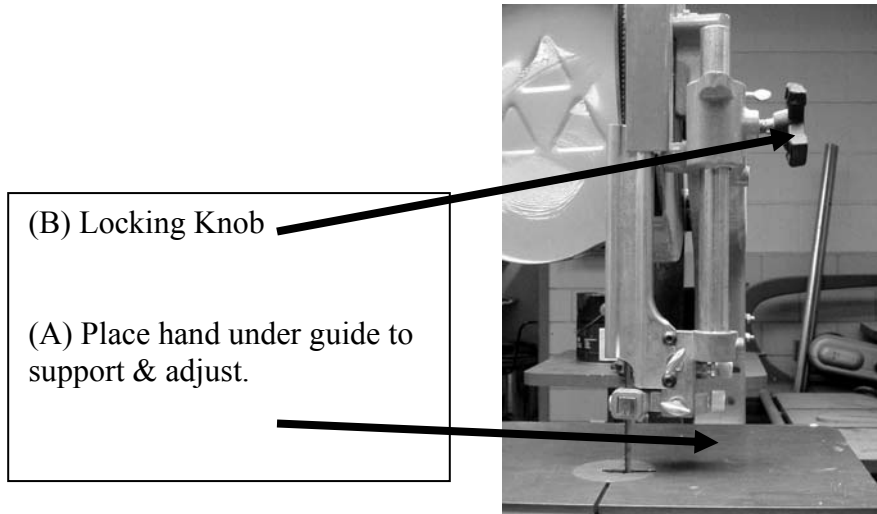
4.1 Introduction

This tool is very versatile and is one of the safer ones in the shop. Care should be taken to ensure your fingers are at least four inches (4'') away from the blade at all times while cutting. It is also important to pay attention to how hard the blade is being stressed and/or twisted during use. How well the bandsaw makes a cut is dependent upon the tightness of a cut's radius, the type of material being cut, its thickness, the width of the blade, and the feed speed. Watching the blade and listening to it can help determine how hard the saw is being worked. An overworked blade will quickly break.

NOTE: Before any settings are adjusted, the machine must be off and stopped. Before the machine is opened or the blade is handled in anyway, the machine must be unplugged.

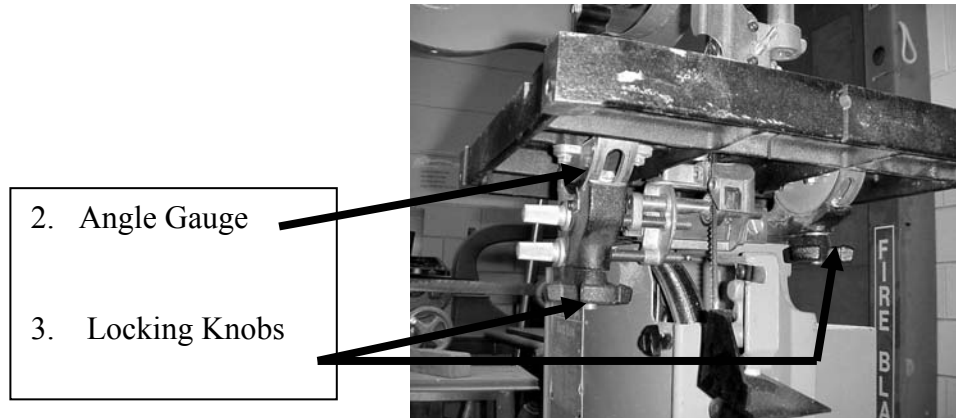
4.2 Guide Height Adjustment

The blade guide must be adjusted so that the bottom of the guide blocks are approximately 1/4" above the wood. To adjust the guide height, place your hand under the guide (A), loosen the locking knob (B), adjust the height and retighten the locking knob.



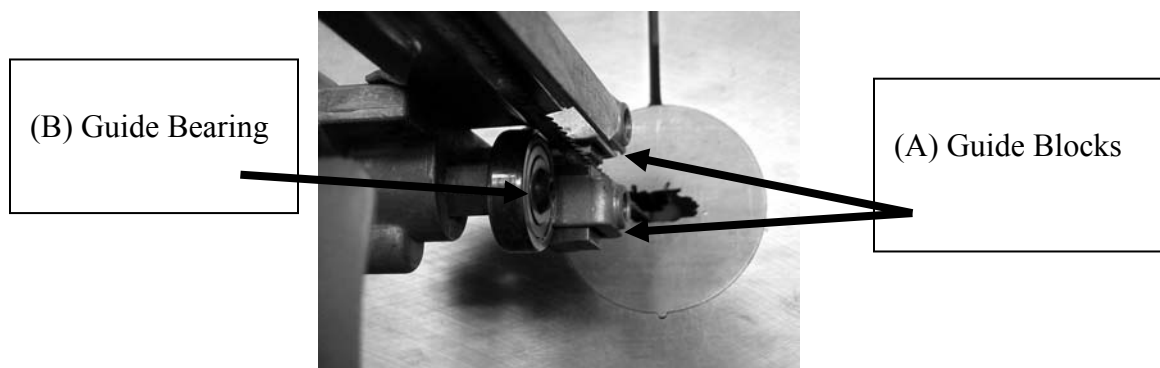
4.3 Table Angle Adjustment

To change the angle of the table, loosen the two locking knobs (B) located underneath the table. A rough angle gauge (A) is located on the front of the machine, under the table. Note: be sure to securely tighten the locking knobs before starting the machine.

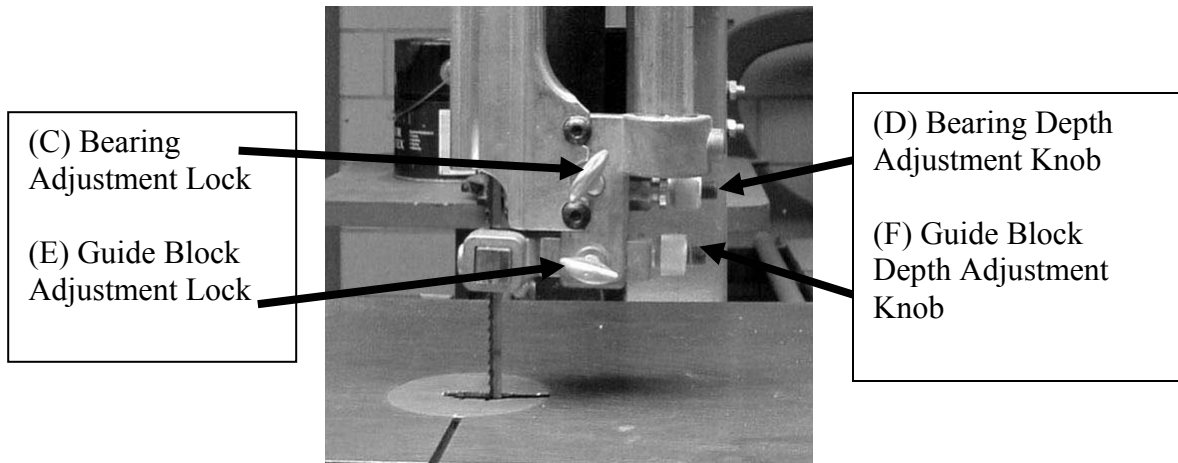


4.4 Rollers and Guides Adjustment

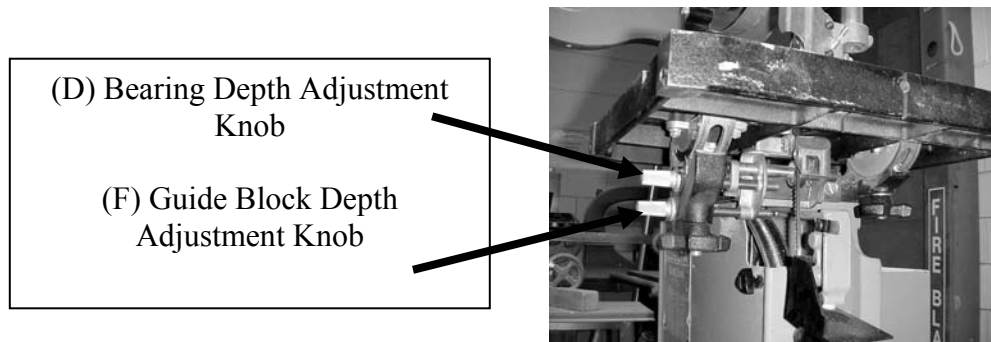
The teeth of the blade must protrude from between the guide blocks (A). The guide bearing (B) behind the blade must be adjusted so that it all but touches the blade. The guide blocks must be adjusted so that they are adjacent (approximately 1/16") to but do not touch the sides of the blade.



To adjust the guide bearing (B), loosen the adjustment lock (C) and adjust the depth knob (D). To adjust the guide blocks, loosen the adjustment lock (E) and adjust the depth knob (F). Retighten all loosened locking knobs when finished.



NOTE: A similar guide and bearing system is located underneath the table, requiring parallel adjustment in alignment with the upper guides and bearings.

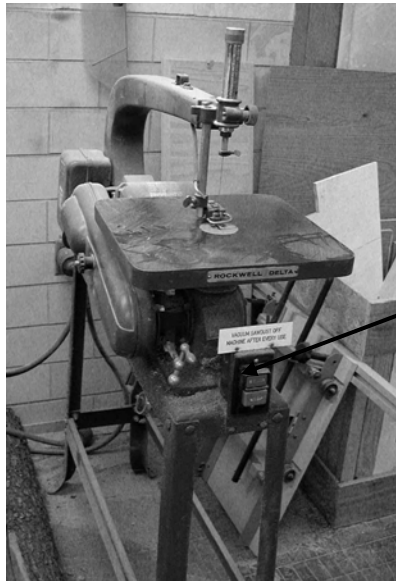


5. Scroll Saw

5.1 Introduction

The scroll saw is ideal for making tight, curving cuts in wood up to 3/4" thick. Its curving cuts can be made tighter than those made on either of the bandsaws. And because its blade is removeable, cuts do not have to start

and end at the edge of a board. They can begin anywhere there is a hole in the wood.



Power On & Off buttons

5.2 Tool Use

Adjust the foot before using saw by loosening the thumbscrew and placing wood against the blade. Let the foot rest on the wood and then tighten the thumbscrew

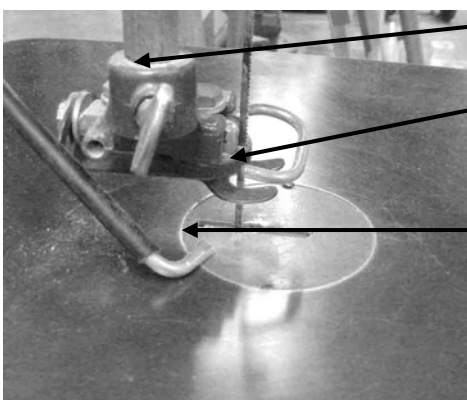
Make sure that the air tube is pointed towards the front of the saw blade. This will blow sawdust out of the way so you can see what you are cutting.

Turn the machine on by pushing the green button.

Hold wood flat on the table at all times. When cutting, push and steer the wood into the moving blade, following your line.

Keep fingers out of the orange area (no closer than 3" from the blade.)

Turn off the machine by pressing the red button.



Thumbscrew

Foot

Air tube

6. Panel-saw

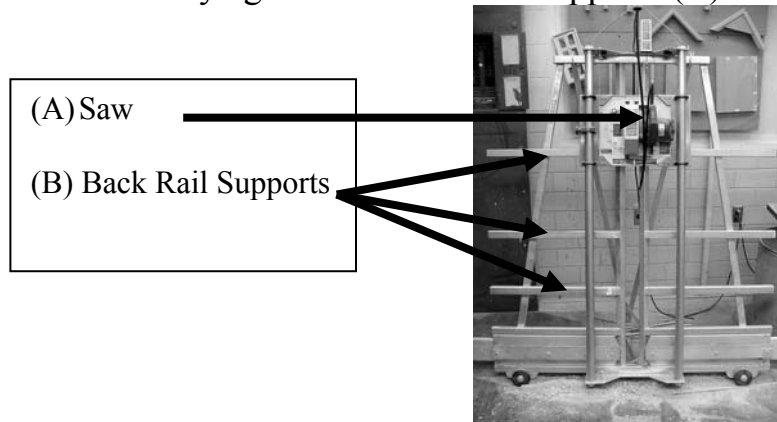
6.1 Introduction

The panel-saw is a useful tool for crosscutting large pieces of wood. Its design allows for accurate 90° cuts. Although a relatively safe tool to use, operators must be sure that the wood touches at least two support rollers on either side of the blade, the wood must be held firmly in place during cutting, and care needs to be taken when cutting off short ends.

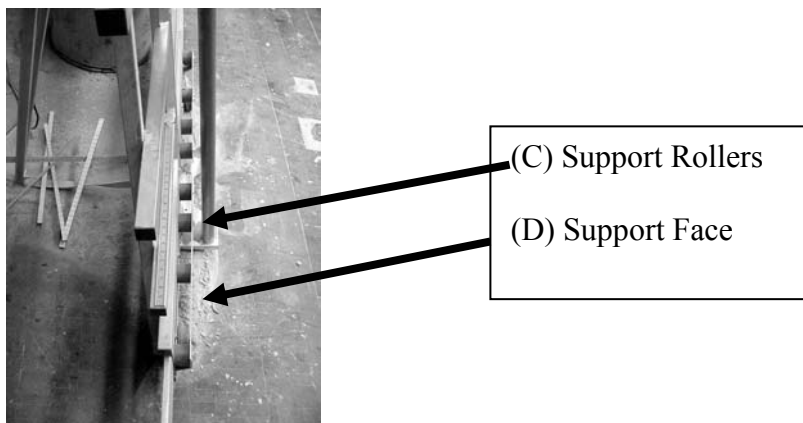
Because this tool is exceptionally loud during use, earplugs are recommended.

6.2 Setting-up

Before inserting material to be cut, be sure that the saw (A) is in the upper most position. Slide the material into position from either side, ensuring that it rests flatly against the back rail supports (B).



Be sure that the material being cut sits on at least two of the red support rollers (C) on either side of the blade—and is not caught on the aluminum support face (D).

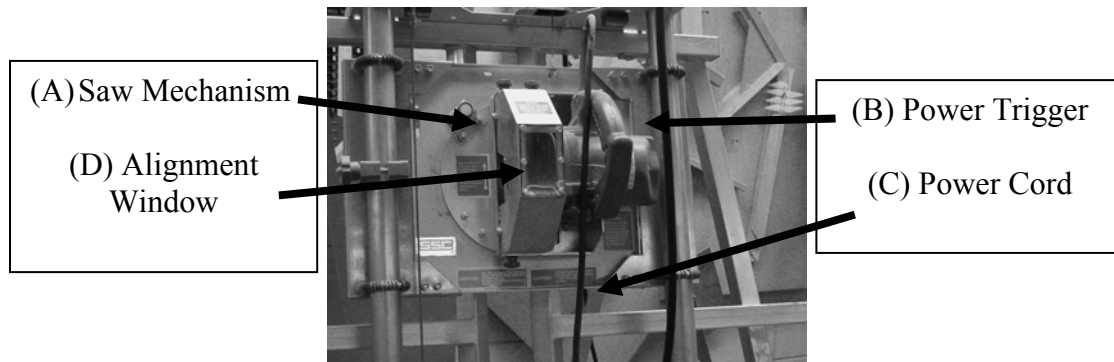


6.3 Tool Operation

The tool is used by first aligning the material to be cut, then moving the saw mechanism (A) up away from the material, depressing the power trigger (B), waiting for the saw to come to operating speed, then applying an even downward pressure, cutting through the wood. The pressure and cutting speed are dependent upon the type and thickness of the material being cut, as well as the type and condition of the saw's blade.

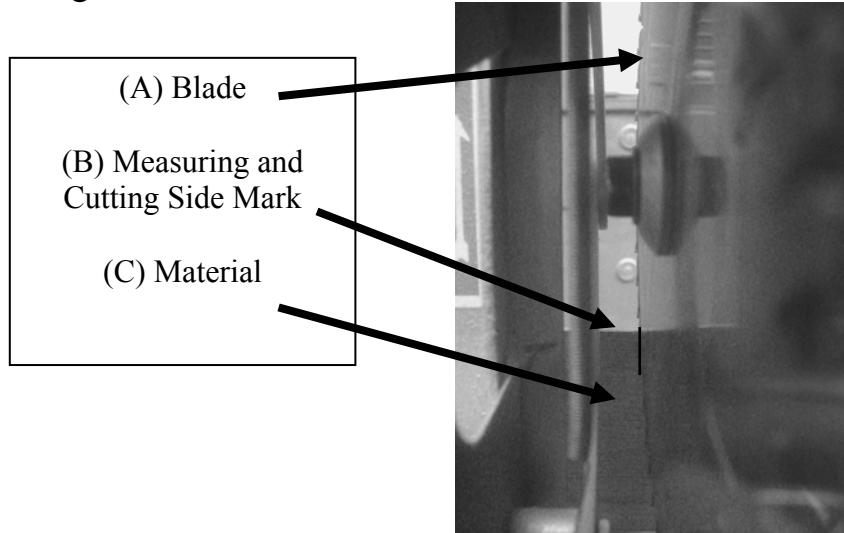
Note: Before cutting begins, be sure that your hand and arm are free of the power cord (C) and that the wood is securely held in place.

Once the saw has come to the complete bottom of the track and the cutting is finished, release the power trigger, turning off the saw. Wait until the blade is no longer turning, then guide the saw mechanism back to the top position by hand—DO NOT let the spring mechanism retract the saw itself.



6.4 Aligning the Blade for Cutting

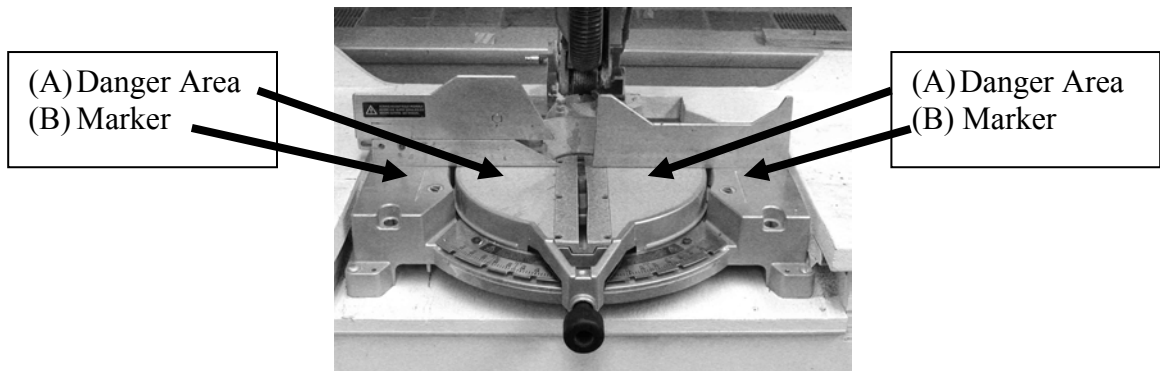
To align the blade (A) with the desired cutting mark (B), look through the alignment window on the front of the saw's guard cover. Lower the saw down to the material, being careful not to depress the power trigger, and bring the blade close to the material (C). Adjust the position of the material until the blade aligns with the cutting mark. Note: be sure to align the blade on the cutting side of the mark to ensure an accurate cut.



7. Compound Miter Chop Saw

7.1 Introduction

The compound miter chop saw is a very useful tool for relatively accurate and quick crosscutting of medium to small stock up to 6" wide. Materials to be cut must be properly placed, securely held or fastened down and then slowly cut. Your hands must be kept outside of the danger area while cutting. No wood smaller than 8" long. The danger area (A) is identified by markers (B) and orange paint on the saw's table.



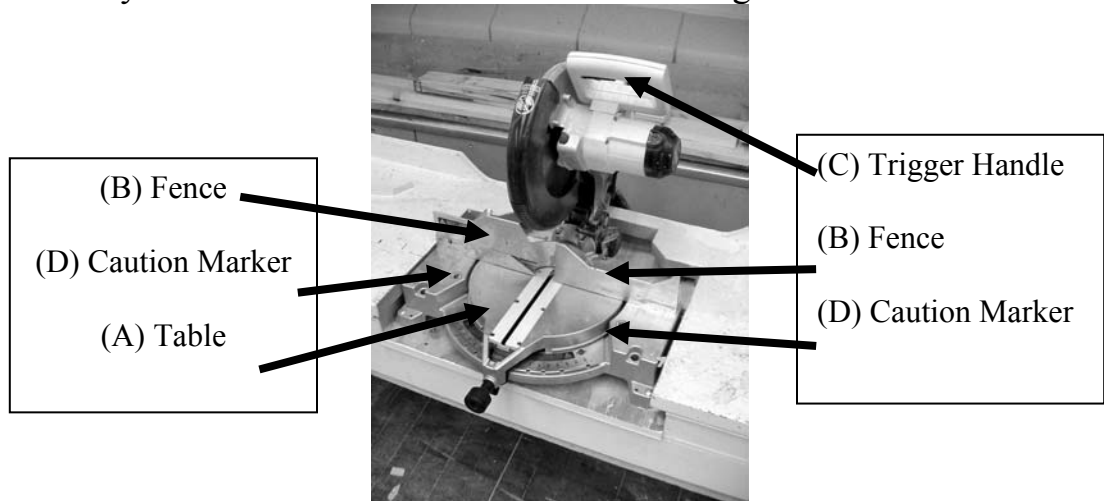
The saw is also capable of making compound miter cuts.

7.2 Tool Use

Turn on the dust collector. Be sure stock sits flatly upon the face of the saw's table (A) and in contact with the fence (B). Firmly grip the trigger handle (C) without pulling the on trigger, lower the blade and align the wood to the desired cutting location. The guard will automatically move itself out of the cutting path when the saw is lowered.

NOTE: DO NOT CROSS YOUR ARMS DURING OPERATION OF THIS TOOL. IF HOLDING THE WOOD TO THE LEFT SIDE OF THE BLADE, USE YOUR RIGHT HAND TO OPERATE THE SAW. IF HOLDING THE WOOD TO THE RIGHT SIDE OF THE BLADE, USE YOUR LEFT HAND TO OPERATE THE SAW.

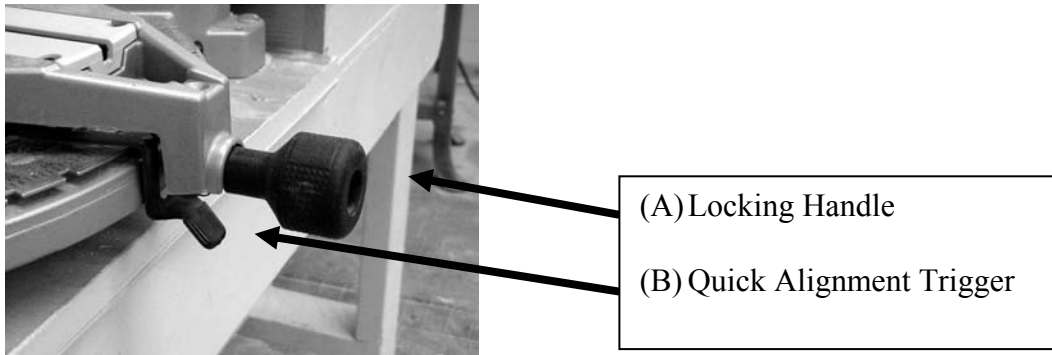
Be sure that your hands are located outside of the danger.



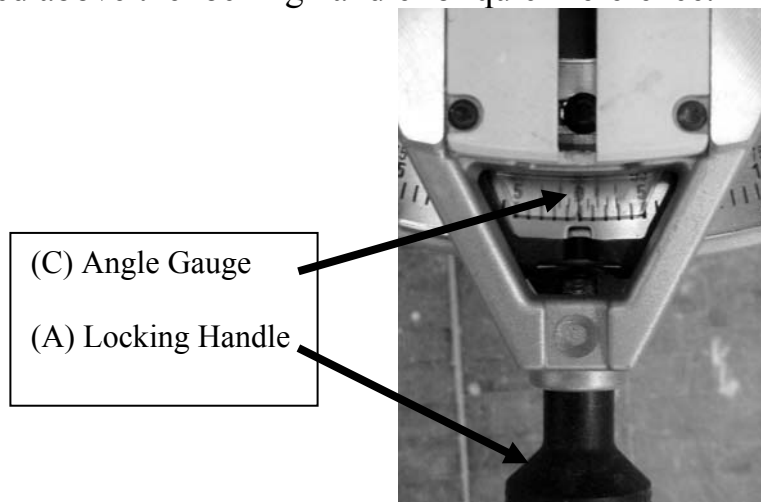
Once the wood is properly aligned, lift the blade clear of all material (while ensuring that the material is still securely held in place) and squeeze the trigger handle to start the saw. Once the saw has come up to speed, carefully lower the blade through the material. Once the saw has reached the bottom of its throw, turn off the saw. When the blade has stopped turning, then lift the saw mechanism back to its upright position.

7.3 Adjusting for Miter Cuts

The compound miter chop saw can create miter cuts quickly and efficiently. To adjust the angle of the miter, first loosen the locking handle (A), then lift the quick alignment trigger (B) and swing the saw in either direction to achieve the desired angle. Once the angle has been established, tighten the locking handle (A).



By releasing the quick alignment trigger (B) near a commonly used angle, and slowly sliding the saw towards it, the trigger will automatically engage in its pre-established alignment. A relatively accurate angle gauge (C) is located above the locking handle for quick reference.



7.4 Using the Clamp

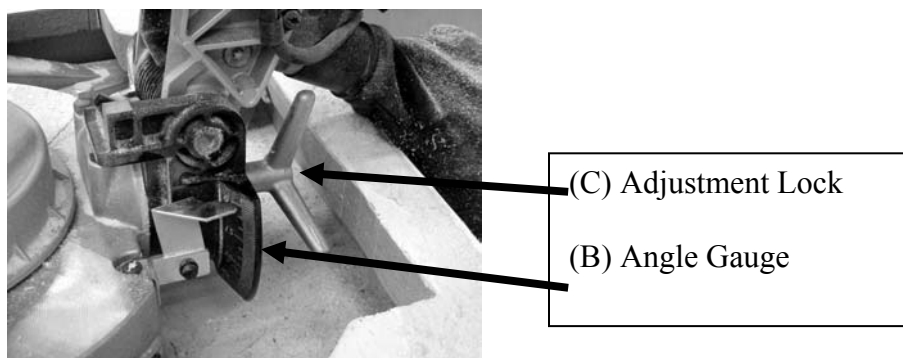
Materials to be cut must be securely held or fastened at all times. A quick release clamp (A) is available to secure materials in place. Simply insert the clamp into its anchoring hole (B) on either side of the saw's table, flip the quick release lever (C) forward, and tighten the clamping handle (D) until the material is secure. Once cutting is finished, loosen the clamping handle (D) enough to release the quick release lever (C), which can then be flipped back to free the clamp screw.

Make sure that you are securely holding the wood. Do not rely on only the clamp!



7.5 Compound Miter Cuts

If a compound cut is needed, the saw's bevel is adjustable—although limited in only being able to tilt to the left side. To make this adjustment, loosen the adjustment lock (A) behind the table. The angle gauge (B) is available to guide the saw's adjustment. Once the desired angle is set, tighten the adjustment lock before operating the machine. Be sure to move the fence to the left out of the way of the blade path.



8. Radial Arm Saw

8.1 Introduction

The radial arm saw's primary use is for crosscutting flat stock. Its wide cutting capability (up to 12" wide) makes it suitable for material too large for the compound miter chop saw. An extremely useful aspect of this tool is its ability to make shallow kerf or dado cuts across a board for such work as lap-joints or mortise and tenon joints. Multiple passes next to each other create lap joints or tenons in a manner much safer than crosscutting on the table saw.

It is important to remember that the saw is pulled towards the operator, and that all fingers and objects need to be clear of the cutting area, outside of the area painted orange. Also, a firm grip upon the handle, coupled to a steady, controlled pulling motion are required to reduce the chances of kick back, stalling, or unintended cutting.

No pieces of wood smaller than 8" in length can be cut on this saw. If the wood is smaller than 8", use either the manual miter box and saw or the small band saw with its fence or miter gauge.

8.2 Setting-up

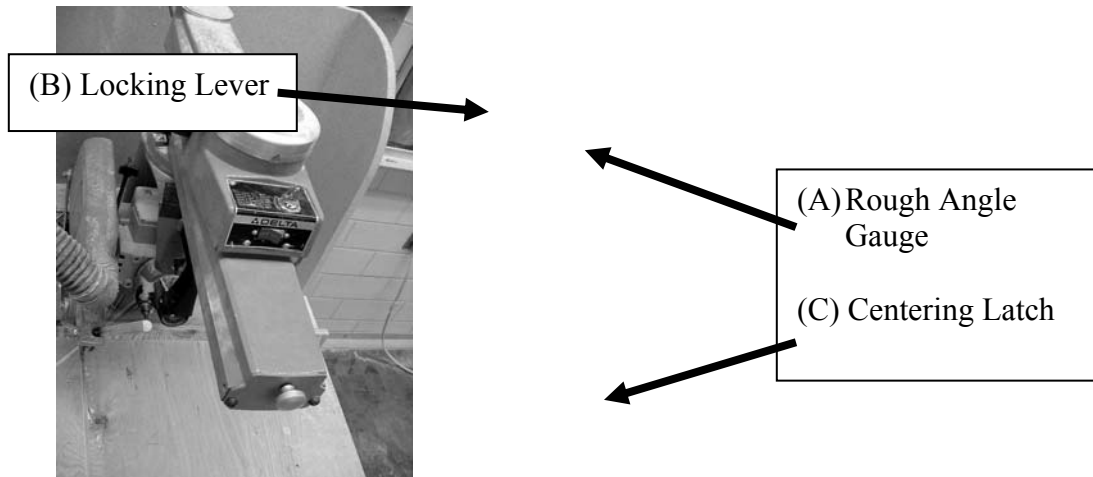
Before using the tool, it is important to ensure that it is set-up correctly for your needs. Check the depth of the blade to the table—typically this is set so that the blade just enters into the cut area of the table (A) so that it will cut completely through the board.



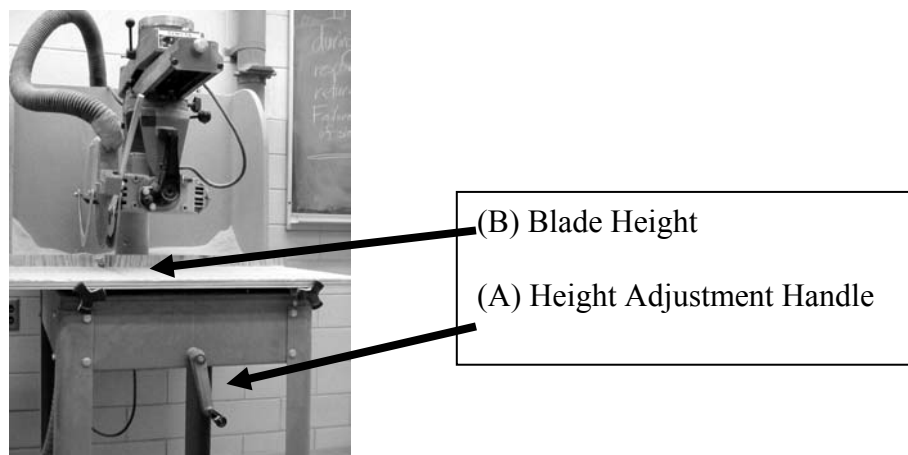
(A) Blade Adjusted for Full Cut

Ensure that the cutting angle is adjusted to your needs—to do this, examine the rough angle gauge (A). To adjust the angle, release the locking lever (B) by pushing it back, pull the centering latch (C) towards you, and slowly swing the arm to the desired angle.

NOTE: BEFORE MAKING THIS ADJUSTMENT ENSURE THAT THE BLADE CLEARS ALL OBSTRUCTIONS—ESPECIALLY THE TABLE. This can be achieved by raising the blade away from the table (see below).



To adjust the blade up or down, carefully turn the height adjustment handle (A). Watch the progress of the blade relative to the table (B) while adjusting the blade height, and be careful not to drive the blade into the table surface.

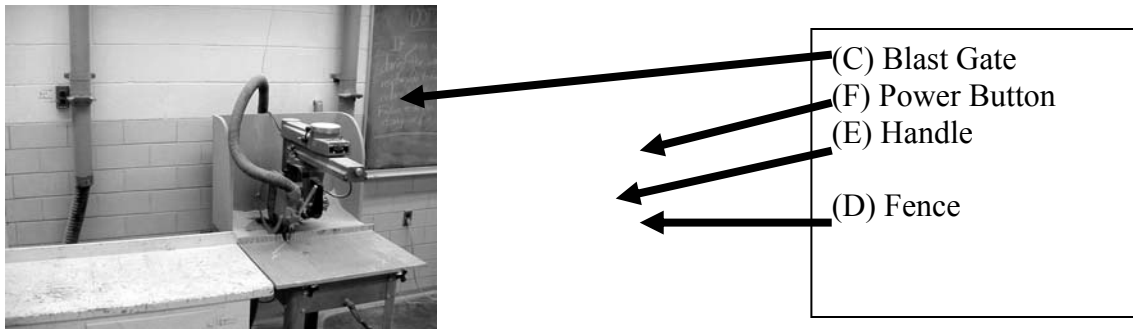


8.3 Cutting

The radial arm saw uses the woodshop's centralized dust collection system to reduce dust and shaving buildup. Before cutting, start the dust collector by pressing the black "on" button. Be sure the air gate is pulled out to the open position.

Ensure that the saw's blade is unobstructed so that it may spin freely and that the stock is squarely and firmly placed on the surface of the table and against the fence (D). Hold the wood against the fence with one hand and firmly grip the black handle with the other hand. Gently push the saw to its furthest back ready position.

Turn on the saw with the hand that is holding down the wood. **DO NOT LET GO OF THE SAW HANDLE.** When the saw is turned on, again hold down the wood. .



Once the saw has come to its full operating speed, slowly and evenly pull the saw through the board being cut. After completing the cut, push the saw again to its furthest back position. Turn off the saw with the hand that is holding the wood. **DO NOT LET GO OF THE HANDLE.** After the saw is turned off, you may remove your cut wood but do not put your hand in the path of the blade, even when it is off. If it is turning at all, it can still cut!

If, when cutting, the blade begins to stall, you are cutting too fast, if this happens turn motor off immediately. A nice, even cutting speed is best and is easily identified by listening to how hard the motor is working.

9. Sanding Station

9.1 Introduction

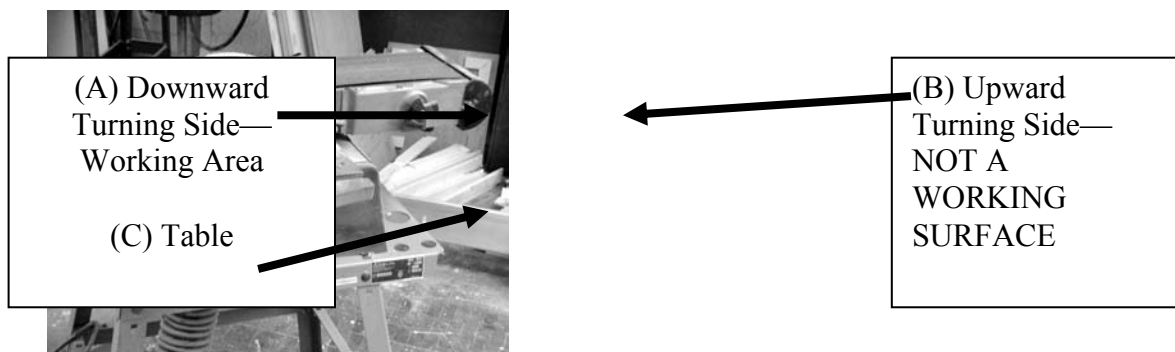
The sanding station has two different types of sanders; a disk sander and a belt sander. Their primary purpose is for rough sanding and smoothing of wood, as well as offering some limited capability for shaping. Projects requiring anything more than moderate removal of wood should utilize another tool to reduce the chance of burning or overworking of the tool.

Before utilizing the sanding station, the central dust collection system must be started and the appropriate air gate on the sanding station hose must be in the open (out) position.

Care should be taken to ensure that no loose clothing, hair, or other protruding objects could become entangled within the belts or mechanisms of the tool. Material being sanded must be securely held and correctly oriented to reduce the chance of it being grabbed and kicked-back. Also, materials that are glued together must be completely cured (12 hours minimum) before being sanded, and no other materials (such as nails, plastic, etc.) but wood can be sanded.

9.2 Usable_Working_Areas

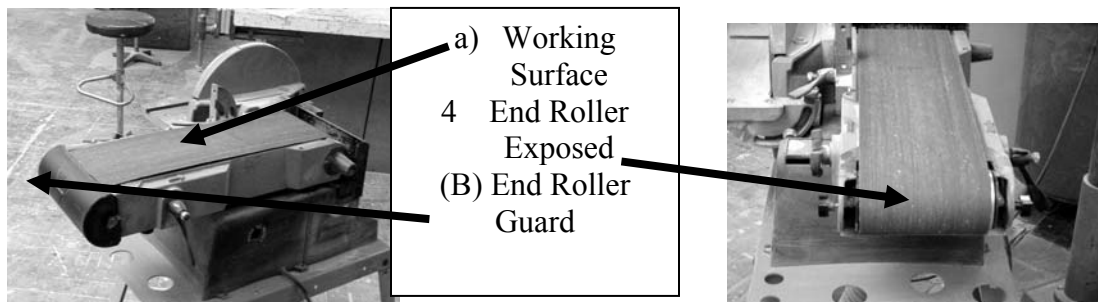
Although over half of the face of the disk sander is exposed, only half of that space is available for use. The downward turning half of the disk (A) is the proper working area(left side). Material should not be sanded on the upward turning half of the disk (B) because of the risk of kickback and flying debris. Items being sanded on the disk sander need to be securely held and thoroughly supported by the sanding table (C).



The entire exposed face of the belt sander (A) is available as working space. Care needs to be taken that the material and/or other items (i.e. hair, clothes, wood) does not slip under the sanding belt's edges. Care should also

be taken to avoid working on the edge of the sanding belt because the belt can become stressed and tear.

Occasionally, when concave areas of an item need to be rough sanded, the end roller guard (B) can be removed to gain access to a curved sanding area (C). Special care needs to be taken when performing this type of work to keep materials and fingers clear of all mechanisms and moving parts. Immediately upon completion of this type of sanding the guard cover must be properly replaced.



10. Oscillating Spindle Sander

10.1 Introduction

The oscillating spindle sander is used to smooth out curving edges of cut materials. It can be used to gently or rapidly shape both flat stock and three-dimensional pieces. There are different sized spindles for different sized curves. The spindles and the accompanying tables inserts may be changed by the technicians as needed to accommodate the size of your work.

The table can be tipped to match the angle of the piece that is being sanded. To do this, first loosen the lock on the left side of the machine and turn the hand wheel on left side of machine until you have the desired angle. Then tighten the lock.

10.2 Tool Use

Turn dust collector on.

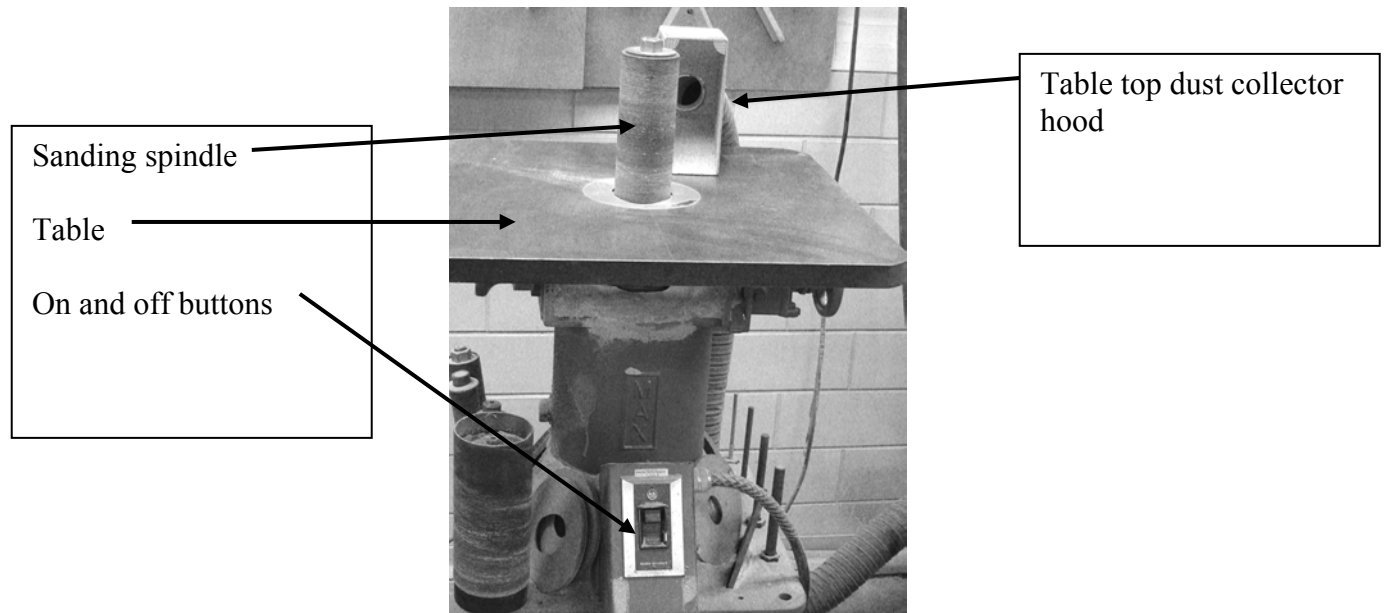
Turn machine on by pressing the green button.

Hold wood on the table of the sander and move back and forth (left and right) against the spindle. (Table top dust collector hood may be moved as needed.)

Table angle may be changed also.

Turn machine off when done.

Turn dust collector off!



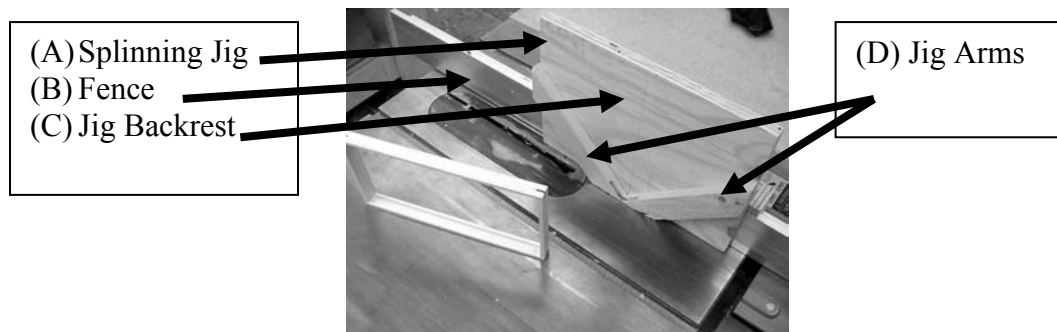
11. Special Cuts

11.1 Introduction

Woodworking offers a vast array of technical problems. Experience and creativity are often the only sources of resolution for some issues, encouraging a strong tradition of sharing and discussion amongst those working in this field. Thusly, although some interesting and creative solutions are outlined in this chapter, nothing can replace the guidance and expertise associated with experience. With this said, whenever in doubt, unsure, or uncomfortable with using a tool to perform some task, never hesitate to seek advice or help. Often you will find someone experienced with what seems an insurmountable problem that will have a lovely and easy solution up his or her sleeve.

11.2 Splined Corner Cuts

Splined corners are a means to both increase the structural integrity of a corner joint as well as offering an interesting detail when woods of differing color are used. The joint is simple in that the two frame rails are glued together in a butt-joint fashion, meeting at 45°. Once dry, the splinning jig (A) is slid onto the fence (B) and aligned the proper distance from the blade, the depth of the blade is set (the strongest is when the cut is through the entire depth of the wood, but not protruding into the central area). The frame is carefully set into the jig, checking to make sure it is flat against the backrest (C) and squarely set into the holding arms (D). Once aligned and set, the piece is carefully passed through the blade—the machine is then turned off. Once the blade stops, the frame is removed from the jig, the jig is repositioned before the blade, and the frame is turned and placed to make the next cut.



11.3 Cutting Flat-stock 45° from the Corner

To make quick, accurate 45° cuts on the corner of flat stock, utilize the corner-cutting jig on the table-saw. The bottom of jig (A) slips into the guiding groove (B) of the table saw. The stock is inserted squarely and firmly into the holding area (C) of the jig. The blade is set to the required depth and the piece is run through.

NOTE: Pieces that are thicker than the plywood backing of the jig cannot be cut in this manner—care should be taken not to cut the supporting cross-member (D) in half!

