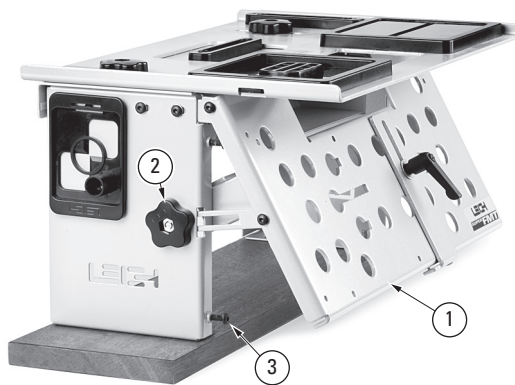


## SUPER FMT CHAPTER 3

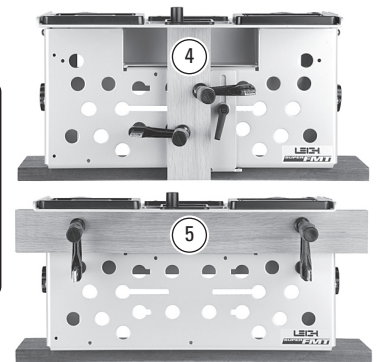
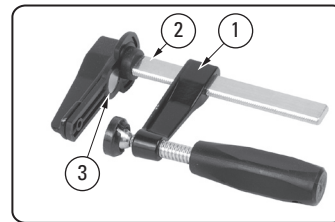
# The Super FMT Jig

*The Clamp Plate and Clamping  
The Table  
Jig Operation Concept  
Safety and Router Operation  
Wood Preparation*

### The Clamp Plate and Clamping

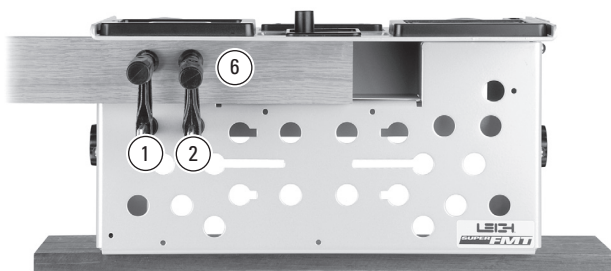


**3-1** The clamp plate ① is adjustable up to 30° from vertical and is held securely by two quadrant knobs ②. A set-screw ③ allows for positive return to 90°. **To ensure flush and in-plane joints, it may be necessary to adjust the clamp plate angle. See Appendix II, Jig Adjustments.**



**3-2** The two F-Clamps have a capacity from zero to 3" [76mm]. The threaded clamp arm ①, is removable and the clamp bar ② is inserted through the clamp plate hole from the rear. Each clamp 'foot' has a powerful rare earth magnet embedded in its plastic 'pad' ③ which maintains clamp position. Normally tenon workpieces will be clamped vertically ④ and mortise workpieces horizontally like this ⑤, or...

### Using Two Clamps

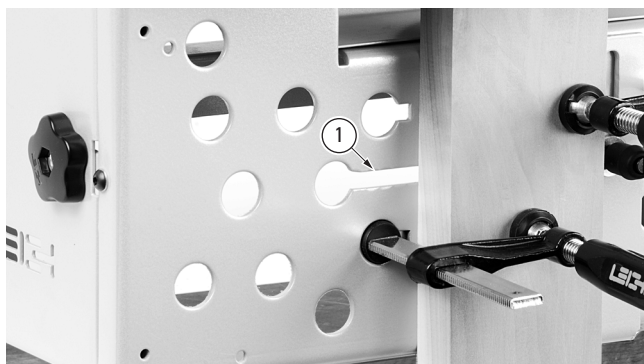


#### Using Two Clamps on Top Left or Top Right Corner

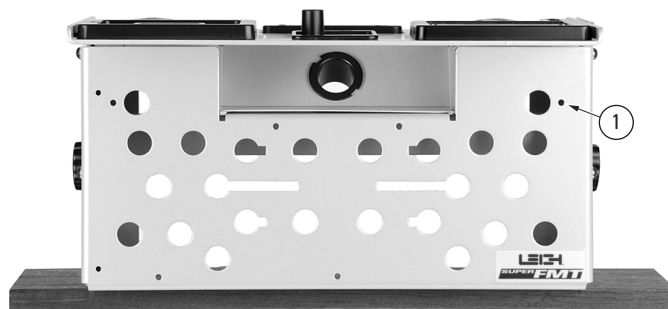
**3-3** ...like this ⑥. For clamping very small workpieces see Chapter 4, Small Joints. **Attention: When using two clamps as pictured, tilt the clamp plate fully upwards before inserting clamps. Insert the outermost clamp ① from below the horizontal bar on the inside of the clamp plate. Insert the inner clamp ② from above the horizontal bar on the inside of the clamp plate.**



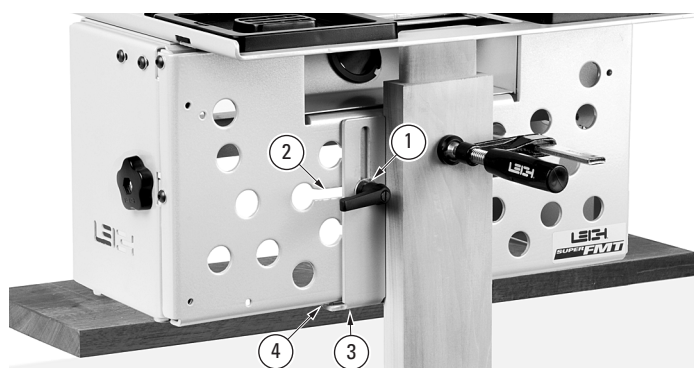
**3-4** ⚠ **Do not over tighten the clamps;** excessive force may damage the workpiece. A few minutes of trial and error testing will soon give you the feel for the correct clamp tension.



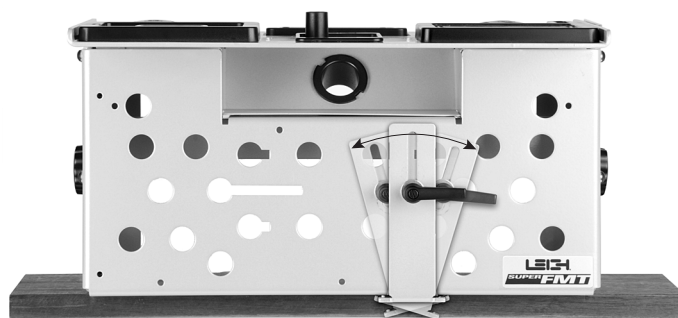
**3-5** The clamp plate holes allow for full clamping coverage. The two long keyholes ① are for the sidestop fence, but these holes (not the slots) may be used for clamping if required.



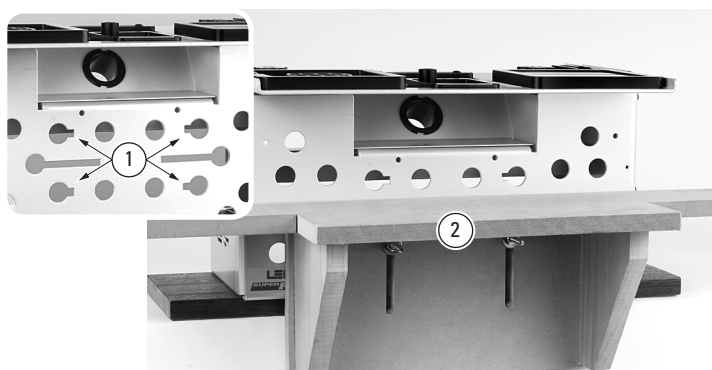
**3-6** The clamp plate is provided with seven small through-holes ①. If a facing board is required use No.8 or M4 wood screws (not supplied) from the rear. Alternatively the clamp plate holes could be marked onto a ply or MDF panel, bored through with a  $\frac{3}{4}$ " [20mm] Forstner bit and attached with a pair of optional Leigh F-Clamps.



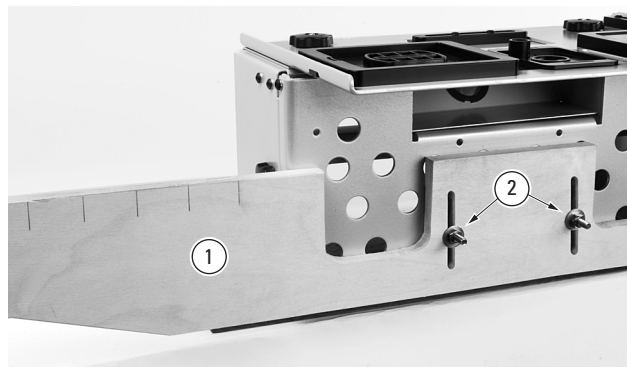
**3-7** The sidestop fence is attached by a single index lever ① and carriage bolt inserted through one of the two 'keyhole' slots ②. Most tenon pieces are routed vertically, and for that purpose the bottom of the fence ③ acts as a T-square against the bottom edge of the clamp plate ④. See Appendix II (A2-5), for sidestop squareness adjustment.



**3-8 Angled Joints:** Simply loosen the index lever, adjust the fence to the desired angle and re-tighten the lever.

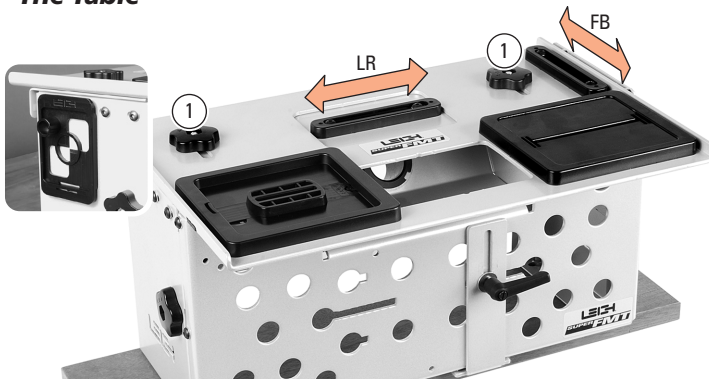


**3-9** The jig clamp plate has four clamp holes with notches ① to allow the mounting of a shop-made mortise beam ② or outrigger beam for handling large mortise pieces for efficient routing of multiple mortises. See Chapter 4, Production Procedures.

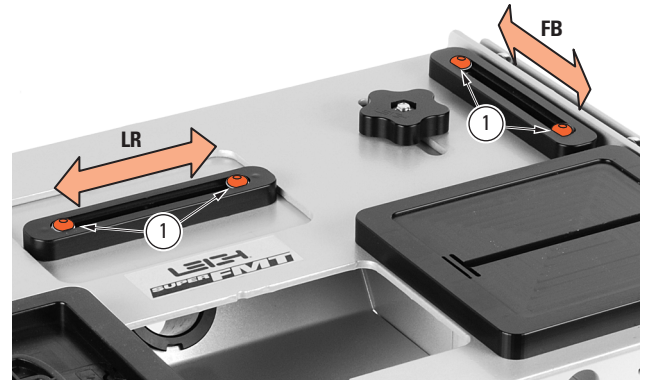


**3-10** The outrigger beam should be  $\frac{3}{8}$ " to  $\frac{1}{2}$ " [10-12mm] plywood, shaped as suggested to minimize weight. Drill and cut out as shown ① and attach using either  $\frac{1}{4}$ -20 [M6] carriage bolts and wing nuts (not supplied) ② or alternatively a pair of optional Leigh F-Clamps ■. See [leighjigs.com/support.php#r22](http://leighjigs.com/support.php#r22)

### The Table

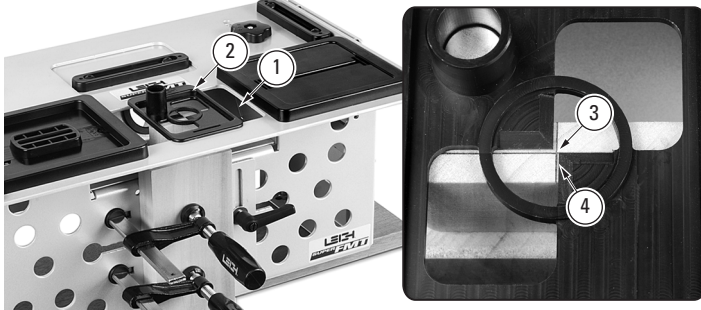


**3-11** The table is clamped in any desired position by the Table Clamp Knobs ①. Loosening the knobs slightly releases the table, which can then be moved in any direction to any position within its range.

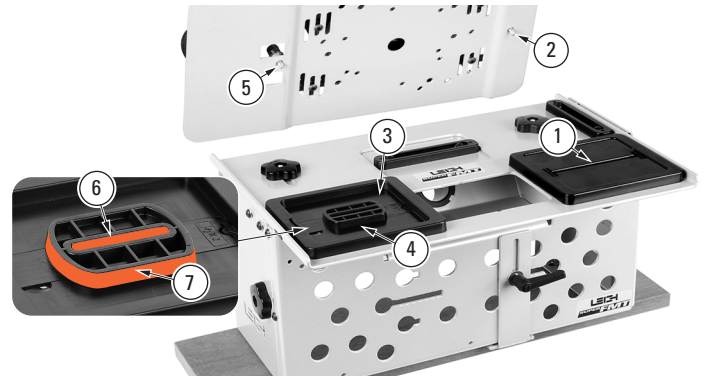


**3-12** Adjustable Limit Stops ① are used to limit or prevent table movement left to right (X-axis) and front to back (Y-axis), and to precisely align double and quadruple mortises and tenons (see Chapter 5). Use Limit stops when you see these icons:

LR for left-to-right table movement  
FB for front-to-back table movement.



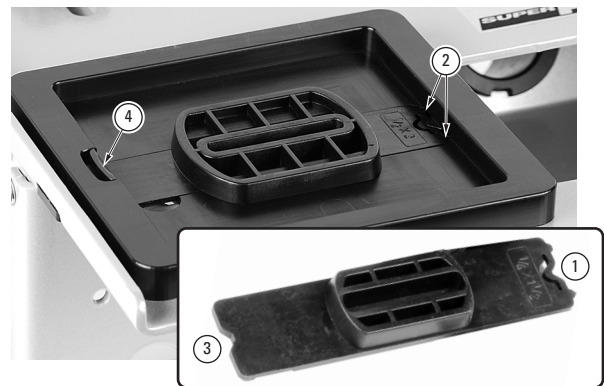
**3-13** The table has a bit opening ① and a Joint Aligning Sight ②. The sight and opening have matching locating notches and allow precise table positioning over joint cross marks ③. Because the human eye excels at comparisons, we can perceive differences as small as .004 in the space between the edges of the line and the triangles ④. That's .002 off center! You can readily center the sight using slight table movements until the spaces appear the same. The sight magnet allows for convenient storage on the end of the jig body.



**3-14** To the right front is the right hand "Guide Pin Track" ①. The right hand router sub-base Guide Pin ② runs in this track in all routing operations. To the left front is the Guide Recess ③, in which all Joint Guides ④ are placed. The left hand router sub-base Guide Pin ⑤ runs in the guide slot ⑥ for routing mortises, or around the outside of the Guide ⑦, for routing tenons.



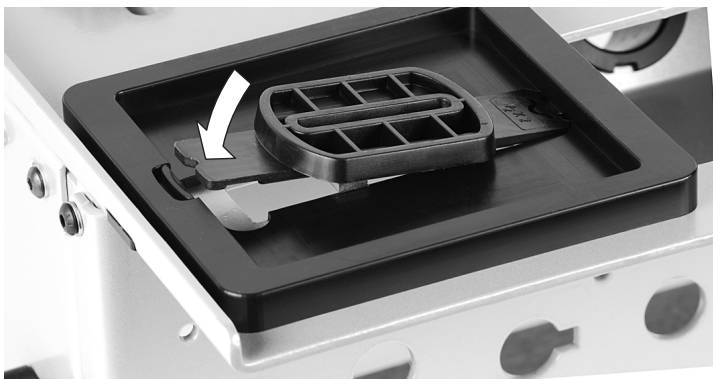
**3-15** The Guide Pin cannot move horizontally outside the recess ①, and prevents the bit from touching the sides of the bit opening ②.



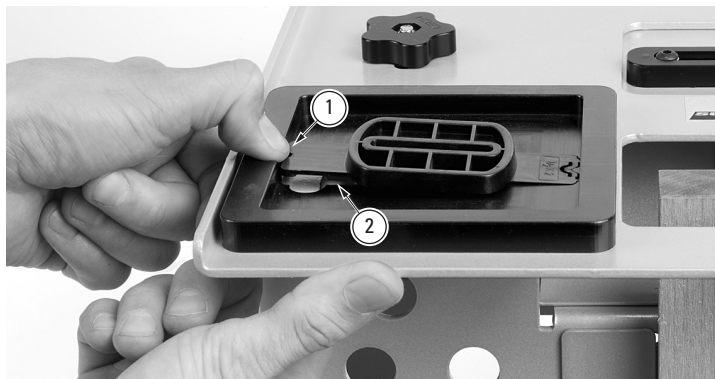
**3-16** Two small projections on the Guide ① fit into undercuts on the right side of the guide recess ②. The left end of the Guide ③ is pushed down and retained by the spring-loaded Guide Latch ④.

**⚠ Note:** the guide end shapes are not identical. Guides can only be installed one way as shown here.

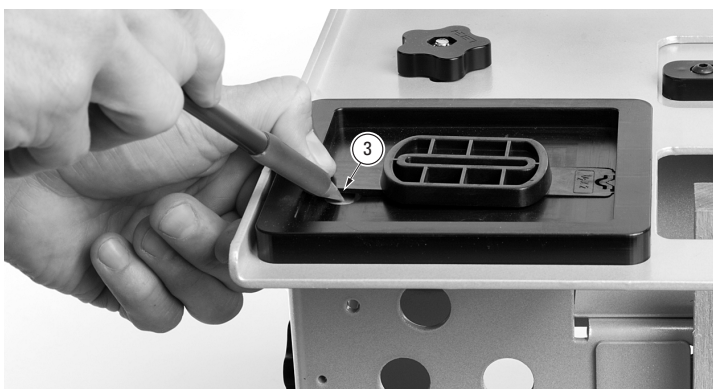




**3-17** Snap the Guides in like this. Use firm pressure just next to the guide latch. Note: The guides are injection molded acetyl and the guide bases may vary slightly in tolerance. **Some may require more pressure to insert.** The tighter guides will become easier after a few insertions.



**3-18** To remove a Guide, pull back the latch ① and push through the hole from below with your fingertip ②.

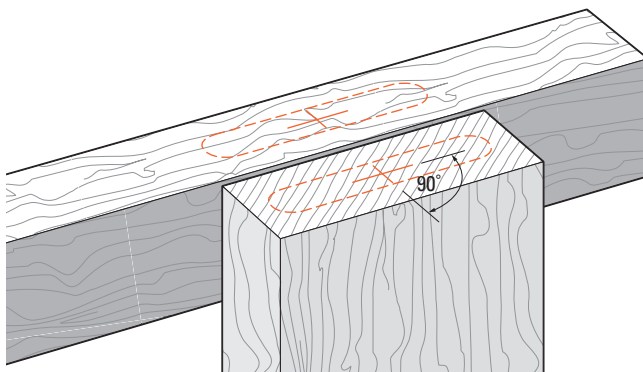


**3-19** If the finger hole is not accessible from below, use your fingernail or a small **non-metallic pry** to lift the Guide up ③. ■

### Jig Operation Concept

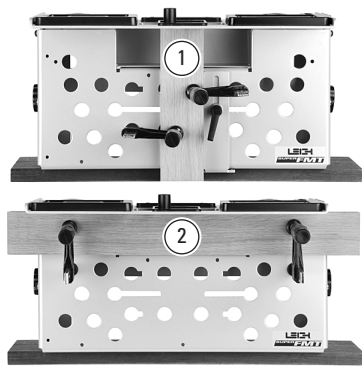


**3-20** Select a guide and bit. Snap the guide into the guide recess and install the bit in the router.



**3-21** The centers of a mortise and a tenon are marked with a cross.

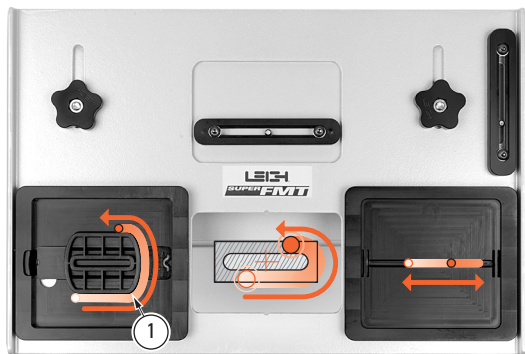




**3-22** Tenon workpieces are usually clamped vertically ①. Mortise workpieces are always clamped horizontally ②.



**3-23** The jig table is centered over the marked workpiece with the sight ①.

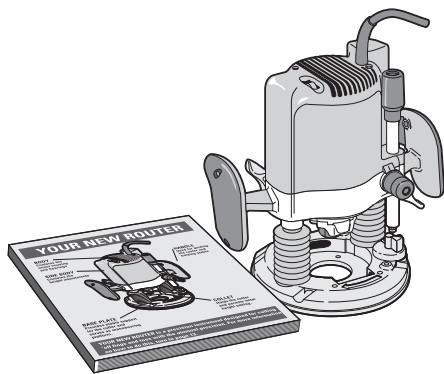



**3-24** Tenons are routed with the guide pin running around the outside (tenon) part of the guide ①. See Chapter 4 for routing techniques.



**3-25** Mortises are routed with the guide pin running in the inside mortise slot of the guide ②. Always rout the mortise slightly deeper than the tenon length. **Note: In most constructions, only one tenon and perhaps two mortises need to be cross marked and sighted. Please read all of the procedural chapters to gain the utmost efficiency from your Super FMT. ■**

### Safety and Router Operation



**3-26**  Read the owner's user guide that came with your router. It is essential to understand the router manufacturer's instructions completely.




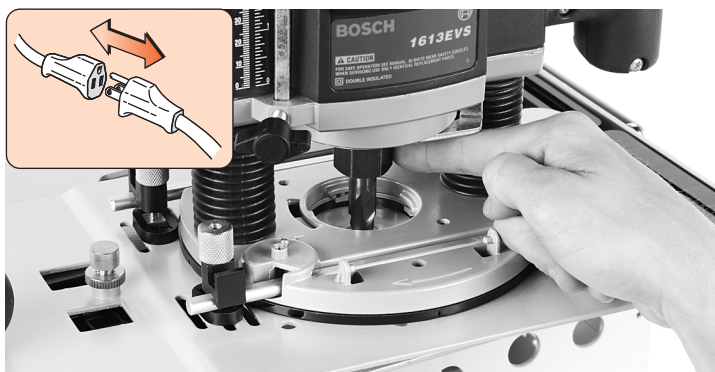
**3-27** Always wear approved safety glasses and hearing protection. Protect yourself from harmful dust by wearing a face mask. We highly recommend you acquire and use the optional Leigh Super FMT Vacuum Attachment. Connect your shop vacuum or dust collection system directly to the vacuum box.



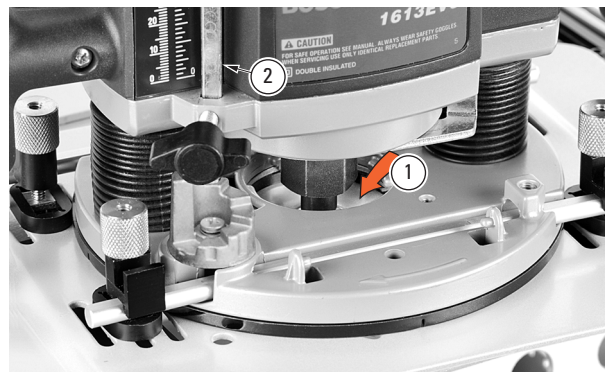
**3-28** The optional Vacuum Attachment consists of the metal box with adaptor, two additional adaptors to suit multiple hose sizes and two hex nuts used to attach the box.



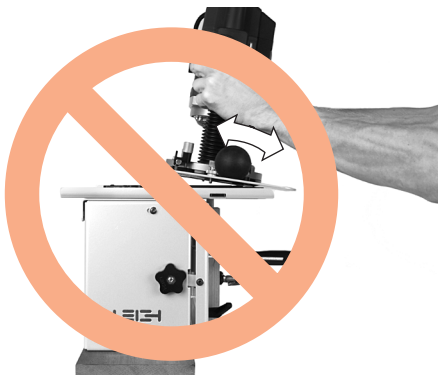
**3-29**  **Never drink alcohol or take medications that may cause drowsiness when you will be operating a router.**



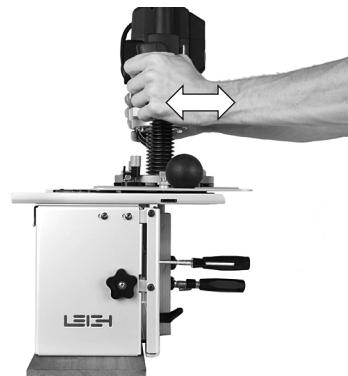
**3-30** Always disconnect the power source from the router when fitting bits, or making adjustments. Before connecting the router to the power source, make sure the bit revolves freely through the sub-base bit hole, and table and clamp plate bit openings in all extreme guide pin positions and preset bit depths.



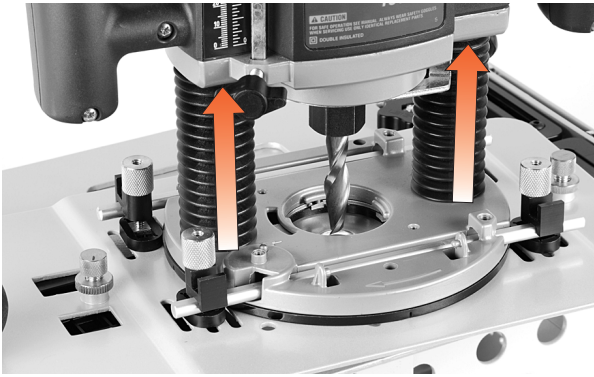
**3-31** Make sure the router collet does not contact the Super FMT sub-base at full plunge cuts ①. Set the router plunge stop rod as necessary to prevent this ②.



**3-32** Do not tilt the router on the jig.



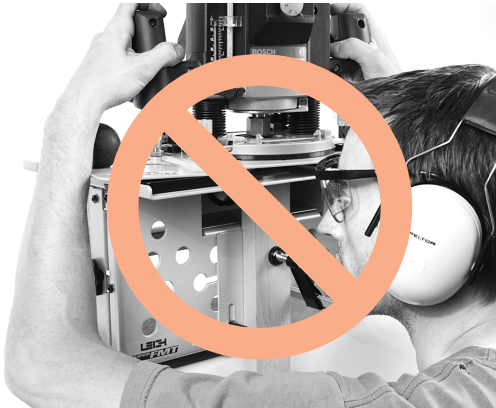
**3-33** Keep the router flat on the jig table.



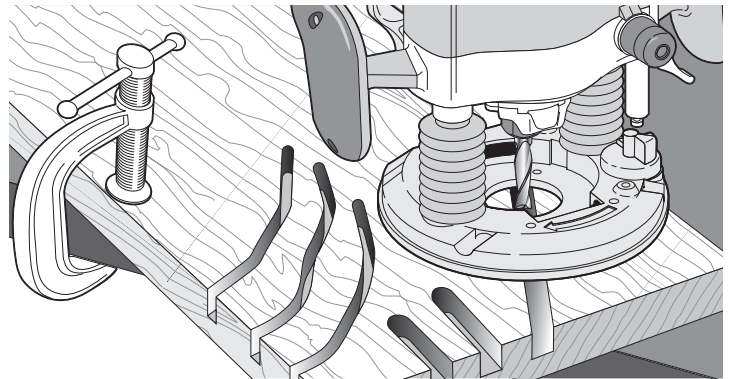
**3-34** Always raise the plunge router mechanism before removing the router assembly from the jig.



**3-35** The Super FMT must only be used with a plunge router. Never, ever use a fixed base router!

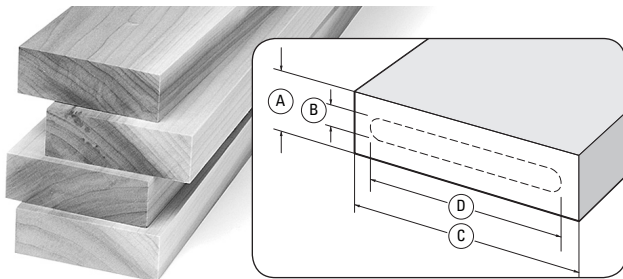


**3-36** Do not rout at face level.



**3-37** If you have never used your router before, be sure to follow the router manufacturer's instructions for its use. Make plenty of simple open-face practice cuts before you try to use the router on the Super FMT. ■

## Wood Preparation



**3-38** You will want to test the jig, so prepare some stock with a thickness **A** about 2.5 to 3 times the bit diameter **B**.

For example:  $\frac{1}{4}$ " [6mm] bit  $\frac{5}{8}$ " to  $\frac{3}{4}$ " [15-19mm]

$\frac{5}{16}$ " [8mm] bit  $\frac{3}{4}$ " to  $1\frac{5}{16}$ " [20-24mm]

$\frac{3}{8}$ " [10mm] bit  $1\frac{5}{16}$ " to  $1\frac{1}{8}$ " [25-30mm]

$\frac{1}{2}$ " [12mm] bit  $1\frac{1}{4}$ " to  $1\frac{1}{2}$ " [30-36mm]

and a stock width **C** of say, one and a half bit diameters greater than the selected guide length **D**. ■





## SUPER FMT CHAPTER 4

# Mortise & Tenon Routing Procedures

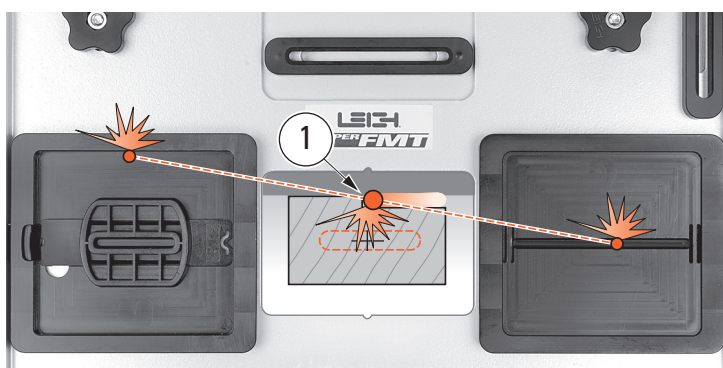
### Single Mortise & Tenon, Test Production Procedures Small Joints

*Before using your Leigh Super FMT you must have completed all of the preparatory steps including reading the router safety recommendations on the previous pages. If you haven't done so, it is essential that you do it now.*

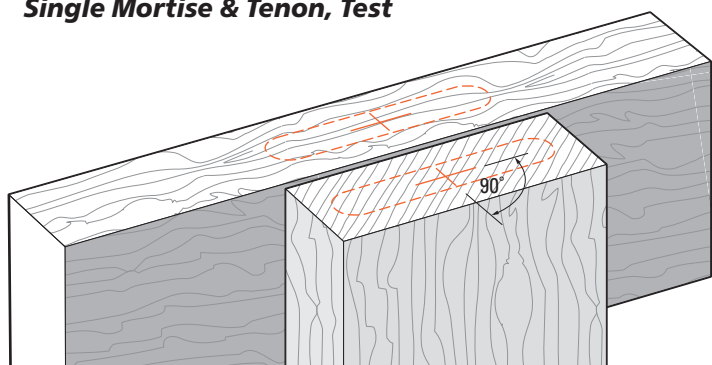
### ⚠ IMPORTANT SAFETY NOTE

Take great care to not “trap” the bit against the side of tenon rails ①. Do not attempt to rout center tenons in rails thicker than  $1\frac{5}{16}$ " [34mm] before referring to 5-39 through 5-44.

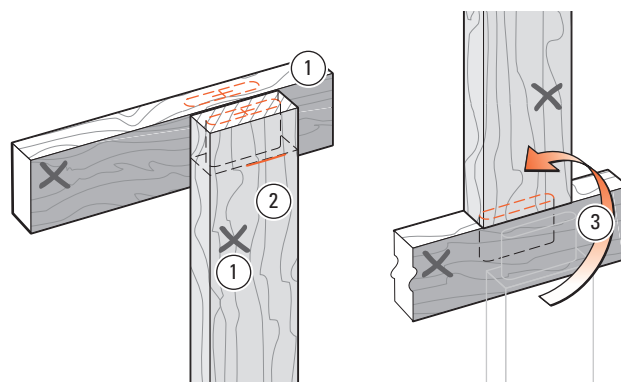
Without using the table movement as prescribed, the bit would have to be plunged into the side of the tenon rail causing the bit to powerfully “drive” the router across the jig. **This could be dangerous and can damage the jig.**



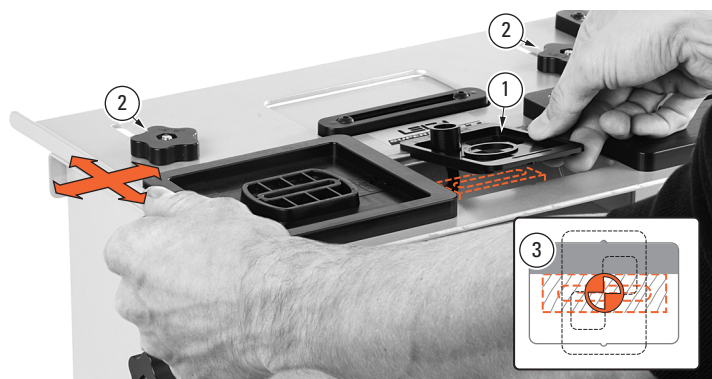
### Single Mortise & Tenon, Test



**4-1** Let's make a plain single mortise and tenon. Using a fine pencil, mark a cross at the center of the required tenon and mortise positions, the cross lines along and across the axis lines of the joint, at 90° to each other. Mark the mortise several inches [10cm] or so away from the end.



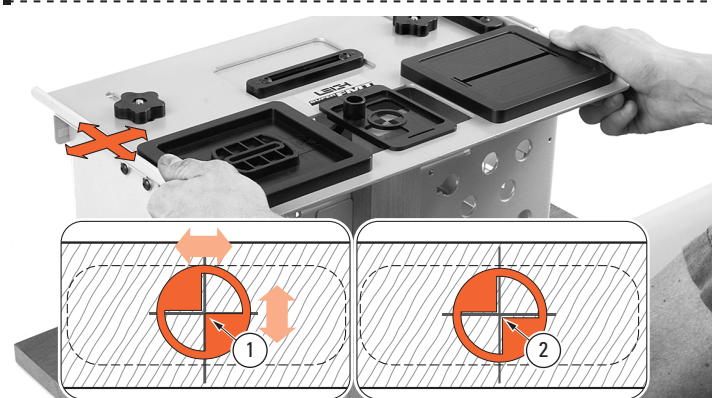
**4-2** In almost all cases, it is critical to have the same side of workpieces reference against the clamp plate for each tenon and mortise. So mark one side of each workpiece to reference “this side toward the clamp plate” ①, or “away from” if you prefer. Make a pencil mark ② to the required shoulder depth on the tenon workpiece. When the joint is cut, the tenon piece is rotated 180° to assemble ③.



**4-3** If you have not yet mounted the sidestop fence, do so now (see 3-7). Place it off center either side, it doesn't matter which. Fit the table sight in the bit opening ①. Loosen the table knobs ② and move the table to position the sight over the approximate tenon piece position ③. Lock the table knobs. **Always lock the table before positioning workpieces.**



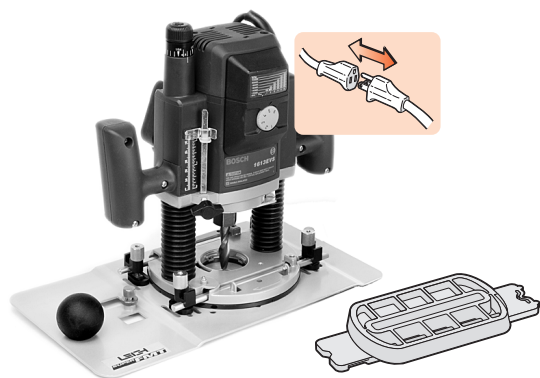
**4-4** Clamp the tenon piece with the end lightly touching the underside of the sight ①. Its side edge should touch the previously set sidestop fence ②, with the marked side toward the clamp plate.



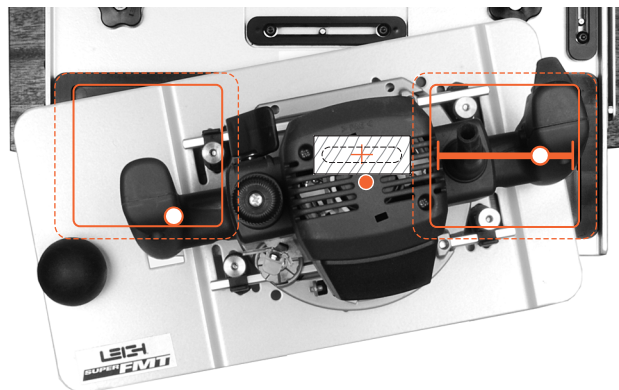
**4-5** Loosen the table knobs and move the table until the sight opening is positioned equally around the layout marks on the workpiece. Lock the table. Because the human eye excels at comparisons, differences as small as .004 can be perceived in the space between the edges of the line and the triangles as shown here ①. You can readily center the sight using slight table movements until the spaces appear the same ②.



**4-6** Unlock the two **FB** front/back limit stops. Move both so they touch the Stop Post, and tighten both stops ①. This prevents front-to-back movement of the table when later sighting the mortise. Remove the sight and store it at the end of the jig.

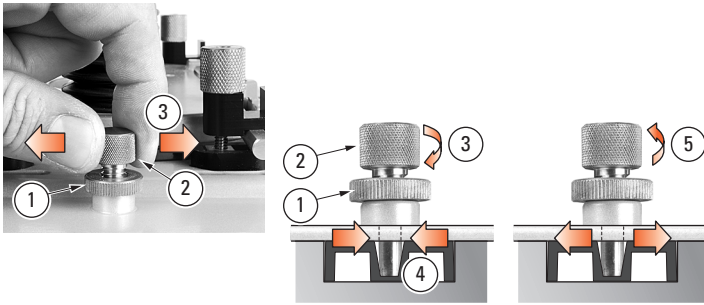


**4-7** Unplug the router. Insert the selected guide into the guide recess and matching diameter bit into the router.

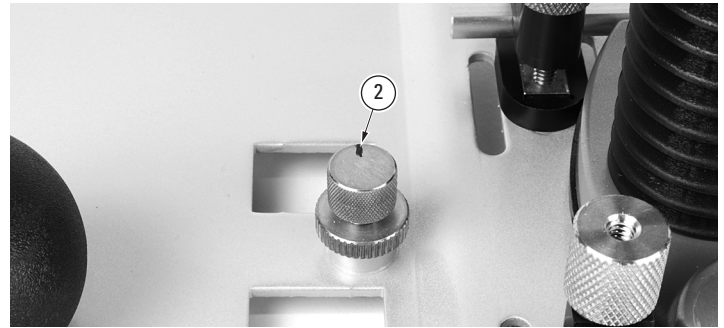


**4-8** Make sure the two guide pins are turned up approximately two-and-a-half turns from the lowest position to avoid the end of the guide pin contacting the bottom of the guide pin track and guide recess! Place the router on the jig table, the right-hand guide pin in the right side track, the left-hand guide pin in the near side of the guide recess.

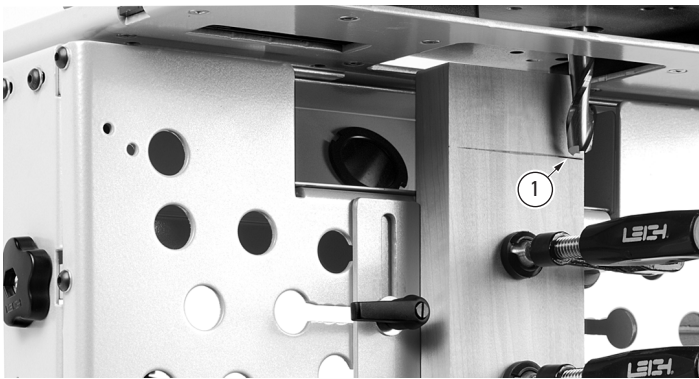




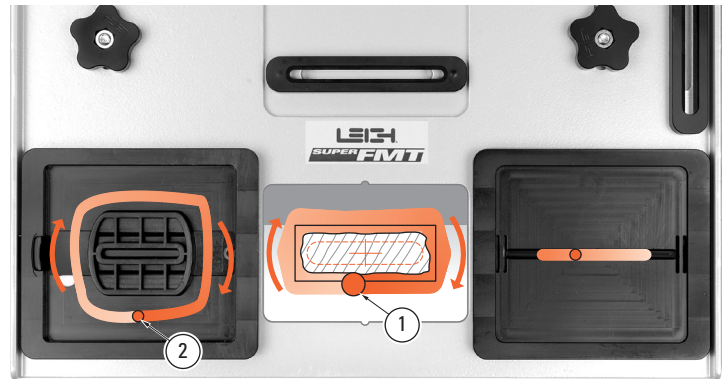
**4-9** Adjust the right hand guide pin. Turn guide pin lock nut ① up under the guide pin ②. Turn the guide pin down ③ until all front-to-back “play” is eliminated ④, then turn it back up  $\frac{1}{8}$  of a turn ⑤. To prevent the guide pin from turning, turn guide pin lock nut down firmly against the threaded boss. The router/sub-base should slide freely left to right. Once set, RH guide pin should require no more adjustment.



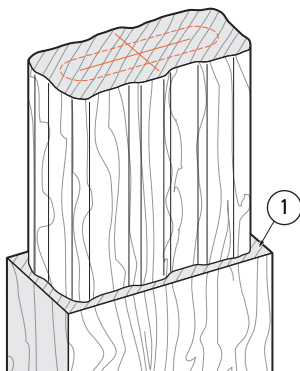
**4-10** Repeat this procedure with the left guide pin set in a guide mortise slot. When you have minimal “free play”, use a permanent ink pen to mark a small “dash” at the 12 o’clock position on the guide pin ②. This indexes the guide pin. Before routing your first joint, turn the guide pin up 2 full turns. This is your starting point. Record “number of turns up” or “down” when joint fit is good. Each  $\frac{1}{8}$  turn of the LH pin changes the joint glue line fit by approximately 0.0011" [0.03mm].



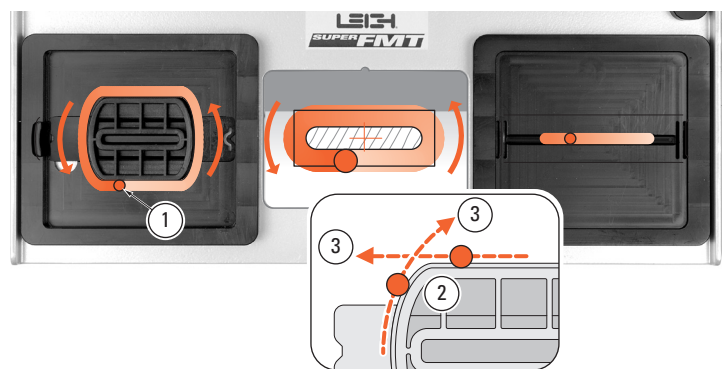
**4-11** Plunge the router so the tip of the bit is level with the pencil mark of the tenon shoulder ①, and lock the plunge. Set the plunge depth stop rod to its stop. Tenons are routed in one depth setting; it is not necessary to make multiple passes at different depths of cut.



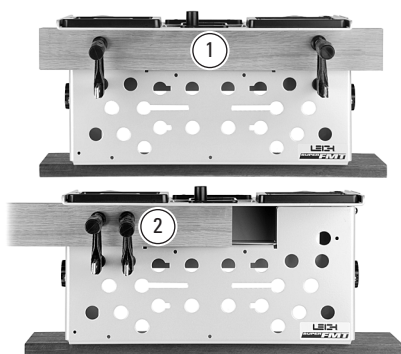
**4-12** Read 4-12 through 4-14 before routing. With **guide pin in near side of guide recess**, switch on router power and with firm control, move it in until the bit lightly touches the tenon workpiece. **Very carefully, with the bit very lightly engaging the wood surface, “climb rout” clockwise around the tenon piece ①.** Maintain very light bit contact. **Do not run guide pin on guide yet ②.**



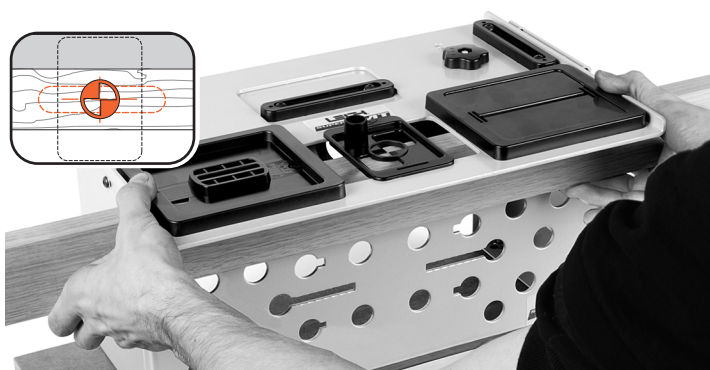
**4-13** Control the router firmly, the router is driven clockwise by the bit rotation. This first shallow climb cut will leave a small but clean shoulder ①.



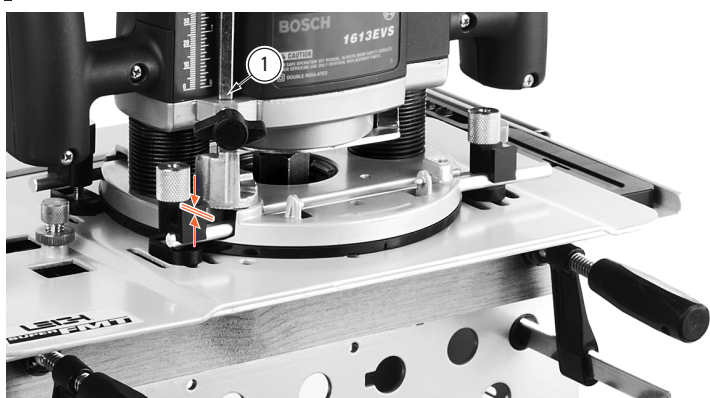
**4-14** Routing counterclockwise, run the guide pin around the tenon guide surface. Make sure the pin contacts the entire outer surface ①. In these first test cuts, check the tenon for a completely smooth cut before removing the piece from the jig. Until you are confident with this procedure, as a final cleanup we recommend you run the guide pin “off” of each guide “corner” ② in both directions ③.



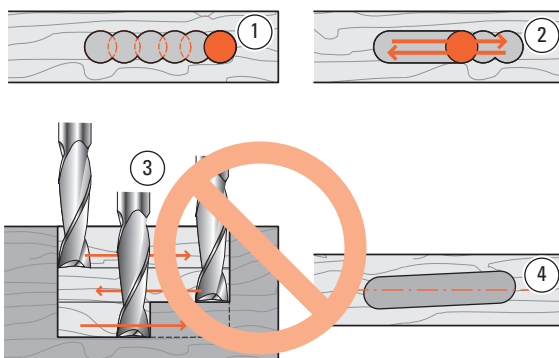
**4-15** Remove the router and tenon workpiece from the jig. Position the two clamps so the mortise piece can be positioned for secure holding. Clamp to either both sides of the bit opening ① or to one side ②. Note: Leaving a “horn” on the ends of mortise pieces as in ① not only makes for easy clamping, the horns will be an aid in assembly gluing and clamping later. **Refer to 3-3.**



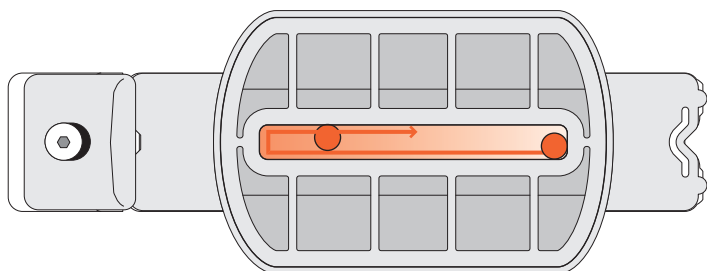
**4-16** Fit the sight and remove the sidestop fence if it is in the way. With the marked side of the mortise piece toward the clamp plate, either move the board left and right to align the cross with the sight and clamp in place, or clamp in place first and move the table to align the sight. Remember, you previously set the **FB** limit stops to allow only left/right movement.



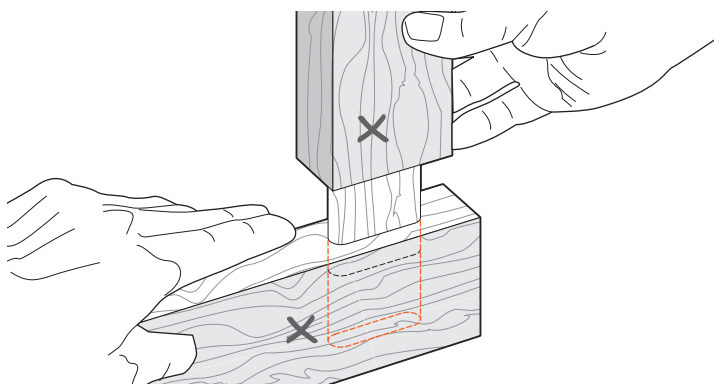
**4-17** Remove the sight and place the router/sub-base assembly on the jig, the left hand guide pin in the mortise slot part of the guide. Now raise the plunge stop rod ① slightly, say  $\frac{1}{32}$ – $\frac{1}{16}$ " [1–1,5mm] to allow the mortise to be routed slightly deeper than the tenon to ensure perfect tenon shoulder flushness on the finished joint.



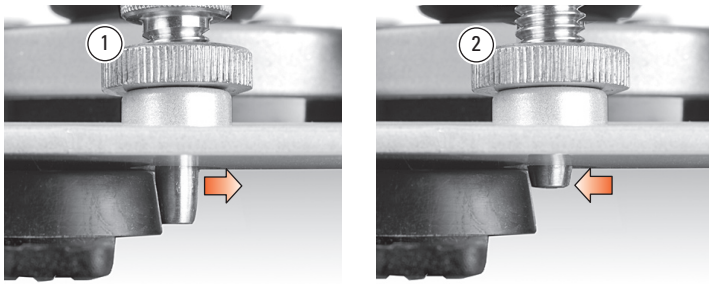
**4-18** The best way to rout mortises (parallel to workpiece) is to plunge slightly overlapping holes to full depth ①, and then clean out left-right-left at full depth of cut ②. **Do not rout left-right-left at progressively greater depths without plunging holes ③...** the bit's rotation will pull the bit off the intended mortise line with each pass ④ and the mortise may not be parallel to the workpiece.



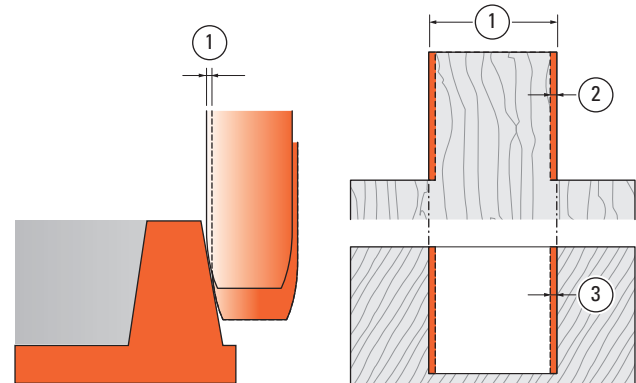
**4-19** Make sure the guide pin is run clockwise against both the front and rear of the mortise guide slot on the final passes. The gap between pin and mortise guide slot is greatly exaggerated in this illustration.



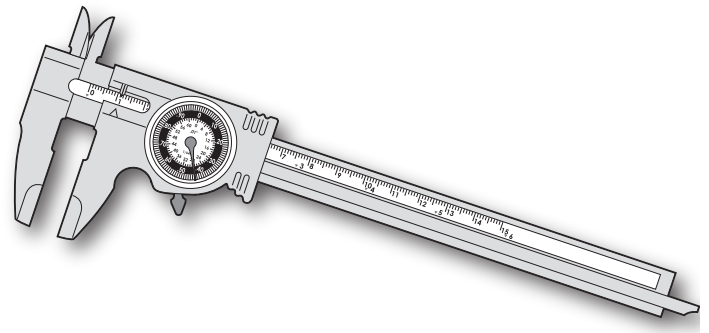
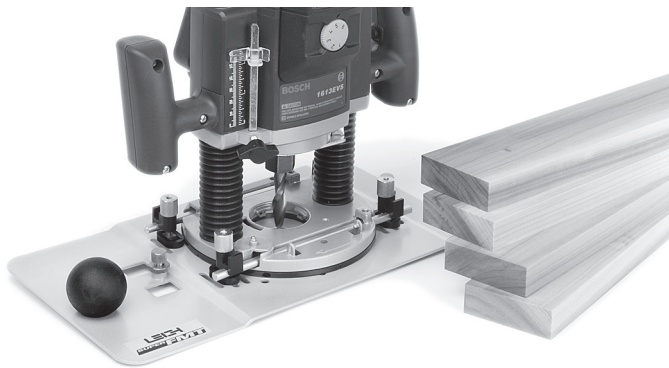
**4-20** Remove the mortise piece and keeping the marked faces adjacent, test the tenon for fit and flushness. If the face sides are not flush, check the straightness of the two parts. If they are straight, the clamp plate may not be vertically parallel to the bit. See Appendix II, Jig Adjustments, A2-1 through A2-3.



**4-21** Joint fit is adjusted with the left hand guide pin only. If the joint is too loose, turn the guide pin down ①. If the joint is too tight, turn the guide pin up ②. For how much, see 4-22. Guide pin changes affect the mortise and tenon, so rout a complete new joint. **Establish ideal pin height for both mortise and tenon at one pin setting.**

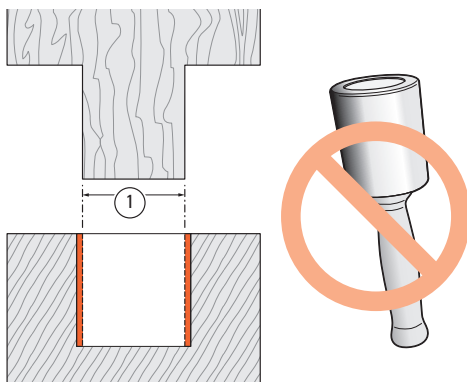


**4-22** How much adjustment is required?  $\frac{1}{8}$  of a turn of the guide pin knob will change the joint glue-line fit by 0.001" [0,025mm] ①, i.e. turn  $\frac{1}{8}$  up; the bit will reduce the tenon thickness by ~0.001" [0,025mm] (half of that per side ②) and increase the mortise width by the same amount ③. Dimensions and angles shown here are exaggerated.



**4-23** The Super FMT can provide this accuracy for settings but remember, you're working with wood and a hand-held router, with a lot of movement tolerances; it's not a computer-controlled milling machine. Nevertheless, the Super FMT will allow you to do very precise and consistent work.

**4-24** If you have a dial or digital calliper (every shop should have one) you can literally measure the tenon and mortise and adjust accordingly. Every ~0.002" [0,05mm] of difference in mortise to tenon size (say ~.001" [0,025mm] on the glue line) should require  $\frac{1}{8}$  of a turn; down to tighten, up to loosen.



**4-25** Generally we have found the best fit differential to be 0.005" [0,13mm] "loose". Basically, the dry joint should "push" together fairly easily, but not fall apart under its own weight. If a mallet is needed, it's too tight.



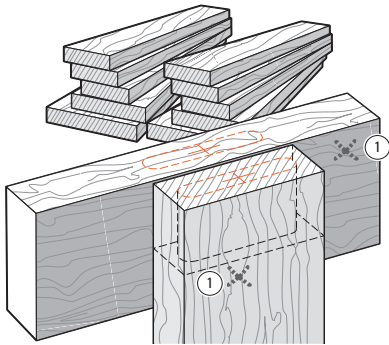
**4-26** Once you've established the guide pin setting for a specific bit/guide combination, record the setting on the following page. For example:  $\frac{5}{16}$ " x  $1\frac{1}{2}$ " [8x35mm] "up  $1\frac{3}{4}$  turns". Using the same bit and guide next time, use the recorded setting for a good fit first time. Note: Different wood species may require slightly different settings. ■



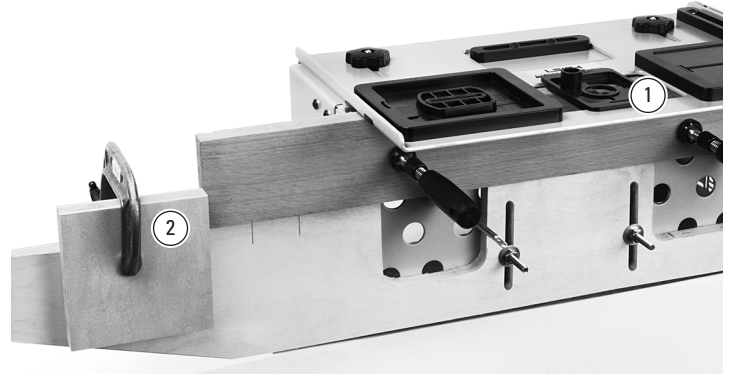
[illegible]

Hint: Photocopy or scan this page for future records.

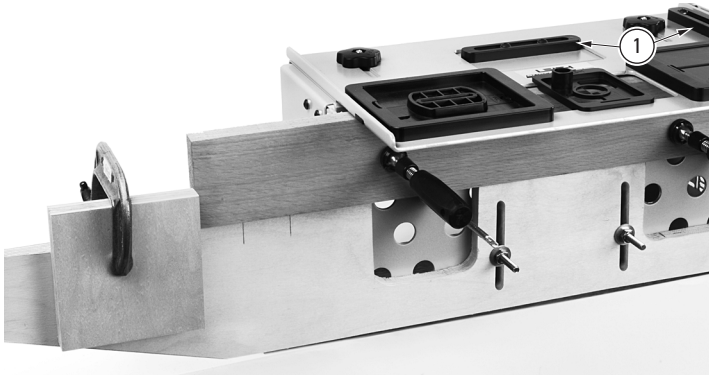
## Production Procedures



**4-27** When routing frame joints it is only necessary to mark and sight a single tenon and perhaps two mortises. Once the sidestop fence or outriggers are set and the table sighted for one joint, any number of similar joints may be routed without marking. We recommend marking the finished face which goes against the clamp plate (shown here from operator view) ①.



**4-28 Mortises** Sight ① one mortise and set a stop block ②.



**4-29** Set both sets of axis stops to prevent unintentional table movement ①.

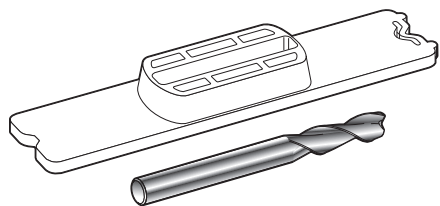


**4-30** Sight the second mortise by moving the mortise piece (not the table), and set the second stop block ①. Rout any number of successive (unmarked) mortises without removing the router from the table.

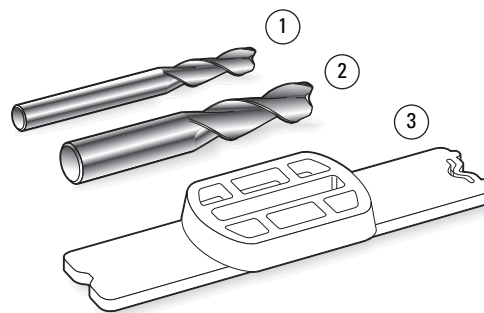


**4-31** Multiple mortises in "ladder" type construction are rapidly routed. Mark all mortises on only one piece (only one of the marks needs a front-to-back mark!). Sight the first mortise (cross) to set the table and mark the top of one outrigger in line with workpiece end ①. Table locked, move workpiece, sighting each successive mortise line, marking the outrigger(s) ②. To rout, align unmarked board ends with outrigger marks ②. ■

## Small Joints



**4-32** The Super FMT is designed so that both mortise and tenon of a particular sized joint may be routed with the same sized bit. So if you are making a single frame with a  $\frac{1}{4}$ " [6mm] guide and bit, this works very effectively. However, if you are in production, it is much more efficient to rout small tenons with a larger bit.

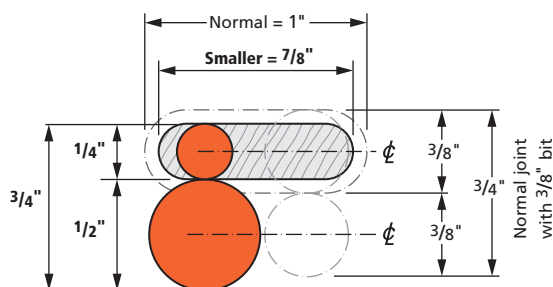


**4-33** For example, if you want to rout many  $\frac{1}{4}$ " [6mm] mortises and tenons, the tenons can be much more speedily routed with a  $\frac{1}{2}$ " [10mm] bit. Here's how.

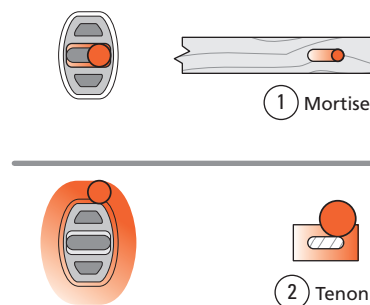
Select  $\frac{1}{4}$ " [6mm] bit for mortises ①.

Select  $\frac{1}{2}$ " [10mm] bit for tenons ②.

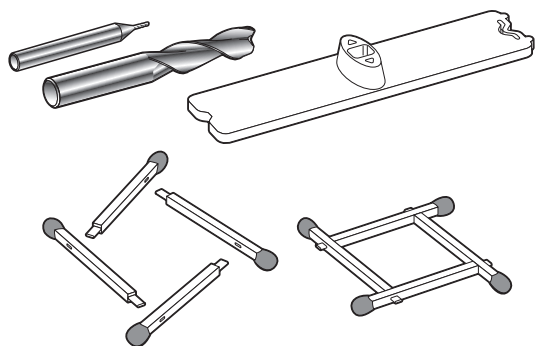
Select  $\frac{3}{8}$ " [8mm] guide ③ for length from the guide/bit selection chart in Appendix I.



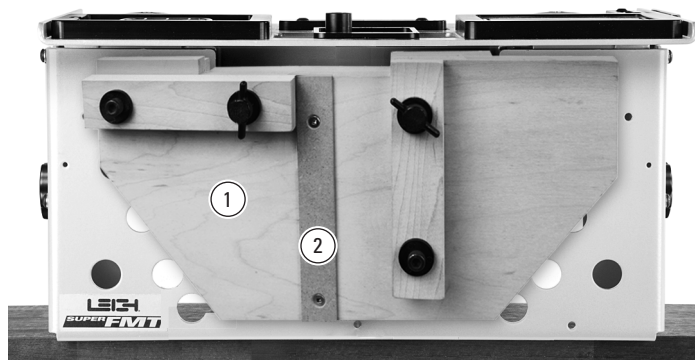
**4-34** The diagram illustrates routing the  $\frac{1}{4}$ " joint described above (guide not shown). The result is a perfect  $\frac{1}{4}$ " mortise and tenon,  $\frac{1}{8}$ " smaller both ways than the guide size. Any two bit diameters which add up to two times the nominal guide size will produce a joint the size of the smaller bit. Bear in mind, the maximum usable bit diameter with the Super FMT is  $\frac{1}{2}$ " [12mm].



**4-35** Using a small guide, combined with an even smaller mortise bit and larger tenon bit gives the Super FMT an additional unique ability to rout joints smaller than the smallest ( $\frac{1}{4}$ " [6mm]) guide. For example, take a  $\frac{1}{4}$ " [6mm] guide and **step up** by  $\frac{1}{8}$ " [3mm] to  $\frac{3}{8}$ " [10mm] diameter on the tenon bit...and **step down** the same amount for mortise bit to get  $\frac{1}{8}$ " [3mm] mortise and tenons...**all with adjustable joint tightness.**

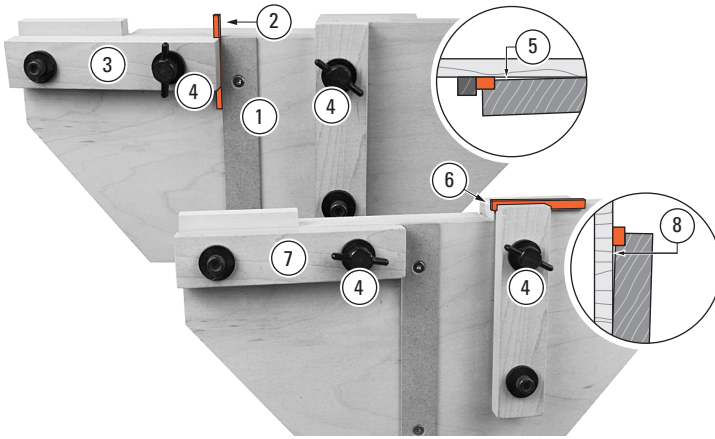


**4-36**  $\frac{1}{32} \times \frac{3}{32}$ " [0,8 x 2,4mm] mortises and tenons on this "match frame" were formed (with machine tool bits) on a  $\frac{1}{4} \times \frac{5}{16}$ " guide. The  $\frac{15}{32}$ " tenon bit is  $\frac{7}{32}$ " larger than  $\frac{1}{4}$ ". The  $\frac{1}{32}$ " bit is  $\frac{7}{32}$ " smaller than  $\frac{1}{4}$ ". A similar metric set: 6mm guide, 1mm mortise bit, and 11mm tenon bit produce 1mm joints. Machine tool bits as small as .010" with  $\frac{1}{4}$ " shanks and similar metric bits are available from machine tool suppliers.



**4-37** For very small joints we recommend attaching a rigid piece of ply or MDF ① minimum  $\frac{3}{4}$ " [20mm] to the clamp plate, using the through screw holes in the plate. This should have its own mini sidestop fence attached for tenons ②.





**4-38** To hold very small workpieces ②, make up a rabbeted holder ③ with the rabbet slightly shallower than the workpiece thickness, leaving a gap at ⑤ and ⑧. **i.e. For Tenons:** Sidestop ① Tenon Piece ② Holder ③ Clamp ④ Gap ⑤. **For Mortises:** Mortise Piece ⑥, Holder ⑦, Clamp ④, Gap ⑧. ■