Under Table Routing and Shaping with the Double-Tilt System

SAFETY

WARNING

READ, UNDERSTAND AND FOLLOW ALL THE INFORMATION IN THIS OWNER'S MANUAL.

The meanings of **WARNINGS, CAUTIONS, AND NOTES** are:

WARNING

A WARNING is given when failure to follow the directions could result in injury, loss of limb, or life.

CAUTION

A CAUTION is given when failure to follow the directions could result in temporary or permanent damage to the equipment.

NOTE

A NOTE is used to highlight an important procedure, practice or condition.

NOTE

It is important to provide adequate lighting in your shop area.

Eye Protection

- **Always wear eye protection when you use power equipment. Use goggles, safety glasses or a face shield to protect your eyes.**
- **Goggles completely surround and protect your eyes. Many goggles will also fit over regular glasses. Be sure your goggles fit closely, but comfortably.**
- **Safety glasses don't fog as easily as goggles and can be worn all the time. Regular eyeglasses normally have only impact resistant lenses. They are not safety glasses.**
- **A face shield protects your entire face. And you can flip it up out of the way when you don't need it. A face shield can be used with regular glasses.**

Ear Protection

- **Prolonged exposure to high noise levels from high speed power equipment can damage your hearing.**
- **Hearing protectors screen out noise that can damage your ears. Wear hearing protection when you are exposed to high intensity power equipment noise.**

WARNING

- **Read, understand and follow the Mark V/7 Owner's Manual and the manual for every power tool you use.**
- **Additional warnings, cautions and instructions and operating techniques are provided in the Shopsmith book, Power Tool Woodworking for Everyone. (A copy is included with your new Mark V/7, and is also available from Shopsmith.)**
- **Wear proper eye and ear protection. Also, wear a dust mask.**

Setting Up the Under-Table Shaper Mode

1. Turn off and unplug the Machine.

2. Using your 5/32" Allen wrench, remove the Saw Table Insert (138) and replace it with the Shaper/Router Table Insert (see figure C-89).

NOTE

If dust collection chute is attached to the bottom of the Shaper/Router Insert, remove prior to attaching the insert to the worktable.

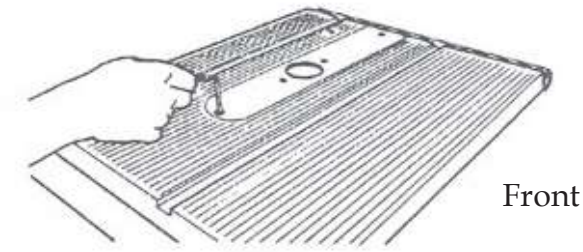


Figure C-89

3. Screw the Shaper Guide Pins into the Shaper/Router Table insert. Tighten slightly with a flat-head screw driver.

4. Slide the Headstock all the way to the left on the way tubes so that the Headstock is up against the Power Base Mount. Tighten the headstock lock.

5. Mount the Shaper Arbor (555117) on the main spindle. Tighten the setscrew against the flat of the spindle.

6. Position the worktable surface just above the top of the Headstock. Tighten the table height lock. Then loosen the tilt lock and tilt the table to the left 90°. Tighten the tilt lock.

7. Using your 5/32" Allen wrench, remove the Tie Bar Guard (155) that is attached to the Tie Bar underneath the worktable.

8. Dismount the worktable by loosening the table height lock and pulling the worktable straight up, as shown in figure C-90.

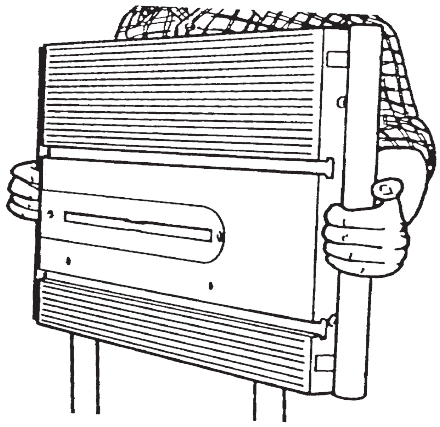


Figure C-90

9. Turn the worktable 180° so that the surface of the worktable faces the opposite direction and remount into the carriage. To remount the worktable, loosen the table height lock and place the support tubes in the carriage. Gently rock the worktable front-to-back until the racks engage the pinions and the tubes drop smoothly into the holes. Sometimes it helps to slowly turn the table height crank clockwise while you rock the table. This will position the support tubes at exactly the same height and get the racks started properly in the pinions. Lower the table all the way in and tighten the table height lock.

10. Slide the carriage toward the headstock until it butts up against the rubber spacer next to the headstock. Secure the carriage lock.

11. Check and secure if necessary, the headstock lock, the carriage lock, the table height lock and the worktable tilt lock.

12. Loosen the locking knob on the base mount on the right hand side of the way tubes (xxx). Grasp the way tubes with both hands close to the base mount, then raise the machine into the vertical position. Tighten the base lock on the back side of the Mark 7, then rock the way tubes side-to-side. Retighten if possible. This helps take the play out of the base pivot and keeps the Mark 7 from wobbling.

13. Loosen the quill feed lock and the table height lock. With one hand, turn the quill feed to raise the shaper arbor up through the hole in the shaper/router table insert. At the same time, with the other hand, move the

worktable in and out by turning the table height crank. Adjust the worktable so that the shaper arbor is centered in the shaper/ router table insert. When centered, secure the table height lock and secure the quill lock (with the quill extended so that the shaper arbor is above the worktable).

14. Using a 11/16" wrench, remove the hex nut and rub collars on the end of the shaper arbor. First place a rub collar back on the arbor. Then put the cutter on the arbor. Make sure to position the cutter with the cutting edge facing the direction appropriate for the direction the work piece will be fed into the cutter. See the instructions on page A-12 for rotation information.

15. Install another rub collar onto the arbor. Then place the tongue washer on the arbor with its "tongue" in the arbor's slot. Finally, thread the hex back on the arbor as shown in figure C-91.

WARNING

Always use a rub collar under all shaper cutters. Also, be sure the tongue washer is correctly installed and directly under the top hex nut, and that the nut is tight.

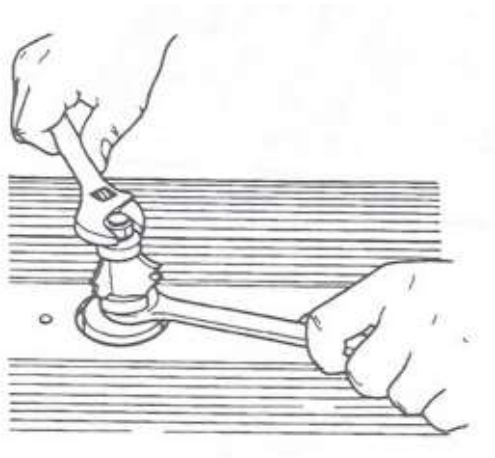


Figure C-91

16. Adjust the height of the cutter to the desired profile by loosening the quill feed lock and rotating the quill feed handle. Be sure to secure the quill feed lock when completed.

17. Attach the Shaper Guard Assembly to the worktable by sliding the T-Nut attached to the post into the T-Slot (Miter Gauge slot) on the worktable closest to the carriage. The T-Nut should be slid in from the outfeed side of the cutter/worktable and positioned so that the guard shield fits over both pins on the Shaper Table Insert. Lower the guard shield so that the bottom is 1/8th inch above the workpiece. Lower the Brush Assembly so that is 1/8th inch above either the workpiece or the worktable, whichever is appropriate.

18. To add dust collection, attach a 2½ inch hose to the top of the shaper guard assembly.

WARNING

When returning from the Shaper mode to other operations using the worktable, be sure to replace the Tie Bar Guard to the Tie Bar located under the Worktable.

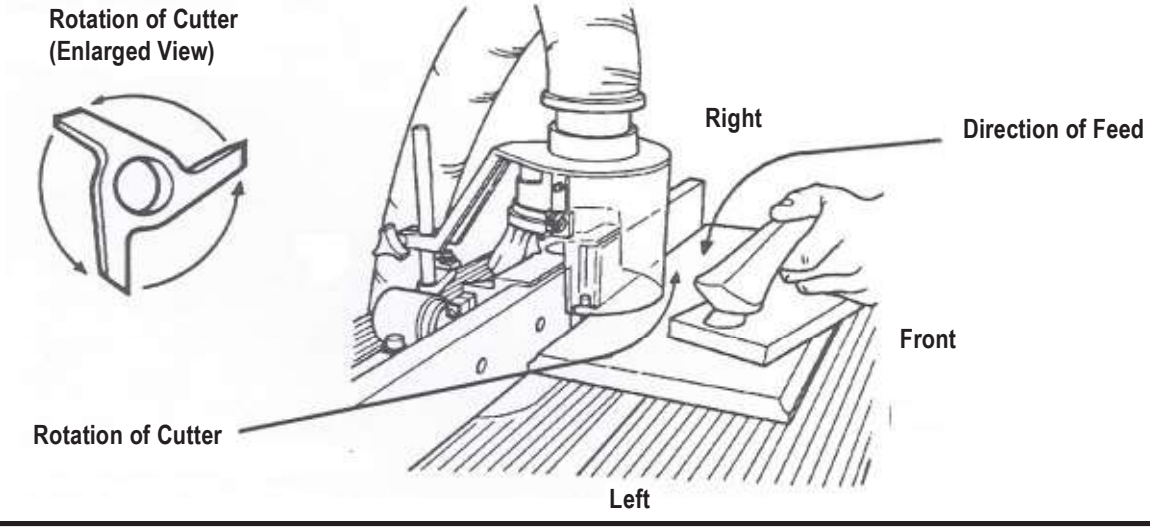
Under-Table Shaping Operations

WARNING

- Internal routing or shaping of the edge of a hole (or small opening less than 6" in diameter) in any shape should not be attempted.
- Never "freehand" shape or route. Always use pins with piloted router bits or rub collars with shaper cutters.
- Never attempt pin routing or pin shaping when removing the entire edge of the workpiece.
- Try to free the workpiece so that the cutter is cutting in the same direction as the wood grain, though this is not always possible.
- Always feed the workpiece against the rotation of the cutter. Otherwise, a kickback will occur.
- Feeding the workpiece too fast and/or exceeding the maximum recommended 1/8" depth-of-cut could result in "stalling" the motor or belt slippage.
- Make sure the cutting edge of the shaper cutter faces toward the direction of the workpiece feed. For forward direction, this is right to left, in reverse mode.

WARNING

- Feed the workpiece at a slow, steady rate. Use extra care in shaping or routing workpieces with figured grain or knots, as these may cause kickbacks.
- Use a push stick to feed workpieces up to 3" wide. When it is necessary to push a narrow workpiece underneath the circular shield, use a long piece of scrap wood to feed the workpiece into the cutter and use a feather board to hold the workpiece in against the shaper fence.
- Always use a fence (like the Shopsmith Shaper Fence) or table insert pins and rub collars to guide and support the workpiece. Failure to do so could result in bodily injury.
- Always use a shaper fence when removing the entire edge of the workpiece.
- Always use a fence (such as the Shopsmith Shaper Fence) when using router bits or shaper cutters without pilots or rub collars.



NOTE

The Speed Chart for the Mark 7 is programmed into the control panel of the PowerPro headstock. Refer to page D-2 of this manual for operating instructions. If your operation is not listed in the speed chart, refer to the Manufacturer's recommendations.

Safety

WARNING

Before performing Under-Table Shaping operations:

- Read the SAFETY section, especially for the Under-Table Shaping mode.
- Complete ALL the Assembly and Alignment procedures.
- Secure locks.

Operations

Several things affect the quality of cut made by the Mark 7 including cutter sharpness, cutter speed, cutter diameter, cutter length and profile, feed rate and wood hardness. To get the most from you Mark 7, you must consider all these elements every time you use it. Also, you should carefully choose wood stock with straight grain and free of knots.

There are several ways you can best use the Mark 7 for Under Table Shaping. Go to the section which best describes the activity you wish to perform:

- ***Shaping and Routing,* using the Optional Shopsmith Shaper Fence.**
- ***Pin Shaping and Pin Routing***
- ***Routing with Specialty Bits*, which remove the entire edge for decorative edges or jointing use the Optional Shopsmith Shaper Fence.**

Shaping and Routing

You can use pins which thread into the shaper table insert, or a shaper fence when you use the Mark 7 for shaping or routing. However, we strongly recommend using the Optional Shopsmith Shaper Fence whenever possible, since it offers the most support for the workpiece and it provides more efficient dust collection. And you must always use a shaper fence when you remove the entire edge of the workpiece.

Some customers may already own a Shaper fence. If you do not own one, you should buy the Shopsmith Shaper Fence (part number 555144) before operating the Mark 7 as a shaper. The following instructions and illustrations show use of the Shaper Fence. Unless you will be pin shaping or pin routing irregular stock with piloted bits, we recommend the Fence.

Shaper Cutters

If you are not using Shopsmith Shaper Cutters, make sure that the cutters you use are rated for 12,000 rpm. Shaper cutters can cut many different profiles. A glue joint shaper cutter, for example, is designed to cut the full profile of the workpiece. A combination cutter such as the bead and quarter round, is designed to cut a profile on part of the workpiece edge. This partial cut may constitute the entire operation, or it may be just part of a profile which is produced by several passes with the same cutter or in combination with other cutters

WARNING

Never use shaper bits larger than 2-1/8" diameter, and which have an exposed cutting edge of 2-1/2".

A variety of shapes are possible by changing cutter height, depth of cut, worktable height and sequence of passes. Shaper rub collars control the lateral depth of cut when pin shaping. Since the collars turn with the cutter, they tend to score the wood. This can be minimized by bearing against the collars with light contact and by keeping

collars clean and free of nicks and burrs.

You should sharpen the shaper cutters before you use them. Sharp cutter can determine the quality and efficiency of a cut. Figure D-54 shows a shaper cutter being sharpened on an oil stone. For more information on how to sharpen shaper cutters, see the "Sharpening" Chapter in the Shopsmith book, Power Tool Woodworking for Everyone, 4th edition.

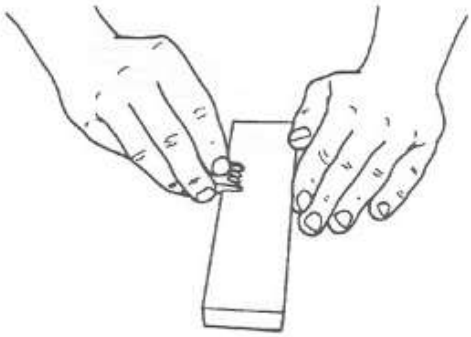


Figure D-54

A 1/2" shaper spindle (555117) with rub collars is included with the Mark 7. You may also purchase the optional Ball Bearing Shaper Spindle (order part number 555472). This spindle has ball bearings in the collars which permit the collars to roll with the workpiece and assure a smooth, burn-free result. This means there is much less tendency for the workpiece surface to be marred as the workpiece presses against the collars during the shaping operations.

To assemble the collars and cutters on the Shaper Spindle.

NOTE

Follow the instructions for setting up in the Under-table Shaper Mode in Section C of this manual.

Router Bits and Specialty Bits

You can use most 1/2" Shank router bits with the Mark 7 using the Shaper Fence, but you can use only piloted router bits for pin routing. You can also use any 1/4" shank router bit by inserting the router bit's shank into the optional 1/4" Router Chuck (order Part Number 514632).

WARNING

Never use router bits or specialty bits larger than 2-1/8" diameter, or which have an exposed cutting edge of 2-1/2" or longer.

Also, before you proceed, make sure that:

- Mark V is unplugged.
- Shaper Insert (dust chute removed) is installed.
- All Assembly and Alignment steps have been performed.

***FOR SHAPING OR ROUTING USING A SHAPER FENCE*, go to section directly below.**

***FOR PIN SHAPING OR PIN ROUTING*, go to Page D-30.**

***FOR USING RAISED PANEL BITS USING A SHAPER FENCE*, go to Page D-32.**

Under-Table Shaping or Routing Using a Shaper Fence

Install a Shaper Fence

1. Install a shaper fence on the worktable according to the instructions which came with it. The Mark 7 shaper fence is being installed in Figure D-55, and it is being secured under the worktable by a square nut in Figure D-56.

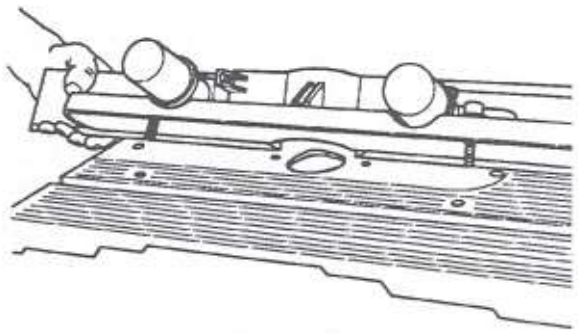


Figure D-55

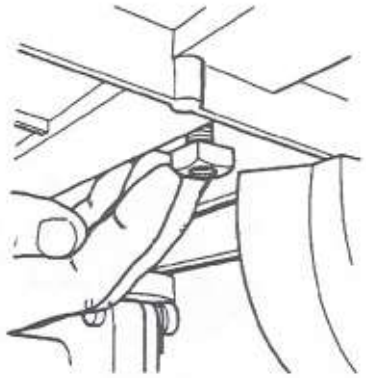


Figure D-56

2. Use a straightedge to set the fence boards parallel with each other, as shown in Figure D-57.

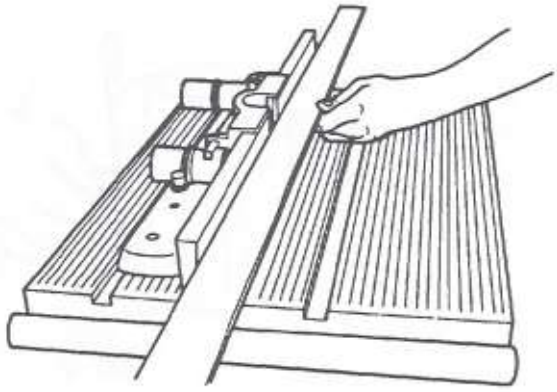


Figure D-57

NOTE

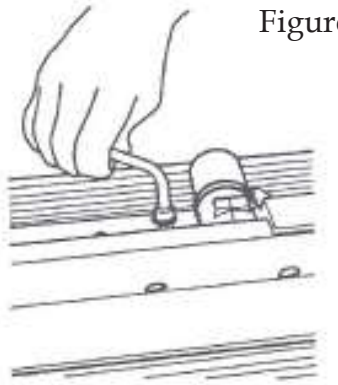
If the fence boards will not set parallel with each other, a slight onetime shimming will be necessary. Before you shim, the back of the shaper fence must be securely attached to the worktable.

CAUTION

To shim, loosen the slotted screws holding the boards to the fence brackets. Insert pieces of masking tape between the back, bottom side of the boards and the face of the brackets. Stick the tape to the brackets. Then tighten the screws and check that the boards are parallel. Repeat, if necessary.

3. After the fence boards are parallel with each other, tighten the shaper fence's socket head cap screws, as shown in Figure D-58.

Figure D-58



4. Adjust the fence boards side to side by loosening the slotted screws which hold the boards to the fence brackets. The cutter should not touch the boards ends. A 1/8" clearance is sufficient. Tighten the screws.

5. If you are edge shaping or routing and part of the edge remains uncut, you must adjust both the infeed and outfeed boards in line with each other, and to the depth of cut you want. Do this by using 5/32" Allen wrench to loosen the cap screws which hold the rear fence guard to the fence assembly. Then turn the knobs in the back of the shaper fence. Each click of a knob is 1/64".

6. When the shaper fence is adjusted for the proper depth of cut, securely tighten the cap screws on the back of the shaper fence.

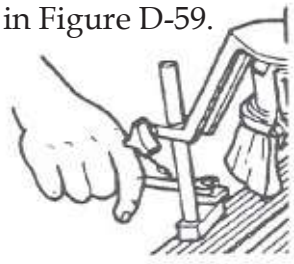
CAUTION

If you are removing the entire edge of the workpiece, the infeed and outfeed fences must be offset in order to support the workpiece before and after cut.

INSTALL THE GUARD ASSEMBLY

7. Place the guard assembly's base clamp to the right rear edge of the worktable and tighten the knob on the bottom of the clamp with a 9/16" wrench, as shown in Figure D-59.

Figure D-59



8. Lower guard shield in place of 1/8" from the top of the workpiece and centered over the cutter. See Figure D-60

Figure D-60

9. Tighten the three-lobed knob on the guard support.

10. Attach the Dust Collector hose to the top opening of the guard.

11. Attach one or more feather boards, if possible.

12. Attach the telescoping legs to the worktable.

MAKE THE CUT

NOTE

Determine whether the Mark 7 needs to be operating in Forward or Reverse Mode based up the direction of the cutter.

13. Adjust the speed in accordance with the speed chart and turn on the Mark 7.

14. Position the workpiece on the proper side of the worktable, as shown in Figure D-61.

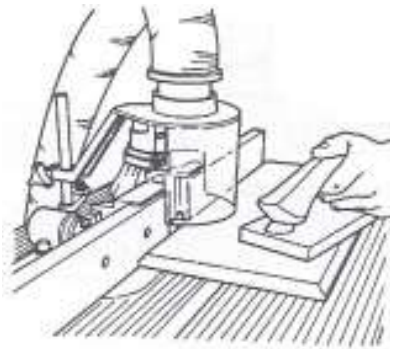


Figure D-61

NOTE

If you are removing the entire edge of the workpiece, run a 12" long piece of scrap wood approximately 4" through the cutter. Turn off the Mark 7, then adjust the outfeed fence outward to meet the finished edge of the workpiece.

WARNING

Avoid taking deep cuts with straight or non-piloted router bits. With the exception of single-pass dovetail cuts, limit the depth of cut to 1/4" for each pass when using straight or not-piloted router bits up to 1/2" diameter. When using shaper or router bits over 1/2" diameter, limit the depth of cut to 1/8" per pass.

Make cuts in more than one pass by adjusting the fence until the final depth is reached. Cuts made with the grain of the wood are always smoother and easier than cuts made against or across the grain. For this reason cross-grain and against-the-grain cuts should always be made slowly. When shaping is required on all four edges of a workpiece, make the end-grain cuts first so any splintering is removed by the edge-grain pass. When it is necessary to push a narrow workpiece under the guard, use a long piece of scrap wood and a feather board to hold the workpiece against a fence.

Whenever possible, make the pass with the cutter under the workpiece. This allows the workpiece itself to act as an added guard. Keep fingers away from the cutting area and hook your fingers over the edges of the workpiece to guard against slipping. Figure D-62 demonstrates a door panel bit cutting under the workpiece.

NOTE

The illustrations show the spindle turning counterclockwise with the direction on the control panel on forward. If the cutters are situated so that the spindle needs to operate in the reverse direction, the feed directions need to be opposite of that shown in the illustration.

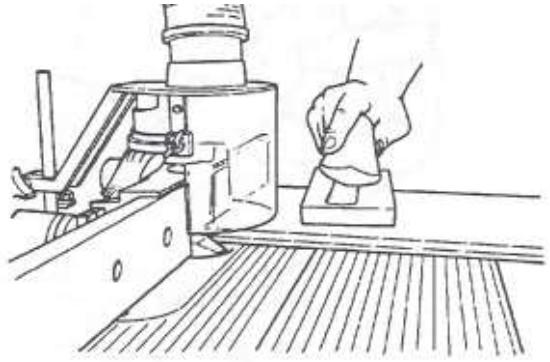


Figure D-62

Using Feather Boards with a Shaper Fence

Feather boards help hold a workpiece in the proper position to the cutter and prevent the workpiece from kicking back. Shopsmith recommends using as many feather boards as feasible to support the workpiece horizontally and vertically. Here are instructions for making a feather board holder to be attached to the top of each side of the shaper fence. Figure D-63 illustrates two feather board holders already installed on the shaper fence.

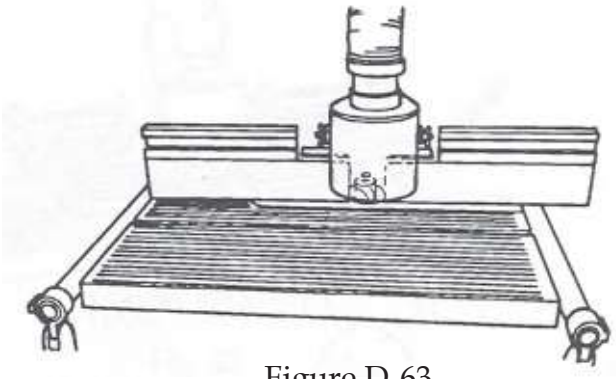


Figure D-63

Make a Feather Board Holder

Tools Needed:

- Electric Drill (or Mark 7 in drill press mode)
- 5/32" drill bit with countersink
- Light mallet or hammer
- Six slotted (or Phillips head wood screw) #6, 2-1/2" long
- Medium slotted screwdriver (or Phillips screwdriver)

1. Each feather boards holder should be hardwood, and should measure about 2" wide x 3/4" think x 9" long. *You may want to work with 18" long stock, then cut in half.)

2. Cut a groove 3/4" wide x 1/4" deep down the middle for the entire length, as in Figure D-64. Place the cut toward the "top" side of the workpiece.

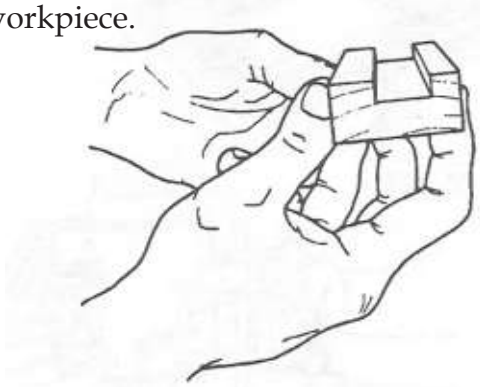


Figure D-64

3. Use the electric drill and a 5/32" bit to drill three holes through the width of each workpiece, as in Figure D-65. Countersink each hole deep enough for the head of the wood screws you will be using. Make sure you don't drill into the groove.

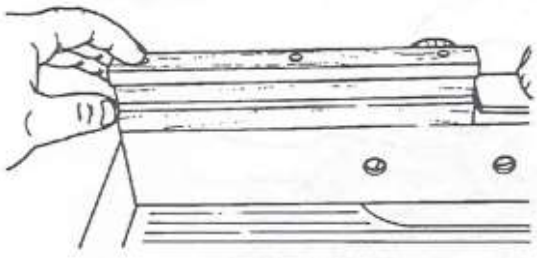


Figure D-65

4. Put a screw in each hole so the screw point is flush with the bottom of the workpiece.

5. Place the feather board holder on top of each fence and line it up with the end of the fence board. See Figure D-65.

6. Lightly tap each screw head so that it punches a mark on the top of the shaper fence. Remove the feather board holder.

7. Use the 5/32" drill bit to drill 1/2" deep holes at each punch mark in the top of the shaper fence.

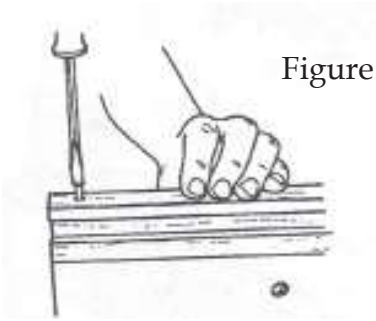


Figure D-66

8. Attach each feather board holder to the shaper fence, see Figure D-66.

Each feather board holder can accommodate one feather board. If you use a feather board on the infeed side, it is usually best to use one on the outfeed side, also. Figure D-67shows four feather boards used for shaping a thin, narrow workpiece. Also notice the use of a push stick.

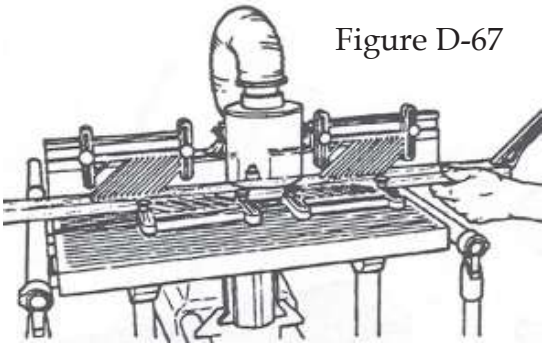


Figure D-67

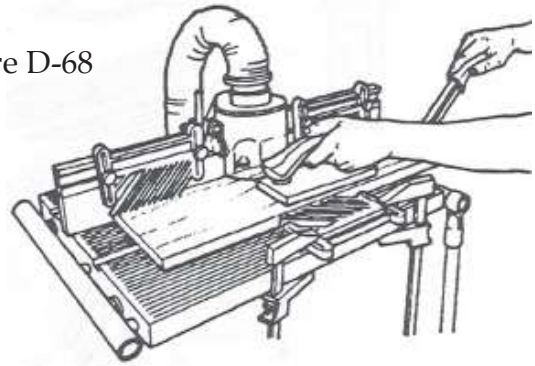


Figure D-68

Figure D-68 illustrates two feather boards mounted on a feather board holder. Since the workpiece is too wide to install a feather board in the miter gauge channel of the worktable, notice how the horizontal feather boards is clamped to the worktable. When you want to use feather boards for horizontal pressure on the workpiece, remove the channel guide from the feather boards and clamp the feather board to the front of the worktable.

Using the Miter Gauge with the Shaper Fence

The miter gauge gives stability and support to end cuts when shaping or routing. Not in Figure D-69 that the dust shield is adjusted to clear both the top of the miter gauge and the handle. It is worth the effort to readjust the dust shield because the miter gauge gives the board extra support and stability during the cut.

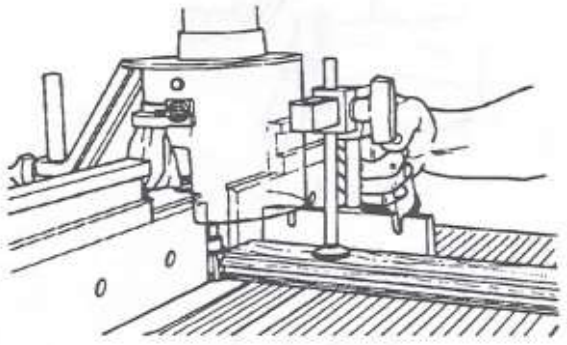


Figure D-69

Using a Extra Dust Collection Hose

Even though the dust shield is efficient, some operations could benefit from using an extra dust collection hose. The Shopsmith DC3300 Dust Collector experiences very little decrease in efficiency when one or tow more hoses are added, so you should consider the setups shown in Figure D-69 and D-70. Figure D-70 illustrates an elbow brush clamped to the worktable behind the shaper fence. This second hose is able to collect dust thrown from the rotation of the cutter.

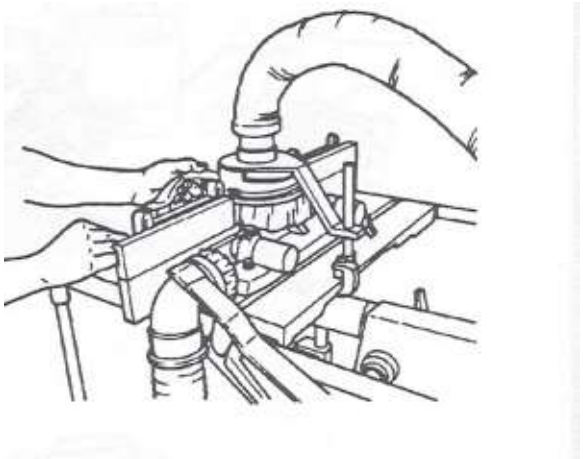


Figure D-70

Figure D-71 shows the utility pickup clamped to the guard support of the standard shield during pin shaping or pin routing operations. The second hose also collects the dust thrown from the rotation of the cutter.

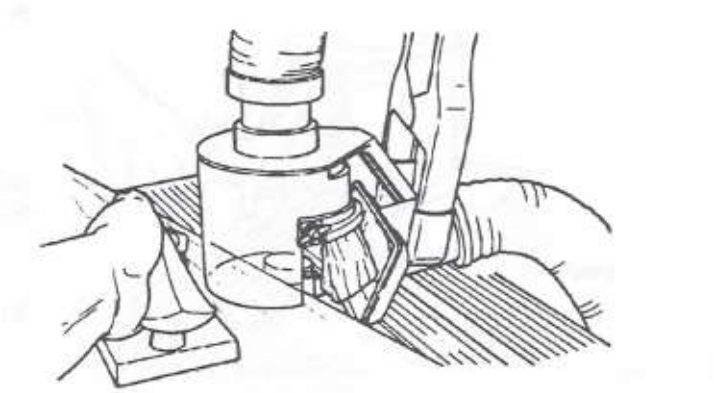


Figure D-71