Assembly and Setup

Guard Assembly

Assemble and set up the guard assembly according to the following procedures:

1. Attach the brackets to the guard. Attach the two brackets (29) to the guard (21) with the carriage bolts (31), washers (30), washers (28) and wing nuts (27). With the hardware at the back of the guard's two outer slots, tighten the wing nuts finger tight.

2. Install the guard assembly on the channel. In the slot of each bracket (29), loosely assemble a screw (23), washer (24), two special washers (25) and a T-nut (26). Insert the edge of the T-nut into the channel first, then pivot the T-nut and push it down into the channel. Raise the guard all the way up the bracket and use a 5/16" Allen wrench to tighten the screw (23).

Channel and Support Bracket Assembly

Assemble and set up the channel and support bracket assembly according to the following procedures:

1. **Install the two support brackets and clamps.** (See Figure 9.) Place the channel (13) with the guard and template support assemblies attached across a corner of your workbench. Use the 5/16" Allen wrench to attach the support brackets (15) to the channel with screws (19) and washers (20) at the **third** hole from each end of the channel. Secure a clamp (16) to each support bracket (15) with a screw (18) and washer (17).

NOTE

The placement of the left-hand support bracket on the channel is for maximum spindle capacity. Depending on the operation being performed, it should be moved to the right as required to provide more rigid support.

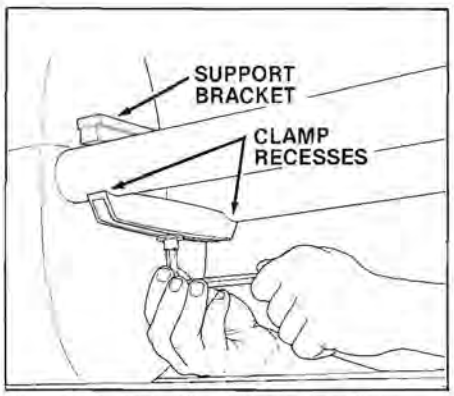

Figure 10. Securely tighten the clamp screws, making certain the clamps are in line with the support brackets and that the clamp recesses are fully engaging the way tubes.

2. Position the headstock and table assembly. Move the headstock to the full left position and move the table assembly to midway between the headstock and tailstock.

3. Mount the channel and support bracket assembly on the way tubes.

WARNING

Have a helper hold the channel and support bracket assembly upright while you tighten the clamps and hardware.

With the clamps (16) turned to pass between the way tubes, set the assembly on the way tubes between the headstock and tailstock. Engage the curved recesses of each clamp against the underside of the way tubes and finger tighten each screw (18).

With the support brackets (15) square with the channel (13) and seated flat on the way tubes, securely tighten the bracket screws (19) with the 5/16" Allen wrench. Then securely tighten the clamp screws (18), making certain the clamps are in line with the support brackets and that the clamp recesses are fully engaging the way tubes. (See Figure 10.)

CAUTION

- **Do not overtighten clamps. Overtightening will damage the way tubes.**
- **Proper engagement and alignment of the clamps is essential for accurate front-to-back centering of the assembly.**

Alignment and Adjustment

NOTE

When you've completed all the *Assembly and Setup* instructions, perform all the procedures in the *Alignment and Adjustment* section before attempting to operate your Lathe Duplicator.

Alignment and Adjustment

After you've completed the **Assembly and Setup** instructions, perform all the instructions in this **Alignment and Adjustment** section before operating the Lathe Duplicator.

Also, whenever you remount the Lathe Duplicator on the Mark V be sure to check the "Table to Lathe Centers Parallelism," "Template Centers Alignment," and "Follower to Cutter Alignment."

CAUTION

The precise alignment of the Lathe Duplicator is critical for exact duplication. If the alignment is not done properly, you'll waste time and materials, and find duplicating extremely frustrating.

Before you begin any alignment procedures, make sure your square is accurate. (See Figure 1.) Select a wide scrap board with at least one straight edge. Place the square against the edge of the board and draw a line across the width. Flop the square over and hold it against the same edge and draw another line next to the first one. If the lines are parallel, your square is accurate.

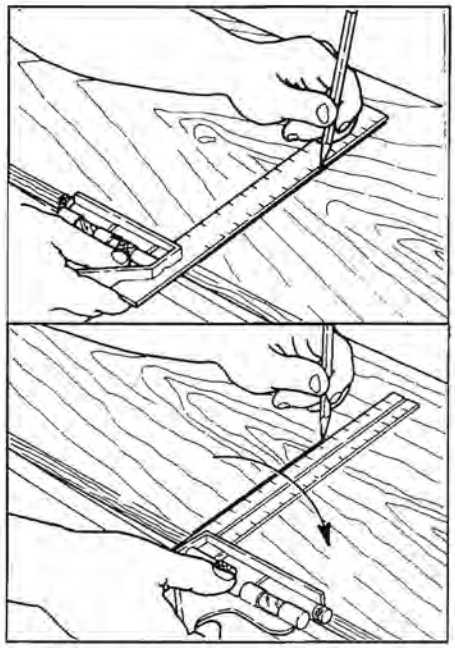

Figure 1. Test your square for "squareness."

Cutter Support Alignment

Align the cutter support according to the following procedures:

1. **Remove the follower support.** Loosen knob (44) and remove the follower support (46) from the follower upright (50).
2. **Move the cutter guide.** Loosen the cutter guide cap screw (53) with the 7/64" Allen wrench, and slide the cutter guide (55) back toward the base (37).
3. **Align the cutter support.** Loosen the two cutter support setscrews (43) using the 5/32" Allen wrench. Make sure the cutter positioning setscrew (42) is lightly seated in the groove of the cutter support (58). Place an accurate combination square against the base (37) and one of the cutter support side flats. Adjust the cutter support so the side flat is against the square. Tighten the two cutter support setscrews (43). (See Figure 2.) Replace the follower support on the follower upright and reposition the cutter guide.

NOTE

Because of possible uneveness on the top surface of the base, it may be difficult to achieve perfect squareness with both side flats. Therefore, indicate off one side flat only.

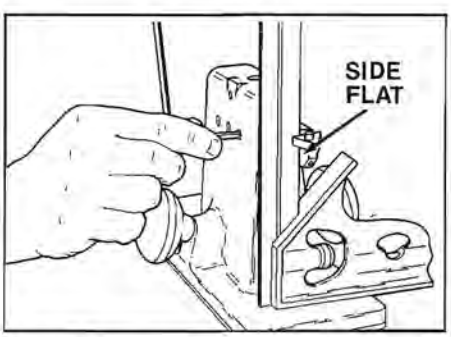

Figure 2. Align the cutter support.

Table to Lathe Centers Parallelism

Align the table assembly parallel to the drive and tailstock centers according to the following procedures:

NOTE

Be sure locks are secure, and the table surface and the bottom surface of the tool rest base are clean.

1. **Align the carbide cutter with the drive center.** Move the table assembly next to the headstock. Position the carbide cutter facing the drive center. Adjust the table height so that the upper surface of the cutter tip almost touches and is in line with the tip of the drive center. (See Figure 3.) Lock the table at this height.

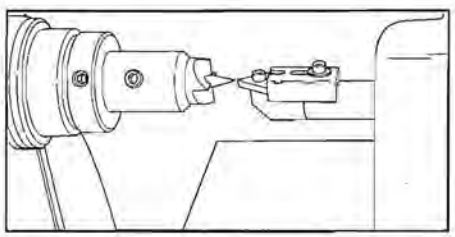

Figure 3. Align the carbide cutter with the drive center.

2. **Check the alignment of the carbide cutter with the tailstock center.** Move the table next to the tailstock. With the tip of the carbide cutter almost touching the tip of the tailstock center, check that the upper surface of the cutter tip is in line with the tip of the center. (See Figure 4.) If the tips are not aligned properly, raise or lower the tailstock as required to achieve alignment. Lock the tailstock. The top surface of the table assembly is now parallel to the drive and tailstock centers.

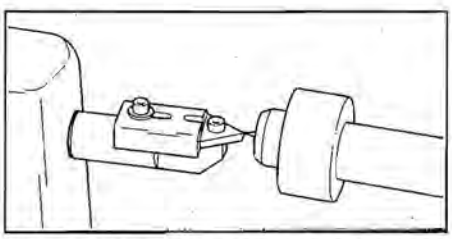

Figure 4. Check the alignment of the carbide cutter with the tailstock center.

Alignment and Adjustment

Template Centers Alignment

Align the template centers according to the following procedures:

1. Align the left-hand template center with the drive center. Move the table assembly next to the headstock and lock the carriage. Table height should be previously adjusted so the top of the cutter is level with drive center. Loosen the template bracket screw (11) with a 5/16" Allen wrench and the two template clamp screws (8) with a 1/4" Allen wrench.

Position an accurate combination square so that its front edge just contacts the tip of the drive center. Carefully move the template support assembly forward on the channel until the tip of the template center just contacts the front edge of the square. Tighten screw (11). (See Figure 5.)

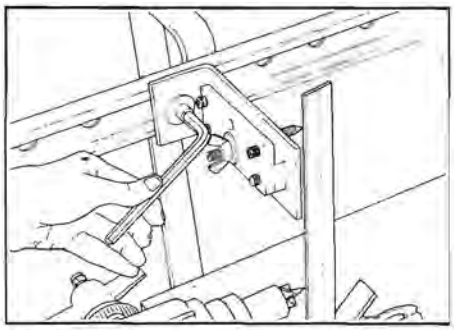

Figure 5. Use a combination square to align the left-hand template center with the drive center.

Reposition the square so that its front edge just contacts the front edge of the drive center tip. Adjust the template support assembly so that the front edge of the template center tip just touches the front edge of the square. With the square still touching the edge of both center tips, tighten the two screws (8). (See Figure 6.)

2. Check the alignment at the back edge of both center tips. Use the square to check the alignment at the back edge of both tips. (See Figure 7.) If there is a gap between the tip of the template center (3) and the square, the square is probably not accurate. Recheck the front edge alignment again. If both tip edges still touch the square, loosen both screws (8) and adjust the template center until an equal gap is obtained on both sides of the tip. Tighten the screws securely.

3. Align the right-hand template center with the tailstock center. Move the table assembly next to the tailstock and lock the carriage. Then repeat the procedures of Steps 1 and 2 to align the right-hand template center with the tailstock center.

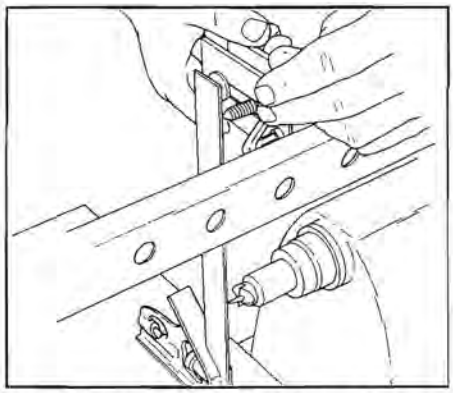

Figure 6. Use a combination square to align the edges of the tips of the left-hand template center with the drive center.

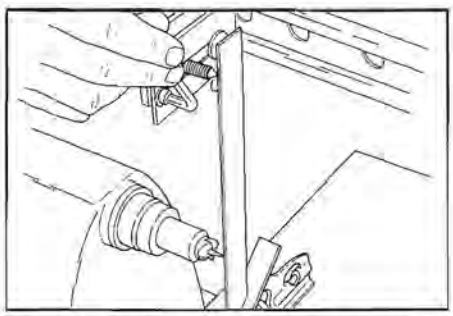

Figure 7. Check the back edge alignment of both tips.

Follower to Cutter Alignment

Align the follower to the cutter according to the following procedures:

1. Align the follower with the cutter. (See Figure 8.) Position the carbide cutter so its tip is touching the tip of the tailstock center. Loosen the follower knob (44) and adjust the height of the follower support (46) so that the tip of the follower is level with the tip of the template center (3). Tighten the knob while wiggling the follower back and forth. Use the 5/32" Allen wrench to loosen the follower upright setscrew (41). Pivot the follower upright (50) until the tip of the follower is exactly in-line with the template center when the tip of the carbide cutter is touching the tip of the tailstock center. Then, tighten setscrew (41) securely. If the follower and the cutter do not touch their respective centers, loosen the two cutter support setscrews (43) using a 5/32" Allen wrench. Also loosen the cutter positioning setscrew (42) 1/2-1 turn. Place a combination square against the base (37) and one of the cutter support side flats. Adjust the cutter support so the side flat is against the square and both the cutter and follower touch their respective centers. Tighten setscrews (42 and 43).

NOTE

When the follower support is moved up or down, knob screw pressure against the flat of the follower upright will maintain follower alignment. Be sure to wiggle the follower support back and forth as you tighten the knob. This will properly seat the cup point of the knob screw against the flat of the follower upright.

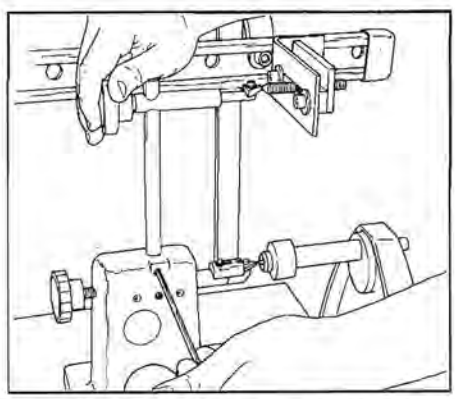

Figure 8. Align the follower with the cutter.

Templates

To duplicate turnings, you'll need a template to follow. For a spindle turning use either a flat template or an original spindle. (See Figure 1.) If doing a faceplate turning (bowls or cups, etc.), you must use a flat template only. Figure 2 shows a spindle template and the finished product. A faceplate template and a side view of its product are shown in Figure 3.

NOTE

You can design your own templates or find template patterns in woodworking books and magazines.

When designing a template, keep in mind the capabilities of the carbide cutter(s) you own. To avoid problems while you're turning your project, it's a good practice to use a detached follower to check your full size paper pattern to be sure that the cutter will work for all contours. For example, if your template has a deep slot or V-groove, will the cutter point go in far enough? If your workpiece has a square in the design, be sure that your template is designed so that the cutter doesn't contact the rotating corners of the square section.

Use a suitable marking device to draw the full size profile on the template material or on white paper rubber cemented to the material. If paper is used, it can be removed after cutting out the template or left on. Each template must have a permanently marked centerline and one or two end lines to indicate the ends of the workpiece. (See Figures 2 and 3.) The template ends to be clamped should be straight and square.

Cut out your templates on a bandsaw using the 1/8" or 1/4" blade. Sand the sawn edges **smoothly** using the pattern files on the jigsaw, hand files, emery board and/or sandpaper. Your completed turning will be no better than the template that it's copied from and you won't want rough spots to be duplicated.

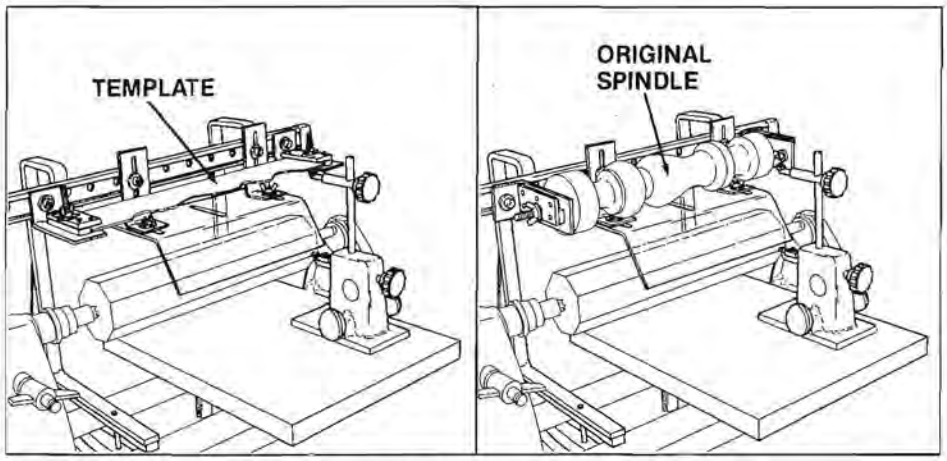

Figure 1. To make duplicate spindles, use a template or an original spindle.

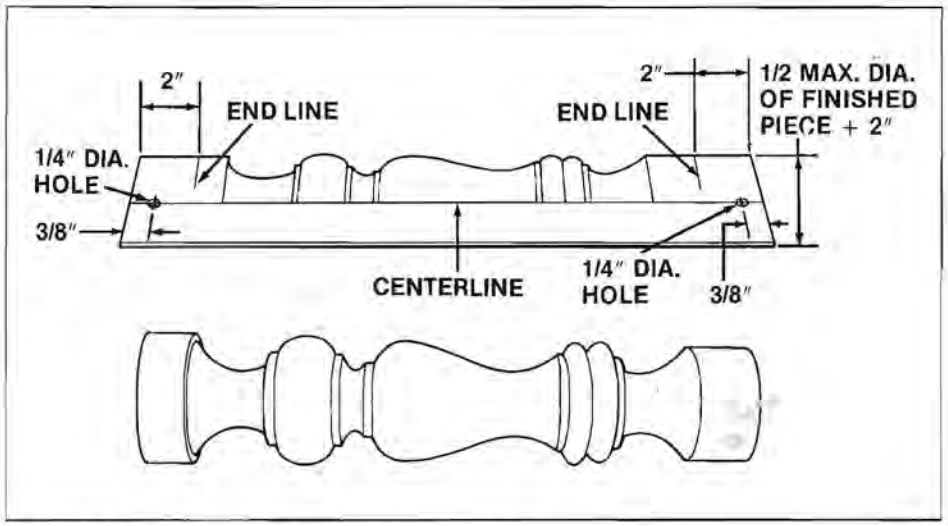

Figure 2. A spindle template and its finished product.

NOTE

To help achieve proper template alignment, drill two 1/4" diameter holes on the centerline, 3/8" from each end of a spindle template (See Figure 2). And drill one 1/4" diameter hole on the centerline, 3/8" from the edge of a faceplate template (See Figure 3). A 1/4" dowel placed through the hole(s) in the template clamp(s) and into the template hole(s) will align the template exactly.

Template Materials

The best materials for your templates are tempered hardboard, thin closed-grain hardwoods (such as maple or cherry) and clear or smoked sheet acrylics. Maximum template length is 36". Material thickness may vary from 1/4" for short templates to 3/8" for longer templates. Clear sheet acrylic templates have one advantage over those made of other materials: they will allow overhead light to shine through, illuminating the workpiece.

Templates

Making Spindle Templates

The spindle template should be 4" longer than the finished product (a 2" extension from each end line). For spindle diameters of up to and including 4", the width of the template should be half the maximum diameter of the workpiece plus 2". (See Figure 2.) For spindle diameters of from over 4" to 8", the back (straight) edge of the template can be no more than 2" from the template centerline. The front (profile) edge can protrude 2"-4" outward from the centerline. Drawing perpendicular lines from the start or end of the spindle contours to the centerline is optional, but they may help you to better visualize the finished spindle profile.

If you're making a template for table legs with a square at the top, be sure to measure the distance from the center of the stock to one corner of the square. This dimension must be incorporated into your template to keep from cutting off the corners.

When turning long spindles with repeat symmetrical designs from the ends to the middle, you can get by with a half template. Just turn one half of the workpiece, "flip" it end for end and then turn the other half.

Pieces longer than lathe capacity, such as bedposts or clothes trees, can be made in sections. Design a template for each section so that the sections will join in an inconspicuous location such as at a V-groove or where two beads meet.

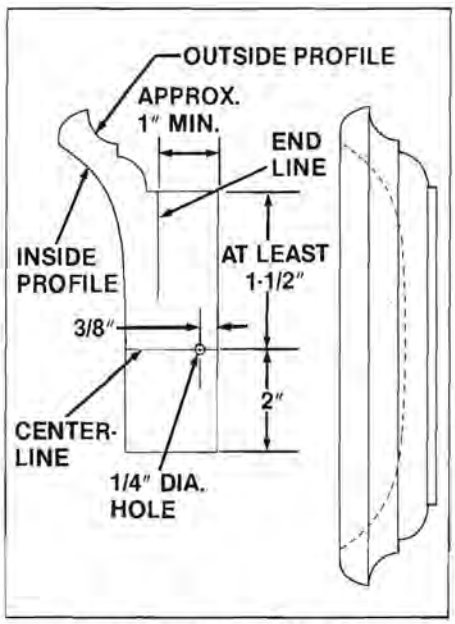

Figure 3. A faceplate template and a side view of its finished product.

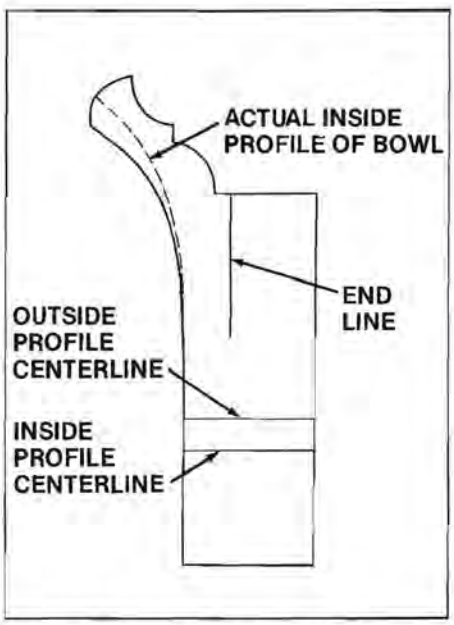

Figure 4. Template for a thin-walled bowl.

Making Faceplate Templates

As shown in Figure 3, the faceplate template has both the inside and outside profiles. Only one end line is required to indicate the outside bottom of the bowl. The 1" dimension from the end line allows for full insertion into the template support assembly. The 1-1/2" and 2" dimensions from the centerline allow both template clamping setscrews to secure the template.

For thin-walled (less than 1/4") cups or bowls, you can make a stronger, less fragile template by working from two centerlines—one for the outside profile and one for the inside. (See Figure 4.)

Another method of making a bowl template is to cut a 1/4" wide section through the center of an existing wooden bowl. When glued to a suitable piece of wood for mounting, it makes an excellent template. You'll lose your original bowl but then you can make as many duplicates as you like.

To cut both profiles without remounting the stock, there may be times when you'll need separate internal and external templates. This will be determined by your setup, the optional accessories you're using and how the stock is mounted to the faceplate.

When you're ready for mass production of bowls, specialty chucks are available which mount to a pin on or recess in the workpiece. For such work, you'll need a chuck mounting template (to cut the pin or recess) and a profile template. In addition to quick mounting and release times, these specialty chucks allow you to produce thinner bottomed bowls without mounting screw holes.

Safety First

WARNING

Most lathe accidents are caused by: improperly mounted workpieces, unbalanced workpieces and improper speed settings. Each of these factors can cause a workpiece to be thrown from the lathe. To protect yourself from injury:

- **READ, UNDERSTAND AND FOLLOW ALL the information given in the Safety section before you perform lathe operations.**
- **You must also READ, UNDERSTAND AND FOLLOW ALL the safety information in the Owners Manual for the Mark V on which the Lathe Duplicator is to be mounted.**

Using the Lathe Duplicator

CAUTION

Be sure that you've performed all the procedures in the "Assembly and Setup" and the "Alignment and Adjustment" sections before using the Lathe Duplicator.

You'll need to go through a learning process during your first several projects. Read this **Operations** section, then begin practicing with simple projects such as the one provided at the end of this section. The two full size pattern layouts go together to make an attractive candleholder. The project will give you experience in both spindle and faceplate turning.

The quality of the cut in lathe turning is determined by five factors:

1. The sharpness of the cutter.
2. The right type of cutter for the job.
3. The lathe speed specified for the operation. The faster the speed, the better the cut. Do not exceed the maximum rpm recommended.

Lathe Turning Speed Chart*

Size of Stock	Rounding	Shaping	Sanding
Up to 2" dia.	C (950 RPM)	F (1300 RPM)	K (2050 RPM)
2" to 4" dia.	B (850 RPM)	E (1150 RPM)	J (1900 RPM)
4" to 6" dia.	A (750 RPM)	D (1050 RPM)	H (1600 RPM)
Over 6" dia.	Slow (700 RPM)	A (750 RPM)	B (850 RPM)

*For Mark V's with 230 v., 50/60 hz. motors, refer to your Mark V Owners Manual for recommended speeds

4. The aggressiveness of the way you use the cutter. Use a light touch for initial rounding, a more aggressive touch when rough shaping and a light touch for detailing.
5. The height of the cutter:

- Cutting above the stock centerline will usually result in a poor cut by tearing the wood.
- Cutting on the stock centerline generally gives the best results, especially at the start of each operation.
- Cutting from 1/32" to 1/16" below the stock centerline sometimes is better for certain types of wood.

Lathe Speeds

Before you begin any lathe operation, set the Mark V to run at the correct speed.

WARNING

Never operate the machine in excess of the recommended speed for the diameter of the workpiece.

The correct speed is determined by the size of the stock you're turning; the operation you're performing—whether you're rounding, shaping, sanding or finishing; and the type of wood you're turning. Use faster speeds as you progress from rounding to shaping to sanding. Also use faster speeds with smaller stock. The larger the workpiece, the slower the lathe speed.

Stock Selection and Preparation

WARNING

- **Make sure the workpiece does not have splits, loose knots, or other defects that could cause the stock to break, splinter or come loose while turning. Never turn second-hand lumber. If you hit a nail or screw, you could be hit by pieces of metal.**
- **If you're turning glued-up stock, make sure the glue joints are strong. Glue the stock and leave it clamped for at least 24 hours prior to turning.**
- **For spindles, always cut stock that's more than 3" square into an octagon using the bandsaw. This removes excess stock, minimizes imbalance, reduces vibration and makes turning safer and easier.**
- **For faceplate stock, always cut the stock round using a bandsaw. This removes excess stock, minimizes imbalance, reduces vibration and makes turning the workpiece safer and easier.**
- **However your stock is mounted to the faceplate, the mounting surface(s) must be true and smooth. Use a hand plane or belt sander for small stock. When making several bowls from larger stock, run it through a thickness planer before cutting it into circles.**

Operations

NOTE

- If turning has small diameter ends, increase stock length to keep cutter from contacting centers.
- If stock has paraffin on the ends, cut off the ends.

Balance is extremely important for glued-up stock, especially long stock and stock that is 3" or more in diameter. If you're gluing together different types of wood, arrange the wood symmetrically. Use one type of wood in the center and the same amount of a different type of wood on the sides. Glue the stock oversize to allow for balance removal.

Examine each piece of wood carefully, even if from the same type of tree. Check the density of the annual rings. Wood with dark annual rings spaced close together is heavier than wood with dark rings spaced farther apart.

To check the balance of your spindle or faceplate workpiece, first locate the centers at each end by drawing two diagonal lines from corner to corner. Drive a standard 8 penny nail straight into each center. Use suitable string to hang the stock in a level position from the front bench tube of the Mark V. The ends of the string should be looped around the nails. (See Figure 1.) Gravity will pull the heavy side down. Use a jointer, bandsaw or hand plane to remove no more than 1/32" at a time from the heavy side until the stock remains stationary when rotated to three positions 90 degrees apart. Locate the lathe centers or the center of the faceplate in the nail holes.

Spindle Turning

You can turn duplicate spindles by using a flat spindle template or by using an original spindle such as a chair rung or an antique table leg for the pattern. (See Figures 2 and 3.)

Set up for spindle turning according to the following procedures:

NOTE

Initial setup of the channel and support bracket assembly was for maximum spindle capacity. For shorter pieces, the left-hand support bracket must be moved to the right to allow movement of the headstock toward the tailstock. The following procedure assumes that a less than maximum length spindle is to be turned.

1. Remove the left-hand support bracket assembly. Slide the guard (21) to the right end of the channel (13). Use the 5/16" Allen wrench to loosen the left-hand clamp screw (18) enough to disengage the clamp (16) from the way tubes. Remove the screw (19) and washer (20) attaching the support bracket (15) to the channel. Remove the support bracket assembly and set it aside. Support the left-hand end of the channel with your hand.

2. Position the headstock. Position the headstock so that the centers are about 1" farther apart than the length of the workpiece, and lock the headstock in position.

3. Remount the left-hand support bracket assembly. Place the support bracket assembly to the right of the headstock to a position which will not interfere with the final position of the headstock nor with proper positioning of the left-hand template support assembly. Install the support bracket screw (19) and washer (20) finger tight, then properly align and engage the clamp (16) on the way tubes. Tighten screw (19) securely. Then, tighten screw (18) securely.

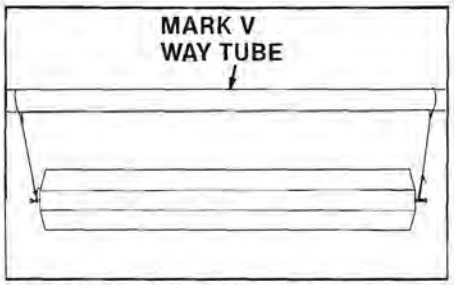

Figure 1. Check the balance of your workpiece.

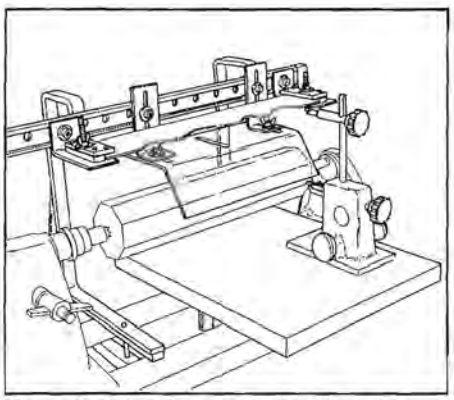

Figure 2. Setup for spindle turning with a template.

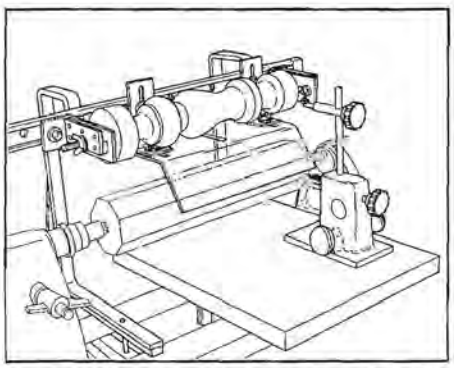

Figure 3. Setup for spindle turning with an original spindle.

Mounting a Spindle Workpiece

Mounting a workpiece on the lathe is an extremely important operation. **Improperly mounted stock is dangerous and difficult to turn.** To properly mount a workpiece on the Mark V, follow this procedure:

WARNING

- **If you're turning glued-up stock, make sure the glue joints are strong. Glue the stock and leave it clamped for at least 24 hours prior to turning.**
- **Make sure the workpiece does not have splits, loose knots, or other defects.**
- **Always cut stock that's more than 3" square into an octagon using the bandsaw.**

NOTE

To properly support a spindle workpiece so that it can be duplicated, both the drive center and the tailstock center must be directly in-line with each other. (Refer to your Mark V Owners Manual to align the lathe centers.)

1. Find the center of the workpiece. To mount stock between the lathe centers, first find the center of the stock. With a straightedge, draw two intersecting diagonal lines corner to corner on each end of the workpiece. (See Figure 4.) These two lines intersect at the center of the stock.

2. Seat the lathe centers. Position the points of the drive center and cup center at the center marks on the workpiece. Then hit the centers sharply with a **plastic or rawhide mallet.** (See Figure 5.)

CAUTION

- **To avoid damaging the live center bearing, always use the cup center for this procedure. The hole left by the cup center will accommodate the live center.**
- **To avoid damaging the centers, do not hit them with a metal hammer. Use a rawhide or plastic mallet.**

When properly seated, the drive center will leave a hole and four slots where the spurs bit into the wood. The cup center will leave a hole and a small circle. (See Figure 6.)

WARNING

When mounting stock between the centers, the spurs of the drive center and the cup of the cup center must penetrate at least 1/16" into the stock. Do not use a drive center, cup center or live center if the point is damaged. The stock could be thrown from the machine.

NOTE

If you're working with hardwood or stock that's less than 1-1/2" diameter, drill 1/8" diameter holes 1/2" deep in both ends of the workpiece, and/or saw diagonal kerfs 1/8" deep. This will help seat the lathe centers and keep the stock from splitting when the centers are driven into it.

3. Mount the lathe centers on the Mark V. Mount the drive center on the main spindle and the cup center or live center in the tailstock.

4. Set the Mark V at the proper speed. Set the Mark V at the proper speed and run it briefly.

5. Mount the workpiece. Hold the end of the stock against the tailstock center, then extend the quill and mount the other end on the drive center.

Figure 4. To find the center of a workpiece, draw two intersecting diagonal lines corner to corner on each end of the workpiece.

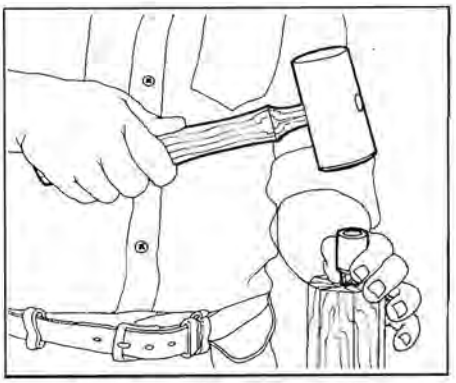

Figure 5. With a mallet, seat the drive center in one end of the workpiece and the cup center in the other.

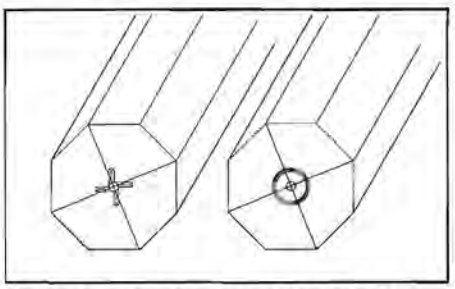

Figure 6. When properly seated, the drive center will leave a hole and four slots in the wood, as shown on the left; and the cup center will leave a hole and a circle, as shown on the right. **The centers must penetrate at least 1/16" into the stock.**